WIN A Dream Computer System!! See page 17.

Ten Industry Leaders On The Future Of Computer Games

COMPUTE!

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1987
Issue 90
Vol. 9, No. 11
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The Leading Magazine Of Home, Educational, And Recreational Computing

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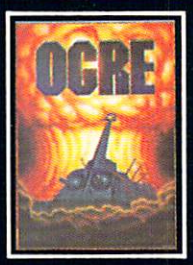

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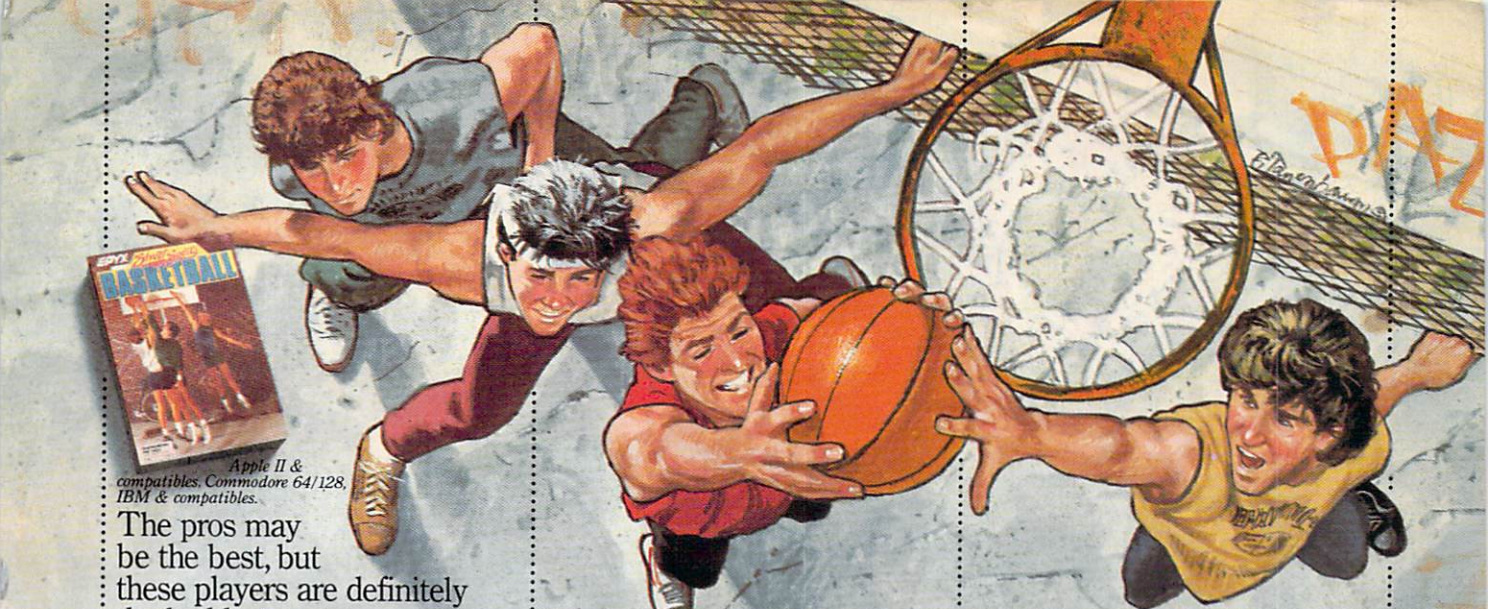

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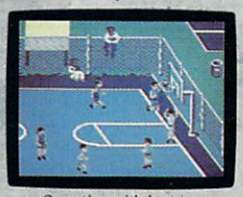

Sometimes it's best to take a pass.

ANOTHER HIT.

It's bottom of the ninth. Batter's 0 and 2. The score—well, maybe it's time to take up bridge.

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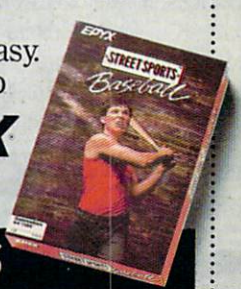
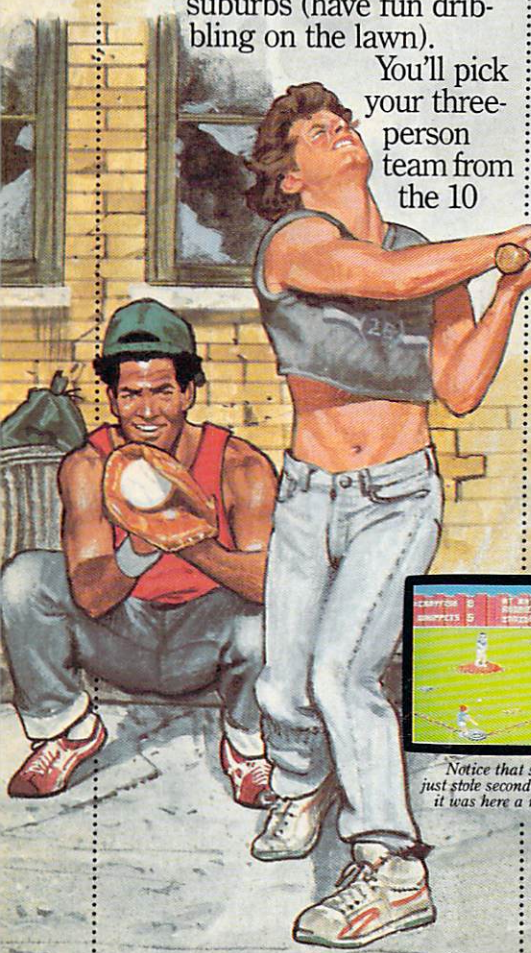


TASTE THE THRILL OF VICTORY AND THE AGONY OF THE STREET.



Notice that somebody just stole second base. Funny, it was here a minute ago.

THE STREET SPORTS SERIES

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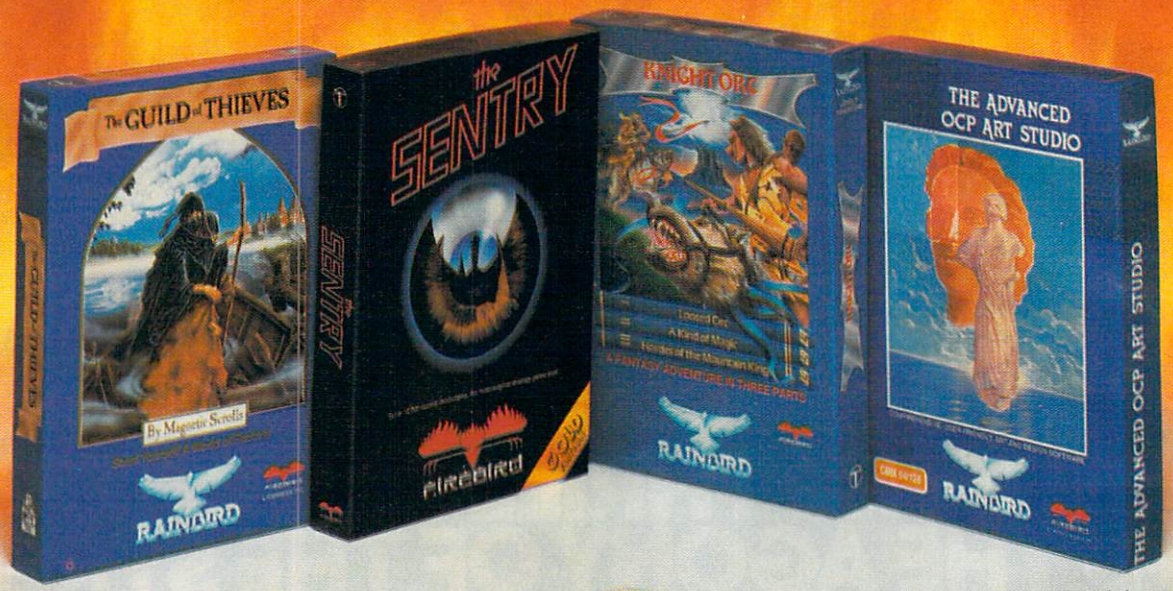

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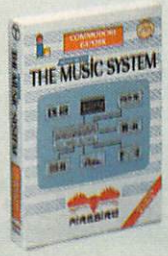

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AP Apple, **GS** Apple IIGS, **Mac** Macintosh, **AT** Atari, **ST** Atari ST, **AM** Amiga, **64** Commodore 64, **128** Commodore 128, **PC** IBM PC, **PCjr** IBM PCjr, • General interest.

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Editor's Notes

We recently had the opportunity to try out an interesting new product for IBM users. What it does is both worthwhile and paradoxical. You plug it in and it makes your hard disk much faster and, at the same time, increases the space available on the disk.

Normally, of course, there's a tradeoff between size and speed. This rule applies to everything from athletes to cooking a roast. Somehow, though, this plug-in card sent our Norton SI disk efficiency index up from 2.3 to a whopping 10.7, and it added several megabytes of storage space to the bargain. At those speeds, articles are checked for spelling in a second. You don't have to worry about power outages either: Set the word processor to back up your file every ten minutes. The backup happens so fast, you almost don't notice it—you just keep on typing while the disk gulps the whole file in the blink of an eye.

It seems that anytime you increase the speed or storage capacity of your computer system, your behavior changes. There are differences in the way you program, write, debug, model financial information—all of the hundreds of things computers are good for (except games). For one thing, you become more experimental. If it takes five minutes to compile and test a program, you'll think twice before making modifications. The price of frivolity is very high when you have to sit around for a long time, waiting for results. But when compilation takes only seconds, you can play around with new ideas, pull and stretch a program, get inventive.

Likewise, additional memory (or a disk so fast it might as well be online memory) permits the luxury of surrounding yourself with your favorite utilities. Keyboard redefiners, macro shortcuts, calculators, note pads, memo files, the entire collection of your personal "desktop" accessories are only a keypress away. Those tools are much more likely to be used when they're conveniently at hand, when you don't have to load them in from floppy disks.

Floppies were a marvel in their day, though. Back in 1981 we were delighted at how much easier computing became when we switched from cassette tape to floppy disk storage. But one day, a machine from the future arrived at our offices on loan for review. It was the size of a suitcase and about as loud as an air conditioner, but the astounding thing was that it could hold and quickly access five megabytes (five and a quarter million characters—enough memory to hold an entire book). It cost around $5,000. Now, of course, you can get 20 megabytes for a few hundred dollars, but the five meg behemoth was a wonder in 1981. It suggested that sometime in the future there may be no need for us to keep feeding tapes or floppies to the computer—everything will be inside, ready when you turn it on.

That day is approaching. This, too, will change the psychology of computing. Consider WORM, a new optical disk technology which offers staggering amounts of storage space. How would you deal with thousands of megabytes, more memory than you could ever fill with programs, writing, even encyclopedias? You could put everything you've ever read, or will read, onto this new kind of disk and still have immense blank areas left over. But there's a catch: It is relentless. The name WORM derives from Write Once, Read Many. It's so big you can put things on it forever, but once stored, nothing can ever be erased.

You write a school paper for two hours, backing it up every ten minutes. All 12 versions are stuck inside your computer. Over the years more information is tattooed into the machine, layer upon layer.

I don't know about you, but I find the whole thing unnerving. Wouldn't you think twice before saving a file or program to WORM, knowing it was going to become eternal? Wouldn't you, for example, try out various versions of a program or a data file on floppy disk before saving it permanently? The most ironic reaction will probably come from people for whom too much is never enough: They'll conserve space; they'll be stingy with the WORM. That's even understandable, a WORM could quickly become impossibly cluttered. Imagine a disk directory with hundreds of thousands of entries. Imagine trying to back up countless megabytes.

The only solution might be to create disk management software that refuses to access whole regions of the WORM, places where you've "removed" excess data. Instead of backing up your hard disk every week, you would decide which versions or duplicates were to be added to the dead zone. Yet knowing that information is still inside, sitting there but inaccessible, is eerie. Nonetheless, so far we've made transitions from 8 to 612K of RAM memory, from 1 to 18 mHz clock speeds, and from .33 to 100 megabyte disks. It's likely that software designers will eventually find ways to make the relentless WORM effective and, possibly, even seem friendly.

Richard Mansfield
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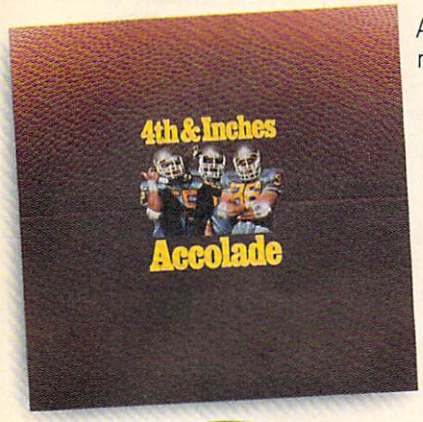

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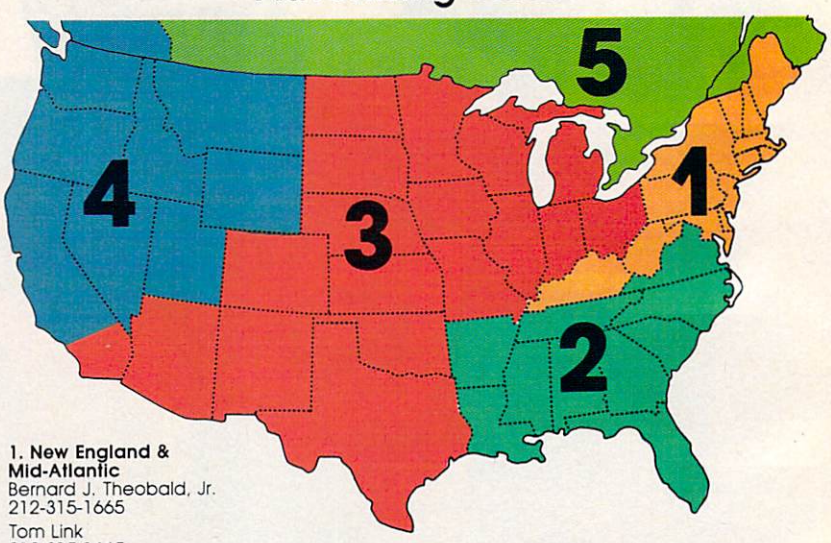

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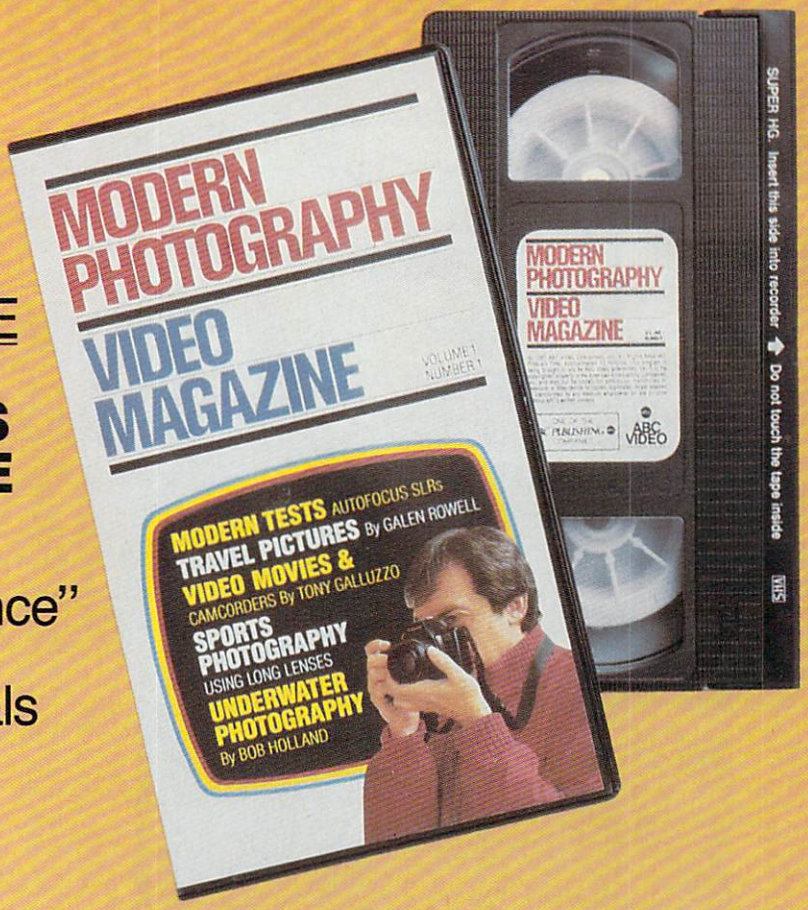

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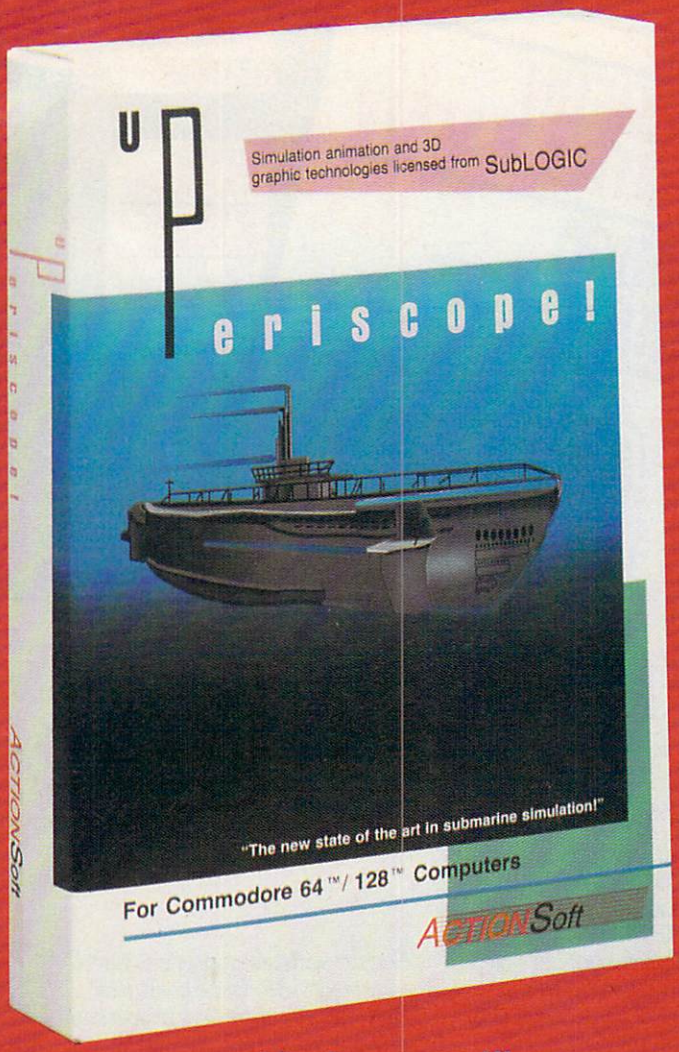

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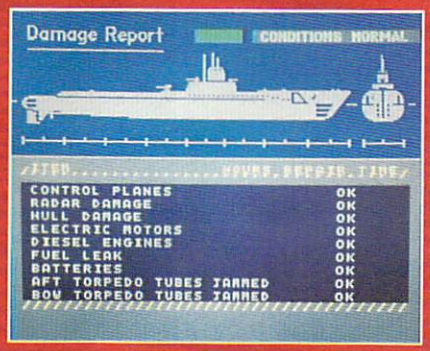
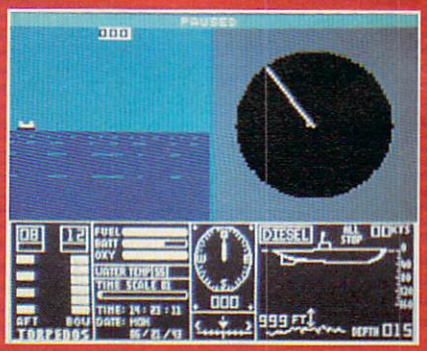
Real 3-D Graphics	Yes	No	No	No
Split-Screen Views	Yes	No	No	No
Torpedo Data Computer	Authentic WWII TDC display	5-line text display only	No	2-line text display only
Size of "World"	All U.S. operating areas in Atlantic and Pacific, fully detailed.	Section of Pacific, not all of Japan!	Tiny, imaginary patrol area.	Sections of Atlantic and Pacific Oceans, partial details only.
Time-Date Selection Capability	Yes	No	No	No
Zoom Feature	Map or ship view	Map view only	No	Map or Ship view
Save Feature	Yes	No	No	Yes

ON RIGHT OUT OF THE WATER!





C64 Screens shown. Other computer versions may vary.

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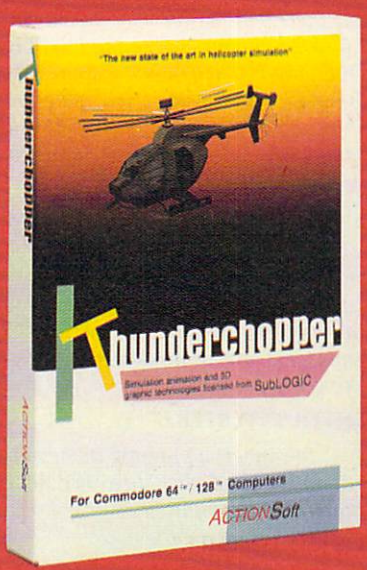

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Or write or call for more information. Up Periscope! and Thunder-Chopper are available on disk for the Commodore 64/128, Apple II, and IBM PC line of personal computers for the suggested retail price of $29.95. For direct orders please specify which computer version you want. Include $2.00 for shipping (outside U.S. $6.25) and specify UPS or first class mail delivery. Visa, MasterCard, American Express, and Diners Club charges accepted.

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Readers' Feedback

The Editors and Readers of COMPUTE!

If you have any questions, comments, or suggestions you would like to see addressed in this column, write to "Readers' Feedback," COMPUTE!, P.O. Box 5406, Greensboro, NC 27403. Due to the volume of mail we receive, we regret that we cannot provide personal answers to technical questions.

MIDI And Micros

I own an Atari ST and am interested in buying a MIDI keyboard, but I don't know which keyboards are MIDI compatible. Does the keyboard come with cables that I can connect to the computer right away? If not, where can I find the cables?

Jasper Wong

There are many synthesizer keyboards available, so it can be difficult to choose one. Among the most popular are the Yamaha DX7II (the latest incarnation of the DX7) and the Casio CZ101. Although MIDI keyboards do not usually come with cables, the cables are not difficult to find. A standard MIDI cable has five-pin male DIN connectors on each end. You should be able to buy one at a Radio Shack or other electronics store, at a computer store, or at a music store.

To use the synthesizer in conjunction with your computer, you'll need to buy appropriate software. Many types are available, ranging from simple programs designed to mimic player pianos, to more ambitious ones that transcribe your playing into sheet music.

The Fastest Amiga Language

I know the Amiga is speedy, and I know its version of BASIC is probably the best, but COMPUTE! has completely neglected to print any machine language programs for the Amiga. There are some tasks (namely, searching and sorting) which require machine language speed.

Vernon Dale Frameli

COMPUTE! depends on its readers to supply the majority of the programs that are published. We simply haven't received many machine language programs for the Amiga (or for the Atari ST, for that matter). One reason may be that programmers are busy testing how far they can go with BASIC and advanced languages like C and Modula-2 before committing themselves to ML. Also, it will take a while for programmers who cut their teeth on the relatively simple 6502 microprocessor to become comfortable with the more complex instruction set of the Amiga's 68000 microprocessor.

Readers interested in submitting articles and programs to COMPUTE! for publication should refer to "COMPUTE!'s Author's Guide," which we publish regularly in this magazine. Copies may also be requested from our editorial offices: 324 W. Wendover Ave., Greensboro, NC 27408.

File Moves And Translations For The Atari

I have an Atari 800XL. I have two questions. First, is it possible to develop a program that will print an untokenized BASIC program to a printer? Also, could you make a translator program that will convert an ASCII file to a BASIC program that can be run?

Howard S. Bacon

In response to your first question, it is certainly possible to write a program to print any ASCII text file to the printer, including an untokenized BASIC program. But there's an easier way. From the DOS 2.0 or 2.5 menu, choose the DUPLICATE FILE option. Then, when you are asked for the source and destination, give the filename as the source and the printer device name as the destination. Here's an example:

```
D:TESTFILE,P:
```

Another alternative is to load the untokenized program into a word processor and print it out from there.

To answer your second question, you can convert an untokenized BASIC program into one that will run simply by using the ENTER command. An example:

```
ENTER"D:TESTFILE"
```

To convert a program in memory into an untokenized disk file, use the LIST command. Example:

```
LIST"D:TESTFILE"
```

With these two commands, you can use your favorite word processor as a BASIC text editor.

Video Cards For PCs

I am interested in purchasing an IBM PC or compatible for home use. For games, what is the minimum (in cost) video graphics card I need? Will I also need a game port for a joystick?

Eldon Brewer

The short answer to your question is that most games require a color graphics adapter (CGA) card, and many also require a joystick. For the joystick, you will need an appropriate interface card. CGA-compatible cards are widely available, and many are relatively inexpensive. Joystick adapter cards are also available, but you might want to consider a multifunction card that includes a serial port, printer port, and possibly extra memory, in addition to the game controller port. You'll probably find that the multifunction card is significantly cheaper than the combined cost of separate cards with equivalent features.

First time buyers are often confused by all the different video options available for PC's and compatibles. Here is a rundown of what's available. The original monochrome display adapter (MDA) gives you highly readable text, but no graphics. The color graphics adapter (CGA) gives you four-color graphics, but produces text that many users find hard on the eyes. Many users want both text and graphics; the Hercules Graphics Adapter (HGA) gives you both, but only in monochrome. Furthermore, the Hercules card is incompatible with programs written for the CGA. For example, none of the BASIC graphics commands support the HGA. An alternative—albeit more expensive—solution is the enhanced graphics adapter (EGA), which offers higher resolution and more readable text. Some EGA cards (although not IBM's) are also compatible with software written for the older MDA, the CGA, and possibly even the Hercules adapter. The EGA is becoming popular, but many software companies still make their games compatible with the CGA to insure the largest possible market for their products.

The introduction of the new IBM Personal System/2 line has added two new standards to the fray. The Model 30 includes a built-in Multicolor Graphics Array (MGCA), which adds a 256-color medium-resolution mode to the EGA ca-

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pabilities. Models 50, 60, and 80 include the Video Graphics Array (VGA) on the system board. VGA features the capabilities of the MCGA, plus 16-color extra-high-resolution modes. IBM has announced a VGA card for use in the PC, AT, and compatibles; other companies are sure to follow suit.

Many IBM-compatible computers now come with built-in video hardware, or else have a particular video card installed as standard equipment. This is an important feature to look for when shopping for a computer because it could save you the cost of add-on boards.

Once you have decided on a video card for your IBM PC or compatible, you'll need to select a monitor which supports that display format. MDA and HGA cards require TTL monochrome monitors; composite monochrome monitors cannot be used. CGA cards generally require RGBI (digital RGB) monitors. Some CGA cards also provide a composite video output, but composite color monitors produce displays that are considerably less sharp than their RGB counterparts. EGA cards require special (and more expensive) EGA-compatible digital RGBI monitors. The MCGA and VGA require analog RGB monitors. A new class of monitors, spawned by the NEC Multisync, has the capability of working with all of these different video standards. As you might expect, however, these units are usually more expensive than monitors designed for one particular type of display adapter.

Missing Keys On The 800XL?

I have an Atari 800XL computer, and I cannot find two of the keys you use in your listings: { and }. Because of these two missing keys, I cannot type in any of your programs.

Geoffrey Wyatt

Computer programs frequently include graphics characters and other symbols that cannot be clearly represented in the printed listing. To avoid ambiguity, COMPUTE! has established a set of conventions for listing these special characters. The characters you mentioned, { and } (called braces), are used to indicate a variety of control codes and instructions. For example, single characters inside braces in Atari listings indicate that the character within the braces should be typed with the CONTROL key held down. The braces themselves are not typed. (Indeed, we deliberately chose a character that could not be typed.) Thus, when you see {,} in an Atari listing, you should hold down the CONTROL key and type a comma. This produces a heart-shaped graphics character. The braces are also used to provide other typing instructions. For example, {6 SPACES} means that you should press the space bar six times.

A complete explanation of our listing conventions may be found in the article "COMPUTE!'s Guide to Typing In Programs," which is included in each issue of the magazine.

Give Me Your Commands

I own a relatively inexpensive modem, and less than top-of-the-line software for my PC. I would like to write programs in BASIC to enhance my modem's capabilities. I would like to find a list of the Hayes command set for my programs.

Peter Laird

The manual that came with your modem should include a complete list of the commands it understands. Most modems these days claim to be "Hayes compatible," but some modems are decidedly more compatible than others. Many of the so-called Hayes compatible modems understand only a limited subset of the full command set of genuine Hayes modems, while others include new commands above and beyond those in the standard Hayes set. If your modem isn't truly Hayes compatible, then using these commands won't have any effect.

Here is a list of the most common Hayes commands:

AT A	**Answer immediately without waiting for a ring**
AT D*n*	**Dial a number, where *n* is the number to dial**
AT F*n*	**Select duplex mode (*n* is 1 for local echo, 0 for no echo)**
AT H*n*	**Select hook status (*n* is 1 for off hook, 0 to hang up)**
AT O	**Switch from command state to online state**
AT P	**Use pulse dialing**
AT T	**Use tone dialing**
AT Z	**Reset modem to its default configuration**
A/	**Repeat last command (useful for redialing)**

All but the last of these commands are preceded by AT. The AT prefix tells the modem to pay ATtention to the following characters. (Hayes modems require that the AT characters be in uppercase; some compatibles may allow either uppercase or lowercase.) To use any of these commands, send them to your modem as you would any other piece of information. The modem must be in its command state to understand the commands; again, see your modem manual for more information.

Safe From Surges

Is it safe to turn on the computer, disk drive, monitor, and printer all at once with the switch on a power strip?

Charles Wilkinson

With your computer and peripherals connected to a power strip, it is tempting to leave the switches for your computer and each peripheral turned on so that they all power up when you turn on the power strip. While many people use such an arrangement without incident, we do not recommend this procedure because it carries a slight risk of damage to your computer.

Turning on all your equipment at once can create a brief power surge. The more equipment connected to the power strip, the bigger the potential surge. For most computers, the ideal sequence is to turn each peripheral on individually, then turn the computer on last. When you're through using your system, turn the computer off first, then each peripheral. Turn the power strip off last.

But don't give up on the idea of using a power strip. It can be particularly valuable for computers and peripherals with external power supplies. Even when the device it supplies is turned off, the external power module is usually still on. (Feel it; it will probably be slightly warm.) Many manufacturers recommend that you unplug the external power supply module when the equipment is not being used to turn it off and keep it healthy. Turning the power strip off has the same effect as unplugging the power supply. Power strips with built-in surge protectors also provide valuable protection from power line surges.

A Matter Of Perspective

I have a simple solution for the man from Saudi Arabia who wanted to type from right to left with his Atari. Just turn the monitor upside down and type POKE 755,12. This will flip the characters upside down and backwards.

Paul Dausman

If a computer user wants to read right to left, all he needs to do is view the monitor through a mirror. For hard copy, he could use a sheet of carbon paper to produce the same effect on the back of the printed page.

Carl Panek

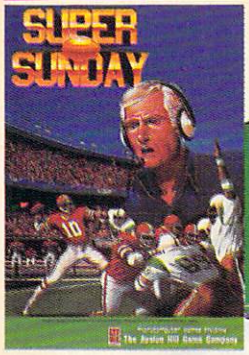
Thanks for your interesting suggestions.

Mainframe vs. Micro

I am a programmer-analyst who works with mainframe computers. I have recently purchased a Commodore 64 for my personal use. I have enjoyed the 64 very much as a game machine, but when I tried to program on it I was appalled at the poor quality of its program editor. I have looked at local computer stores and the other editors available aren't very good either. Are there any good program editors available for the 64?

Scott T. Ellis

You may be surprised to learn that the Commodore 64 is considered to have ex-



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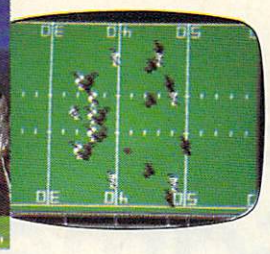

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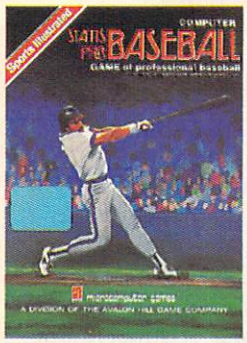

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ceptionally good editing capabilities for a machine of its class. The term program editor *means something slightly different in the home computing world than in your mainframe experience. For eight-bit machines like the 64, editors are usually not discrete programs, but rather integrated with the language's interpreter or compiler. Because of the amount of memory available in eight-bit machines, their editors are usually screen-oriented and lack all the commands of mainframe editors like ISPF or XEDIT.*

At first, the full-screen editor that comes with the 64's on-board BASIC may seem limited when compared with its mainframe counterparts, but after you use it a while you may begin to like it. Many people are disappointed with mainframe editors after using a Commodore 64.

Custom Cursor On The Apple

Can you tell me how I can change the cursor to any character that I want on the Apple IIe with an 80-column card?

Gary Waters

Although undocumented, there is a way to change the cursor on an Apple IIc, or unenhanced Apple IIe with 80-column card. To change the cursor, POKE location 2043 with the ASCII value of the desired cursor character, plus 128. For example, to change the cursor to an underline character, enter the following statement:

POKE 2043,ASC("_")+128

This does not work with an Apple IIe without 80-column capability.

If you do not add 128 to the character value, your cursor will be in a flashing mode. To get a solid flashing cursor, try this:

POKE 2043,32

To return the cursor to normal, press Control-Reset.

Location 2043 is part of the text-screen scratch-pad RAM used by expansion slot 3, or the auxiliary slot on the Apple IIe. This location is used by the 80-column card firmware to determine the cursor character, even when the computer is not in 80-column mode.

ProWrite Review Response

Thank you for your recent review of our Amiga product, *ProWrite*, in COMPUTE!. We feel that the review gave a fair overview of our product. However, there were two minor discrepancies that I would like to mention.

First of all, the review stated that *ProWrite* can use fonts only up to 20 points in size. This is not true; *ProWrite* will work with any font and size you have on your system disk. For example you can use the *Zuma* fonts, some of which are over 100 points in size.

Secondly, the review stated that only graphics printouts were possible, even when the document is exclusively text. Again this is not true. *ProWrite* provides both Near Letter Quality and Draft options for printing. Although you cannot get graphics with these two modes, these may be the preferable methods of printing if your document is exclusively text. You still get the on-screen WYSIWYG display and ease of editing and formatting when printing in these modes.

Thank you again for your review. Aside from these two minor inaccuracies it gave a good description of our product.

James Bayless
President
New Horizons Software, Inc.

We regret the oversight and appreciate the clarification. ©

The Future Of Computer Games:

Ten Industry Leaders Speak Out

Keith Ferrell, Features Editor

Computer games have never been more diverse—or more fun. Whether you want to play a sports simulation, play a strategy game, experience arcade action, explore alternate realities, solve text puzzles, or even create a challenge of your own devising, the software is available. Who develops these programs and brings them to the market? COMPUTE! talked to ten industry leaders to find out about the past, present, and future of entertainment software.

Surveys show that a computer bought for home use is used more often for playing games than for anything else.

And who could blame the users? Today there are games for every interest, from shoot-and-smash arcade games to high-level intellectual exercises. Behind these games are a variety of people, from programmers and designers to marketing specialists and corporate executives. For our annual games issue we talked with several people responsible for some of the most popular games and found them to be as engaging in conversation as their products are on the monitor. They are a diverse group, sharing some striking similarities of outlook as well as having dynamic differences of approach.

But we'll let them speak for themselves. Meet, in alphabetical order, ten of the industry's leading game makers:

Mark Beaumont, Activision
"We're moving beyond action/arcade games and moving toward giving somebody a full-blown experience."

Mark Beaumont, product manager for Activision, entered the consumer electronics industry in 1982, joining Atari at the height of the Pac-Man craze. He moved to Activision the following year and, since 1985, has been involved in the company's product management.

Beaumont has seen both expansion and dramatic retrenchment. Activision grew dynamically, then faced a period of restructuring and realignment. Currently returning to economic health, Activision faces a market far different from that of a few years ago.

Many changes result from hardware evolution. "We're starting to move upwards from the 48K machines and the 64. The market today is as much driven by what works from a hardware system as from the sales area. If a machine is doing particularly well, as the MS-DOS machines are doing now, you'll see more people gravitate to that for development and more games designed specifically for that machine."

The number of different systems is exerting an effect on the industry. "The market is getting segmented. At the low end you have the Atari 2600." The 2600 has enjoyed an unexpected resurgence recently, and Activision is responding by developing new software for 2600s.

Moving up, Beaumont sees several areas of opportunity. "At the lower end of the mid-range you have the Atari ST in 520 configuration, on through the Tandy machines which are making significant inroads at the $700 price point. Then, heading toward the high end you have the Amiga 500. And at the real high end there's the Apple IIGS and the full-boat Amiga. Games are appropriate for each of those machines."

While many of its products are ported to several machines, Activision has found that the games market varies somewhat from machine to machine.

"There's an audience issue at

play. Different kinds of software, different games, appeal to the different machine owners. Arcade games may not work as well on the Amiga as they do on the 64. We're selective about which titles are ported to different systems, and on occasion we will develop specifically for a particular machine. Amiga owners seem to have a desire for fantasy role playing and graphics-intensive products, as well as high-end productivity products. Our *Music Studio* has done very well on the Amiga, for example, where things which are direct ports from other systems might not do as well."

The most dramatic growth has been MS-DOS machines. "As Tandy and some of the other clone manufacturers have brought the price of their computers down, it's opened up a whole new category of buyer. When the MS-DOS machines were a higher-end purchase, the demographics of the buyers were significantly higher, and the kinds of software that appealed to the consumer were quite different. As the demographics have come down, there's been a bigger demand for arcade software. Our *Gamestar* line is a good example. While I don't think that would have done well on MS-DOS machines four years ago, it is doing extremely well now."

Activision understands that computer owners represent a niche within the overall consumer electronics market. Beaumont notes that there are niche markets within this niche market. The key to success in entertainment software, he says, is targeting the largest number of consumers.

"There are subcategories within categories. Working in our favor is the fact that the market continues to grow. As it grows, you bring in a larger variety of people, and individual segments within the installed base also grow."

Market growth can carry dangers as well. "Activision ran into difficulty a couple of years ago. Our mistake was with trying to go to too many different market segments, trying to fragment ourselves too significantly."

With Bruce Davis as the new president and CEO, Activision's recent surge to renewed profitability shows that the company learned important lessons from its slump. "Now we've focused in on the products that have been most successful for us. We're channeling in on those areas that work best—sports software, entertainment software, creativity and productivity software, and not taking too many forays out into the never-never land of 'who knows what this product is.'"

Still, Activision is willing to take some risks. "We will occasionally gamble, but we'll make sure we have the core business taken care of before we do."

Within the proven categories, Activision is still committed to extending the capabilities of its software. "We're trying to create the experience and the environment of each of our games, throughout the software, the packaging, and the documentation, so that players actually feel that they're participating. We're moving beyond action/arcade type run-and-shoot games and moving toward giving somebody a full-blown experience."

Thus, new Activision products such as Gamestar's *Top Fuel Eliminator* offer players the chance to customize drag racers to the conditions of various tracks. *The Last Ninja* will put martial arts skills in the midst of a quest type of story.

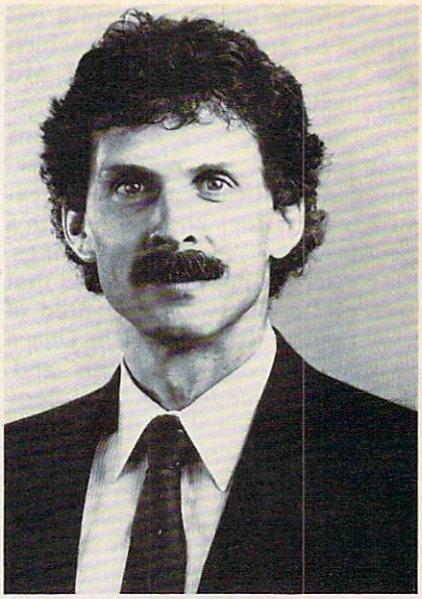
Is there a universal game, a game that will sell 15 million copies? "Consumer taste is so varied that to find one thing that appeals to millions of people would be difficult. To find a market that big, you'd need, for one thing, to have many more computers in the home.

"But that's a double-edged sword. To get more computers into the home you need better software that appeals to more people. As entertainment software becomes better, more people will become interested in computers."

Roger Buoy, Mindscape

"In a decade, we'll be well on our way to projected environments, where you can, through holographic projection, actually take part in an adventure."

Roger Buoy, president and CEO of Mindscape, looks over the company's four-year history and sees the evolution of entertainment software as being shaped by the growth of



both hardware capabilities and software development skills.

"The most dramatic change has been the introduction of the 16-bit computers such as the ST and the Amiga, and more recently the GS. They've brought a whole new level to game-play quality. We're gradually getting nearer the same quality that people expect to see on their TV sets. That's the progression that will continue until we finally reach that accepted standard, which we're all striving to achieve."

For all their advanced capabilities, the 16-bit machines face some problems. It will be a while before the 16-bit machines completely supersede the 8-bit machines. "The problem right now is marketing support for the 16-bit machines. Their market penetration is far below what Atari and Commodore in particular would have expected to achieve. The price has to come down before they become widespread, but also those companies have to focus their marketing. They have to decide what they want their machines to be. It's hard to push an Amiga as a professional workstation and as an entertainment product at the same time."

There has been simultaneous growth in the ability to use 8-bit machines such as the Commodore 64 and 128. "We've learned to get a lot more out of 8-bit machines. Looking at a product such as our *Superstar Ice Hockey*, compared with what was a terrific product four years ago, the older product looks very crude. We're seeing

some terrific products coming out for the 64 and the IBM PC, which are six- and seven-year-old architectures."

There are certain qualifications against which any piece of entertainment software must be measured. What does Buoy look for in a new product? "A couple of things. One is terrific depth, a product that kids and adults won't get tired of very quickly. *Defender of the Crown* is a good example of this and, again, *Superstar Ice Hockey*." Buoy feels that as a result of their depth, such games become experiences rather than just pastimes.

"In another dimension you have arcade games that are so superior in terms of their addictiveness that you can't leave them alone." Mindscape is presently preparing two arcade releases, *Paperboy* and *Gauntlet*, based on two arcade classics.

"On the one hand, you're looking for tremendous depth, but depth of game design includes arcade games. In some ways arcade games theoretically haven't changed a great deal from what we were doing in 1983. You can still be extremely successful, provided the game design is deep enough to provide a very easy-to-play, easy-to-comprehend arcade product."

Perhaps the deepest of all of Mindscape's games, and in many ways the antithesis of an arcade experience, is *Balance of Power*, which simulates the complexity of interrelationships among the world's powerful and emerging nations. Is there a future for such games? "When I first published *Balance of Power*, people thought I was crazy. They saw it as a niche product that would not be successful." The game had been, in fact, originally commissioned by another publisher. "The game was just left to languish. No one wanted to do it." Buoy's instincts were right. "Before Christmas, we'll have done over 100,000 copies."

Not bad for a "niche" product. But aren't all products niche or category products? "We see several market niches, types of games that appeal to different folks."

Is there room for new ideas? Buoy thinks there is. "I'm prepared to take a risk on something new and which represents an opportunity. And there are some things I think you should do just because it needs to be done. *Balance of Power* was like that—it was a product that had so much love and care put into it, and a year and a half of [developer] Chris Crawford's time, that the apparent quality, and the thought behind it, and its depth, were all just phenomenal. It *had* to be published. It's a great piece of work."

What comes next? "As a follow-up to *Balance of Power*, Chris has *Trust and Betrayal: The Legacy of Siboot*. It's a new type of product, involving artificial personality."

In this game, scheduled for release later this year, the player faces the challenge of establishing communications with six different aliens. Buoy admits that *Siboot* is more of a risk than was *Balance of Power*. "*Siboot* is so radically different that it's obviously a publishing gamble. No one's ever done this before. It doesn't fall within conventional lines. But the program's intent is good and the amount of work that's gone into it is phenomenal. *Siboot* is very advanced in its design. It's a fun game, but it's also a very intellectual game. You've got to *think* about it. If you don't want to think about it, and you want something that's more of an arcade experience, it's not for you."

As Buoy points out, no game can appeal to everyone. Whether in arcade games, sports simulations, or intellectual adventures, Buoy is determined to continue developing Mindscape's potential.

He has a clear vision of the company's future and of the sorts of games that lie ahead. In the next few years, he suggests, "we'll be pretty close to TV-quality images, and interactive media will be available using compact disc or laser disc technology."

And farther down the road? "In a decade, we'll be well on our way to projected environments, where you can be in a room and through holographic projection actually take part in an adventure."

Peter Doctorow, Accolade
"You like to push the boundaries of enjoyment."

Peter Doctorow, vice president of design and development for Accolade, has been involved with computers for more than two decades, working first as a programmer in higher-order languages and in real-time assembly language.

Doctorow entered the consumer electronics industry in 1983, when he joined Nolan Bushnell at Androbot. "The company doesn't exist any longer, but at that time we were involved in the development of home robots. The heart of the product was basically a computer on wheels. It was called 'BOB'—Brains On Board."

Serving as director of product development for Androbot provided Doctorow with many challenges. "We spent a lot of time figuring out what we could and could not do in software for this robot." The job gave Doctorow much food for thought. "I was involved in software, and directly in the conceptualization of software capabilities." From Androbot, Doctorow moved to Accolade about a year ago, where he's now applying his experience to developing entertainment software. With games such as *Hardball*, *Ace of Aces*, *Mean 18*, and the new *Test Drive!* and *Apollo 18: Mission to the Moon*, Accolade has continued to broaden its approach to entertainment software, with the added effect of further enhancing Doctorow's understanding of the consumer marketplace.

What makes a game successful? "If I knew that, I wouldn't be vice president of product development. I would be *king!*"

More seriously, he points out

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that numerous factors play a part in determining a game's success or failure. "One element is timing, another is luck. A variety of things have to come together at just the right time. It's not just the product, it's also the packaging and the distribution channels."

Equally important is the consumer. "The market itself plays a role—what the market wants to buy is a big factor. Success is a function of what time of year a product is sold. It's a function of what hardware the game is written for, of how many marketing dollars are spent not only by the publisher but also the hardware manufacturers."

Included among the factors is the product itself. "Success can be affected by what the product looks like, what category the product falls into. Success is also a function of how deep and how playable the product is."

Doctorow emphasizes that his list of factors is not complete. "The formula is not precise, it's not a scientific evaluation."

Development of entertainment software is not for the faint-hearted. "There is great gamble involved." Getting a product from development to market, "means a commitment of people and money—for a *possible* payback. When you go to Las Vegas, your payback can occur within seconds. In the software market, your payback is perhaps 18 months down the road."

The payback is worth the wait, Doctorow feels, and the chance of failure is worth the gamble. "We're not so strictly bound up in just dollars and cents, but we're developing a medium for entertainment, for a recreational market. People like to participate in recreational activities. It's a nice feeling to pull your hair out and gnash your teeth for months, and develop a product that's successful and gets good reviews and favorable word-of-mouth. That's what we're in the business for. You like to push the boundaries of enjoyment."

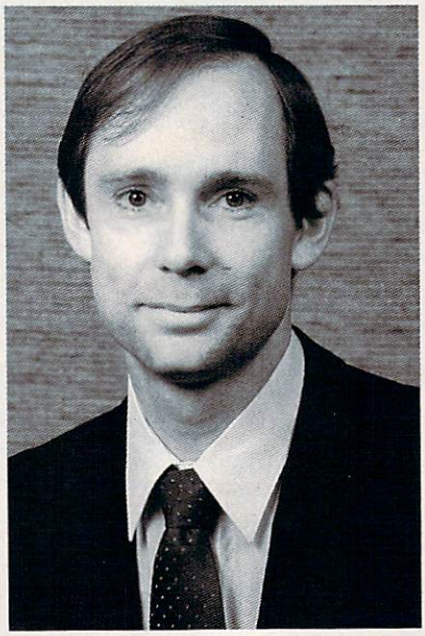
Doctorow wants to see computer games that involve several players, rather than one or two. "We would love to see more group- or family-involvement-type computer games. We took a risk and released a couple of products, *Killed Until Dead* and *Comics*, both of which are an awful lot more fun when there are several people crowded around the monitor. We've learned, though, that it's tough to get groups around monitors."

In part, the impulse toward group games is mitigated by the nature of the computer itself. "One of the nice things about software is that you can play by yourself. You don't have to have 18 players to enjoy a game of baseball. You don't need a foursome to play a round of golf."

The solitaire tendency concerns Doctorow. "I am hopeful that computers will not contribute to the attitude that people should not be social in the way that television contributed to the antisocialization of the human race. People turn on the TV and they go into a coma. I would be hopeful that the computer wouldn't do that. It would be very nice if the computer added to the socialization of the human race. The computer has the capability of bringing people together."

Will Accolade be pursuing "social" computer games? Doctorow chuckles. "It's something we won't give up on yet. I do think that we will continue to see products and develop products that begin to be a bit more risky, that try to open up the standards, that represent the next activities that will entertain people."

Michael Dornbrook, Infocom
"With text there are always new things to do."



Before there were full-color 3-D graphics, there was *text*. And now, with graphics of every variety, there is still text, and one company that continues to specialize quite successfully in text games only: Infocom.

Michael Dornbrook, the company's director of marketing, joined Infocom in 1983 as product manager, although he has been associated with the company since the 1970s. "I attended M.I.T. with [Infocom president] Joel Berez, and when Joel was starting Infocom in the late seventies I was hired to test *Zork* as it was being transferred to microcomputers." Not previously a fan of computer games, Dornbrook found himself captivated by the world of *Zork*, and foresaw a huge market for the game. His foresight was accurate. "*Zork* sold way beyond our wildest expectations."

Working as a consultant, Dornbrook began creating promotional materials for *Zork*. He founded the *Zork* user's group, designed maps and hint books, established a newspaper—*The New Zork Times* (now called *The Status Line* as a result of a settlement with *The New York Times*)—and built a successful direct-mail business. "I did anything that I thought people would be interested in."

In 1983, Dornbrook sold the company his mail-order business, and joined Infocom as a full-time member of the management team.

Since *Zork*, Infocom has published close to 30 text games, marketing science-fiction text adventures *(Planetfall)*, ghost stories *(Moonmist)*, horror *(The Lurking Horror)*, archaeological adventure *(Infidel)*, alternate realities *(Trinity)*, bestseller adaptations *(The Hitchhiker's Guide to the Galaxy)*, and even historical romance *(Plundered Hearts)*.

Dornbrook feels that interactive text games are virtually inexhaustible. "People say, 'What more can you do?' But that's like saying, 'What more can you do with a book?' There have been hundreds of years of books. People shouldn't see text as a limitation. With text, there are always new things to do."

The increasing sophistication of microcomputers has allowed Infocom to assemble increasingly complex adventures. The company has developed its own program-

ming system, with parsers that offer large vocabularies and stories that branch in many directions.

"*Trinity* is a good example. We used a new system, and decided to develop the game for 128K computers. The game needed that much memory to be effective." Didn't that decision cost them sales? Dornbrook admits that Infocom was concerned about producing a game that couldn't tap the huge Commodore 64 market.

"But we sold almost exactly the same number of games that we would have had *Trinity* also been available for the 64. It led us to believe that the 128 market is the more active software buying market now and that there are a lot of 128 owners who are eager to see games developed for their machines."

Can text games, for all the flexibility they offer, compete with increasingly dynamic graphics games? "If people are looking for complete relaxation where they can turn their brains off, our products aren't what they want. But there are a lot of people who do want to keep their brains active. I see our market as about 15 percent of the total home computer market. About one in seven computer users are the potential for us right now."

Can Infocom continue to grow with that size market share? "I'm hoping that we can grow by reaching out with different types of text products. Over time, though, if we really want to reach the whole market—and I'm not sure that we do—I think we'll have to have a different kind of product, with less interaction, with less challenge."

As we move to more and more powerful machines, will we see text adventures moving closer to a real literary experience, to traditional fictional structures? Will we see great novels become interactive computer experiences?

"Taking something like *Wuthering Heights*, for example, and making an interactive experience out of it would be likely to disappoint people. To be interactive, you need a fairly nonlinear structure. Most stories are written with very linear structures in mind. The optimal use of our medium is nonlinear, with different pieces coming together, with a tree structure that offers lots of different ways to go and lots of different possible endings."

Infocom's relation to fiction is like the movies. "It's very difficult to take a great novel and make it into a great movie. They are very different. What's best, I think, is to come up with something brand new, designed specifically for this medium."

The medium itself is in evolution, and that has Dornbrook excited. "As machines become more powerful, as memory costs go down and things like compact discs come onto the market, you can still have the same type of story, but move away from reading."

Text adventures without reading? "Imagine if you could lie in bed and have a voice-recognition system. When you say, 'Open the door,' you hear a creak or shrieks in the distance. You could play in the dark—the game would be all aural. You could have great narrators, different voices for different people. There would be a much wider potential market for something like that—simply because there are so many people who don't read."

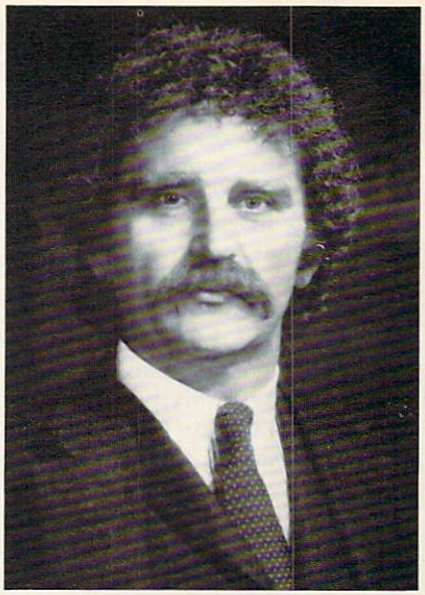
Will Infocom be a part of these new media? "Absolutely. We're interactive storytellers. When we see a medium that lets stories be told, we're going to jump at it."

Thomas Frisina, Three Sixty

"There's a growing market of consumers that don't understand zeros and ones, they don't like big manuals, they want to have fun, they want to enjoy the experience, and they don't want any obstacles."

A founder of Accolade, Tom Frisina left the company earlier this year. "Everybody with an entrepreneurial spirit, gets to the point where they want to do it for themselves. That's why I named my company Three-Sixty: I've come full circle."

How does starting a software company today differ from the early days at Accolade? "We started Accolade in 1985 when the entertainment software industry and the whole home computer industry were in the doldrums. As it turned out, we had the proper set of experiences, and the market was ready for innovation. We built the company to some rather significant heights in a very short time."



Frisina sees both advantages and disadvantages to today's market. "My advantage today is that I have a track record in the industry. But it was easier to get people's attention in 1985. The difficulty is that because the market is healthier, there are more [industry] players today, who are all much bigger than they were in 1985."

Three-Sixty's first entertainment product was released in September of this year. "*Dark Castle* is our adaptation of the hit Macintosh product. We'll be releasing versions for the Commodore, ST, PC, and Amiga. The game is an implementation of the jumper and climber platform arcade game. We've tried to give players a tremendous sense of realism. And we've added a number of innuendos and characterizations." Three-Sixty will follow *Dark Castle* in 1988 with *Harpoon*, an adaptation of the World War III board game on which Tom Clancy's *Red Storm Rising* was based. Versions will be available for all machines.

Is the variety of machines a dilemma? Frisina sees a conflict at the heart of the market. "The conflict exists both from the developers' point of view and the customer's. Developers want to make the best entertainment programs they can, but if they use the most powerful and sophisticated machines, they have a lesser chance of selling a lot of copies.

"Conversely, if developers choose to go where the money is—the Commodore and IBM environments—they end up never satisfy-

ing themselves as creators, because those machines don't have the capabilities of the higher-end machines. It's like the difference between going to see a 16mm movie, and then seeing the same movie in 70mm Panavision with Dolby sound. The market really limits the scope of what a talented creator can do."

There's a consumer-based conflict as well. "I think that eight-bit machine users are satisfied with their machines, only because most of them don't really know what an ST or an Amiga looks like. They only have as a reference the products they purchased previously for their machines. If the industry continues to push the state of the art forward on those machines, then the customer can continue to be satisfied with their eight-bit machines. But when they see an ST or an Amiga for the first time, *then* you have a conflict."

Where does Apple fit? "Apple is a real aggravation for me. They have disavowed any knowledge of a home market since their inception. They don't promote products for the home market, even though there are a lot of Apple IIs in homes, and a growing number of Macintoshes."

Ironically, Apple may have a machine that's ideal for the home user. "The IIGS can satisfy the home market maybe better than any other machine. It offers graphics and sound capabilities that the Amiga and the ST have, combined with a name that customers can trust." Again, Frisina feels that price stands in the way of substantial market penetration. "When the IIGS comes down in price, it could be the ultimate answer to the home market; it has everything the home user could want."

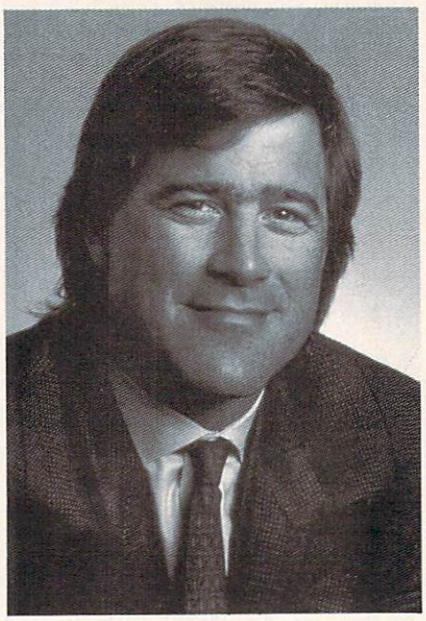
Frisina is concerned about today's software. "We have a terrible problem today with an overabundance of products. There are too many mediocre products."

He sees the lack of quality as endemic to the way the industry is run. "There's a lack of ingenuity, and a lack of commitment to releasing fewer products, but making them bigger, better, and more satisfying to the consumer."

Can this be solved? "I don't think there's going to be a solution. Bigger companies are either in the midst of public offerings, or are public, or have stockholders who want to get liquid. And the way to do that is to get enough revenues. It's my belief that there's not enough commitment out there to raise revenues by putting out fewer products that sell more, rather than more products that sell fewer units."

Frisina plans to concentrate his company's energies on a couple of games each year. He feels certain the public will respond to his approach. "My company is intended to satisfy the growing home market of consumers that have purchased audio and video and car stereo and compact dics. Now, with their discretionary income they are looking to purchase a home computer for the first time. They don't understand zeros and ones, they don't like big manuals, they want to have fun, they want to enjoy the experience, and they don't want any obstacles. And that's what I'm going to give them."

Bing Gordon, Electronic Arts
"We're talking about using the power to give something more like an interactive television experience."



Vice president of the entertainment division at Electronic Arts, Bing Gordon sees the entertainment software industry as being on the verge of broadening its market—a broadening that's the result of hardware advances as well as more sophisticated software. The two go hand in hand.

"The takeoff of Tandy and the IBM compatibles in the home has opened up a whole new computer market. These machines start with about the same amount of power as a Commodore 64, and then beckon us almost toward minicomputer power. It's a real challenge to do a program that's a winner at the low end with 256K of memory and four colors, and then go all the way up and support an EGA card, 640K, and a hard drive."

Does the evolution of hardware spell an end to the Commodore 64–level games? Gordon doesn't think so, noting that different machines offer different challenges and opportunities.

"The 64 has always excelled at games that let you move a lot of sprites around, with pretty graphics and good sound. The IBM-class machines take a little more power to drive graphics that are competitive with 64 graphics, but because of the disk storage and additional memory, you have a lot more room for math. For simulations, that lets us do incredible amounts of high-speed physics calculations."

The ability to do those calculations lends an ever greater realism to simulation games. "The aerodynamics in *Chuck Yeager's Advanced Flight Trainer,* for example, can be that much more sophisticated. With *Earl Weaver Baseball,* there's something like 200 real-world calculations between the time the pitcher winds up and the time the play is finished, all dealing with the batting average against a particular pitcher, the effect of the wind, the speed of the pitch, and so on. It's not possible to do all of that on the Commodore 64, where you compromise the math or the graphics. With the IBM-class machines, we use 48 or 64K of working RAM just for statistical calculations."

This power lets experts such as Yeager and Weaver contribute skills and experience to simulations that come closer and closer to approximating reality.

Gordon suggests that there are games that so far only have been imagined and categories that are as yet underexploited. Interactive fiction is an example. "Today there are basically two kinds of interactive stories. There's the text adventure where you get a 30-page short

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story and try to make it into a 40-hour experience through a bunch of logic puzzles. Or there's the dungeon fantasy with hit points and tons of melee. Text adventures right now are sort of like Double-Crostic versions of novels.

"With the advent of machines with more on-line storage and more audio/visual capability, there will probably be ways to give someone a first-person story experience without having to impose such artificial slowdown points."

Hardware will likewise exert a large influence on graphics software, but its arrival won't be quick. Even the most advanced machines on the market currently can go only so far. "Look, for example, at Compact Disc–Interactive (CDI) technology, with 400 megabytes of disc storage."

As Gordon points out, 400 megabytes is a finite amount of memory, easily used up. "It costs us, on the Amiga, something like 18K a second for digitized sound, and 20K for a screen. Movies go 60 frames a second, but even if you figure 5 frames a second, you're still looking at an animation cost of 50K a second. That's 1 megabyte for 20 seconds, 3 megabytes a minute. So 400 megabytes can give you roughly two hours of just sitting and watching."

Will CDI's arrival change the nature of the home computer market? "There might be a divergence of the market. Certainly there will be a broadening of it."

That broadening will only come, however, if computers become easier to operate. "For all that we in the industry talk about the ease of use of computers, I don't think they're a whole lot easier to use than a ham radio. We've found with different products ways to go after niches, but we haven't been able to make software yet that persuades a broad spectrum of people to walk by a window and say, 'Hey, I want to buy *that!*' It's still more abstract and harder to use than a lot of people are willing to put up with. Right now, there's so much expertise and experience that you need to have in order to get the enjoyment out of a rich and deep computer game, that we've shut ourselves off from a part of the marketplace that just wants to sit and be entertained."

Gordon makes it clear that Electronic Arts is not simply pursuing "transparent" software. "We're talking about using the power to give something that can be more like an interactive movie or an interactive television experience."

Sid Meier, MicroProse
"We're just at the beginning of what can be done with games."

Sid Meier, cofounder and senior game designer at MicroProse, has been fascinated with games for nearly as long as he can remember. "I've always been interested in games since I was young—board games, card games, war games." In college, Meier began considering a career in some aspect of the computer industry. "I did mainline, traditional computing for a while with a couple of companies."

Personal computers presented Meier with the opportunity to combine his gaming and technological interests. "It was a natural match. I got an Atari 800 and started to play around with it." Meier met Bill Stealey and the two started MicroProse five years ago.

"At first, MicroProse was a part-time thing, but our games were fairly well received, and we turned that into a company." The company's growth, "gave me the opportunity to write games full-time, and it's continued to grow from there."

An air-combat simulation put MicroProse on the map. "*F-15 Strike Eagle* was the first really successful game we had. Since then we've put out *Silent Service*, *Gunship*, and *Pirates!*"

Pirates! is Meier's most ambitious game, recreating Caribbean history, with players taking the roles of buccaneers or pirates. The game has strategic, diplomatic, economic, and arcade elements, as well as a detailed social and historical context.

Meier wanted to write an adventure game—with a difference. "The adventure games that I'd played weren't really what I'd wanted out of an adventure game. They were either all text, or they were very numeric oriented. I wanted to just jump in and be the character myself—in a lot of adventure games, you're not the character, you're playing another thing which is the character. Instead of directly playing the role, you play it as a puppet.

I wanted a game where your skills, reactions, and decisions caused things to happen. Not how many hit points or agility you happen to have."

The game had to have animation and action, as well as strategy and planning. "We tried to put all those things in the game. The situation demanded it. If we'd been doing a game—as some of our other games are—with helicopters and airplanes, that's primarily action. When you think of pirates, there's action, but there's also intrigue, trading, politics, and so on."

How long did creating *Pirates!* take? "I spent about nine or ten months on it myself." No game, of course, is assembled alone. "We had an artist working on the game for five months, and our research and documentation took another four or five months. In all, *Pirates!* represents one-and-a-half to two years of work split up among three people."

Are we moving toward games with deeper, more fully realized backgrounds? "Yes—as long as it doesn't intrude on the playability of the game. The more context you have, the more real it is to people, and the more fun they'll have playing it. The down side is that you don't want to get so wrapped up in the historical part that you take away the playability. It's a fine line between presenting it and being

able to play it."

Are games such as *Pirates!* being produced because the technology and programming skills permit their development, or are they a response to an increasingly sophisticated consumer? Meier thinks several factors are at work.

"People are really learning their computers. You can see this as far back as the Atari 2600 machine. If you compare what was available when the 2600 was first introduced, and what was available just a few years later, there's a night-and-day difference. The same thing is happening with personal computers—programmers are learning how to get more and more out of them."

Currently Meier and MicroProse are at work adapting *Red Storm Rising*, Tom Clancy's best-selling novel of World War III. The novel spans several continents, with combat and drama on land and in the air and both on and under the sea.

Other current MicroProse projects include *Airborne Ranger*, an arcade-style game, and *Space*, a science fiction game which Meier says will fall somewhere between *Pirates!* and *Gunship* in terms of the gaming experience it offers.

Meier looks forward to the day when the majority of home computers offer advanced graphics and digitized sound, but he feels those elements will eventually be taken for granted.

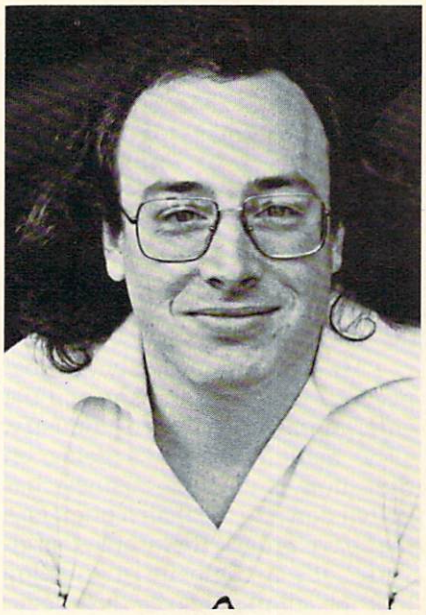
"For a short time people are going to respond to the graphics and the sound, but after that it's still going to be a question of what's in the product: What is the experience that I get out of the game—is it fun, is it challenging? Those are the kinds of games that we want to put out."

Chip Morningstar, Lucasfilm Games

"Habitat is the sort of game people have been speculating about for a long time."

Chip Morningstar wants thousands of people to play his game—all at once.

As games designer for Lucasfilm Games, Morningstar is working on an on-line gaming experience called *Habitat*, which is nothing less than an attempt to fabricate an open-ended environment where



players will, in many ways, make their rules as the game proceeds.

"*Habitat* is a fictitious universe that you access via telecommunications using your Commodore 64. The monitor represents your view of the world, with various animated characters moving around on the screen. One of those characters is you, the others are other people who are simultaneously logged into this on-line service."

How many people can play *Habitat* at once? "There's not really any limit—we're doing this on QuantumLink. They support a large number of subscribers, and conceivably they all could play *Habitat*. All the players will be in one common universe." Not all of them will be in the same local area. As local limits are reached, *Habitat* steers new players to new areas. "We call each area of *Habitat* a region, like the notion of a room in an adventure game or a screen in a video game. The screen will show the objects, scenery, and people located in each region. *Habitat*'s characters are called *avatars*, and there's a limit of six 'live' avatars per region, with a higher number of 'ghosts'—players without bodies—per region.

"Ghosts can move from region to region, they can turn themselves into avatars when they find an open region where they want to do things, or they can simply watch the action. Ghosting allows for theaters, where half a dozen avatars may put on a show, and hundreds of ghosts sit back and serve as the audience."

Morningstar notes that while ghosting offers oportunities, the main motivation for creating this aspect of *Habitat* was technical. "We needed to eliminate traffic congestion problems. If you run into a crowded area between regions, just turn into a ghost and breeze on past. When the ghost finds a region with fewer than six avatars, he can become corporeal, an avatar."

What sort of world is *Habitat*? What sorts of things can avatars do or ghosts witness? "One of our objectives is to make the experience as varied and open-ended as possible. We want it to be different things for different people with different interests.

"Activities range from pure socializing, adding a visual and kinesthetic dimension to one of the things that people already use on-line services for. There will be activities which are planned and organized such as adventures, treasure hunts, road rallies, as well as board games like checkers and chess, or a capture-the-flag game that we're working on."

Habitat is an experiment in social structure as well as being a game. "Urban areas, the core inhabited parts of the universe, are set up as weapons-free zones where you can't attack other avatars. Outlying areas will be a little more rough-and-tumble. One of the things that we expect to happen is that people who are into different styles of behavior will drift in different directions."

Despite weapons rules and traffic patterns, Morningstar is committed to making *Habitat* as open an experience as possible. "One of the things that I'm most interested in is seeing what sorts of social structures evolve. We're not imposing too much in the way of government on this world. *Habitat* is pretty much an anarchy."

Anarchy doesn't necessarily mean chaos. "Whenever you get more than three people together in one place you get something resembling political behavior. It will be interesting to see if all the people who live in a particular town decide that they want to have a town council. The game will leave it up to them to set up their government.

Habitat is a sort of sociological laboratory, as well as a game."

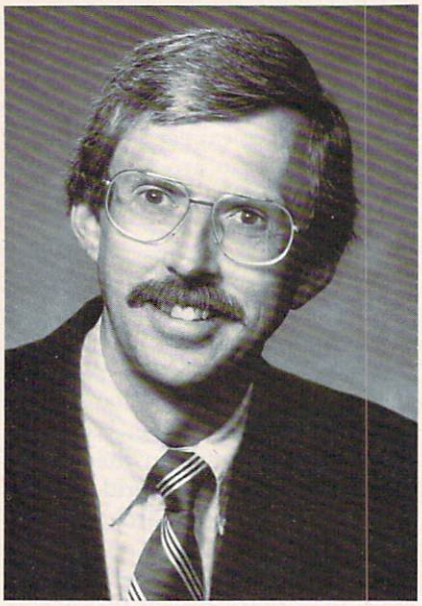
Technical work on *Habitat* began in late 1985, although the earliest glimmerings of it occurred to Morningstar about a year before that. Now, the work is coming together, with play testing under way and hopes for the game being online late in 1987.

Morningstar is aware of the risks involved in *Habitat*. "We're the guinea pigs. *Habitat* is the sort of game that people have been speculating about for a long time. If we're successful, I think we'll be seeing a lot more of this sort of thing."

Looking farther ahead, Morningstar sees great opportunities for on-line games. "With the advent of faster computers, larger memories, better graphics and telecommunications, some of the constraints will be removed from what is possible online. It's conceivable that we'll someday have interactive cable television channels, where several thousand people will be able to share experiences in ways that were never before possible."

David Morse, Epyx

"I want people to say we make the best games on the market."



Chairman and C.E.O. of Epyx, David Morse is experienced in both the hardware and software sides of the industry. The founder and president of Amiga Computer, Morse remained with Amiga for almost a year after selling the company to Commodore in 1984. Because Amiga was designed to serve many purposes in computer entertainment, Morse established close relationships with many of the leading manufacturers of entertainment software.

Asked to join Epyx's board of directors earlier this year, Morse found that many of his interests and goals coincided with those of the company.

He is enthusiastic about prospects for both his company and the entertainment software industry. "The main thing that's going on right now is that the business has gotten down to the main companies that have proved themselves survivors." It's a competitive situation that he thinks makes for better games.

The industry shakeout that has left only a few key players, rather than the dozens of entertainment software companies just a few years ago, coincides with a maturing of programming skills. "We're starting to get real close to the limitations of the hardware on many systems, with the possible exception of the Amiga. But it's amazing the ways that Epyx and other companies have found to make machines like the Apple and the 64 and even the IBM do some very advanced operations that nobody even thought of doing just a couple of years ago."

These increased capabilities are built upon foundations that have taken years to acquire. "It's a very gradual build, with the result that we seem to get smarter and smarter about how to do things on computers."

Development of new products has, as a result, become more intensive. "Our most recent introduction is a good example. *California Games* represents more than three man-years of development time. That's a *lot*—but that's what it takes to make good products." Commitment of those resources has paid off, with reorders flowing into Epyx quickly after the game's early-summer release.

For all the shared experience and knowledge, there are still new areas to explore. "We have a couple of brainstorming ideas a year. Typically, we'll come up with a few ideas that are improvements on existing games. But we also come up with two or three ideas that are totally new, that nobody's thought of before. Of course, just because it's a new idea doesn't mean that it's a good idea."

Despite the arrival of the Amiga and the ST, and the increased market presence of IBM compatibles, Morse sees a lot of life left in the classic game machine, the 64. "It's probably a better game machine than, say, the Sega or the Nintendo. Graphically, there's a lot that can be done with the machine. The 64 accounts for a lower percentage of our business than in the past, although the unit volumes are holding up and actually increasing."

Other machines, though, offer more memory and other capabilities than the 64. Is it a problem to develop for the 64 and then port the game to other machines? "It's relatively easy to convert from the 64 to the Amiga or vice versa, despite some obvious limitations. But if you really want to see limitations, you need to look at IBM machines. That's the most difficult machine to develop for."

Will that change? Will IBM compatibles become more serious entertainment machines in the near future? "Obviously, the ability to play entertainment software is one way to sell machines."

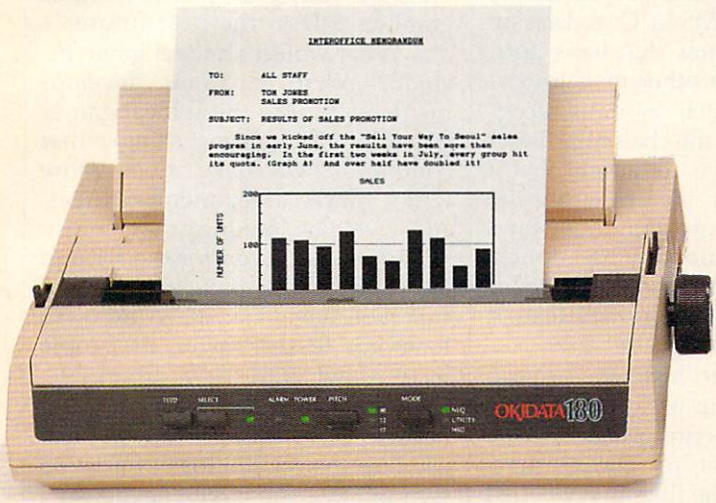
Where are we headed over the next five years? "Two years ago, for example, the Amiga was the hottest machine around. In many ways, it still is. But today, technically, we can build machines that would run faster, do even better graphics, and be far easier to program."

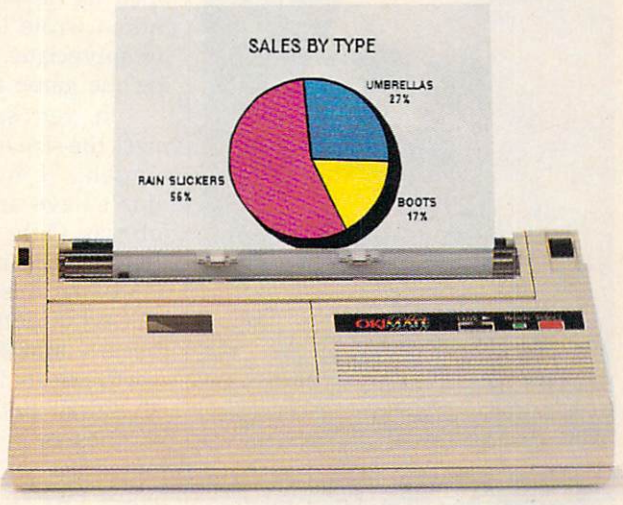
Having participated in the industry from both the hardware and software sides, Morse is excited about meeting the future from the vantage point Epyx offers. "I like product development work. Of all the things I do, that's my favorite. At Amiga, we were working on one product, admittedly a very complex one, but still only a single product."

Epyx offers more diversity. "At any given time there are probably 10 or 15 projects going on. That's very interesting and exciting to me to be involved in all of that."

Morse's goals for the next few years? "I want us to be the best software company. I'd like people to say Epyx has the best games, the

All work and some play.





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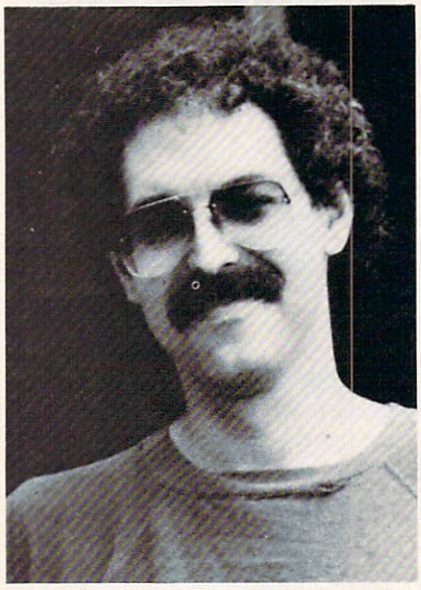
best variety of products. I think we're there in some aspects, and on our way there in others. That kind of growth is what's going to make Epyx a fun place to be."

Ezra Sidran

"Imagination is the only limitation you have. Imagination is a lot more important than programming skill."



Freelance software designer Ezra Sidran has just completed his first major product, *Universal Military Simulator (UMS)* for Firebird. Sidran attended Marycrest College in Iowa, the only college in the country offering a degree program in computer graphics. Sidran's own degree is in computer animation, and he has linked his academic background with his interest in military history and war games.

"I invested a year of my life in writing *Universal Military Simulator*." That year will have stretched to two-and-a-half years by the time *UMS* is on the market late in 1987.

Because he was working freelance, and would not submit the game to publishers until it was completed, Sidran was free to follow his own instincts in pursuit of the creation of a strategy game that differed from others on the market. He wanted to come up with a game that would not only include historical scenarios, but also offer gamers the chance to set up their own battles, and even design their own battlefields. Most of all, he wanted the game to have a different look and feel.

"It's a 3-D game in which players can create and design their own three-dimensional maps, rotate them, zoom in on areas." Those maps can be filled with armies from any time period, equipped with weaponry ranging from bows and arrows to modern firepower to fantasy implements." By the time the game was finished, *UMS* had expanded to 22,000 lines of executable code.

Sidran traces the genesis of the program to an artificial-intelligence program he wrote in college, as well as to other strategy games he developed as he learned programming. Sidran wrote *UMS* in C, a decision he appreciates now that he is porting the game to other machines.

In retrospect, Sidran recognizes the size of the challenge he set himself. "I have to admit that I didn't have any idea how big the job was. Only now do I understand that the reason nobody had done a game like this before was because they all understood how difficult a job it would be."

Dedicated to historical accuracy, Sidran put in as much time in libraries as in writing code. "*UMS* represents a *lot* of library time. Before I wrote the first line of code I spent a full month in the library, not only doing historical research, but also doing market research. I wanted to make sure I had a fighting chance of succeeding with the program."

Sidran attended the 1986 Summer Consumer Electronics Show in Chicago in order to talk with game publishers. He found the entertainment software industry to be friendlier than even he expected—one major publisher passed on *UMS*, but introduced him to Marten Davies of Firebird, who became Sidran's publisher. "I had a contract for the program about five days later."

With *Universal Military Simulator* ready for release, Sidran is hard at work on new products. "I've got three coming up. I'll be working with Encyclopedia Britannica next, doing a dinosaurs game for younger players." The new game will be developed for the PC first and then for the Apple IIGS and the 64.

Sidran also sees himself doing more strategy games. "We haven't yet scratched the surface of what we'll be able to do in simulations. What we call high-tech will be laughable just a few years from now. Twenty years from now will be a great time to be a programmer. It will be easier to develop programs, the graphics and sound will be better, everything will be more sophisticated. Right now, we're at the computer equivalent of movable type for printing presses."

Sidran cites 3-D as an example. "3-D is an illusion. But there are all kinds of wonderful 3-D illusions that you can do on computers. We'll be seeing a lot more vector graphics 3-D in the near future."

What would an ideal game include? What hardware developments will make these ideal games possible? "The biggest thing is that computers will have much more RAM, much larger memory areas. Also, we'll be looking at larger disk storage space. Even for the ST and the Amiga, you have more RAM than you have disk space. So disks have got to get bigger, or people have to get more hard drives."

For all the new technologies, he also feels that we haven't yet used up the possibilities of existing technology. "We haven't exhausted any of our systems, not by a long shot. All good programmers look at any problem as solvable. Step one is defining the problem and planning solutions. As always, imagination is the only limitation you have. Imagination is a lot more important than programming skill. That's what attracted me to computers from the beginning. There aren't any physical limitations to what you can and can't do."

Is there need for new ideas? "They're screaming for new ideas. There's more work than you can shake a stick at."

Currently anticipating a brief vacation from programming, Sidran is nonetheless looking forward to moving on to new frontiers. "I'm planning a new kind of adventure game. It calls for an exceptionally large 3-D map that adventurers will wander around in."

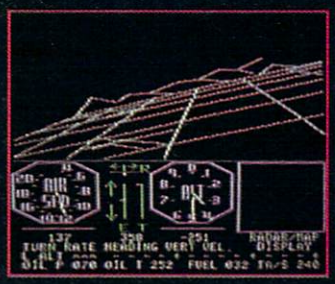
Sidran's adventurers face a situation that he understands well. "Writing a program is like starting out on an incredibly long journey. The sooner you put one foot in front of the other, the faster you get to the end." ©

1987 - Expanding Scenery disk coverage; East Coast, Japan, & Europe

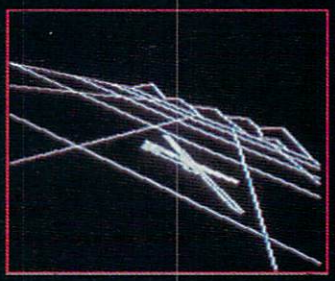
1986 - Flight Simulator II for the 68000 computers

1985 - High-performance Jet flight simulator for the IBM, Commodore 64, and Apple II computers

1982/1983 - Microsoft Flight Simulator & Flight Simulator II



1979 - 3D graphics applied to the original FS1 Flight Simulator for the new Apple II and TRS-80 computers



1977 - SubLOGIC's 3D graphics package in BASIC and M6800 Assembly Language

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Neil Randall

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Even John Wayne wouldn't try this.

Into the Eagle's Nest puts you in the position of a single G.I. during World War II, inside a Nazi fortress simply jammed with enemy soldiers and drunken officers. All you have to do is find three prisoners and blow up the fortress.

This is no cloak-and-dagger job. The Nazis come fast and furious, shooting when they approach and hiding behind every doorway. You have your work cut out for you, and only great players will finally complete the task.

Thankfully, the Nazis are incredibly stupid. They come after you in single file, usually lining up to be shot. As long as you pick your vantage points carefully, you'll be able to polish off dozens of the bad guys while taking almost no damage yourself. As I said, even John Wayne wouldn't try this.

The game is fun, even addictive. The screen shows an overhead view of a very limited portion of the fortress. The graphics display is sharp and colorful, with the brick walls looking like bricks and the floor looking smooth and hard. All items are easily distinguishable, and the textual information is kept to a minimum. All you need is a joystick, some nerve, and a lot of ammunition.

Doors To Danger

To get from room to room, you have to go through doors. Wooden doors can be shot open, but you need a key to open metal doors. You find keys in various parts of the fortress, but since they are rare you have to choose carefully where you will use them. Sometimes a room is accessible from two directions; sometimes you need not enter it at all.

You receive points for shooting enemy soldiers and for finding treasure and various objets d'art as you travel. Unfortunately, and this is a rather strange objection, you also get points for killing drunken officers, who sit passed out at their desks. I say *unfortunately* because for some reason this portion of the game bothers me inordinately. I've done enough killing in computer games to make Genghis Khan seem like a pacifist, but this seems too real, too much like cold-blooded murder. After several hours of play, I found myself avoiding rather than shooting the officers, sacrificing the points for the sake of my conscience. Strange how these things affect you.

To shoot, you need ammunition, which you find scattered throughout the fortress. As you get shot, of course, you suffer wounds (expressed as Hit Points). To get rid of wounds, you must find either cold food or, much better, first aid. It's extremely easy to run out of ammunition and to find yourself being hit from all sides, so keeping an eye on the Ammunition and Hit Point totals is a must.

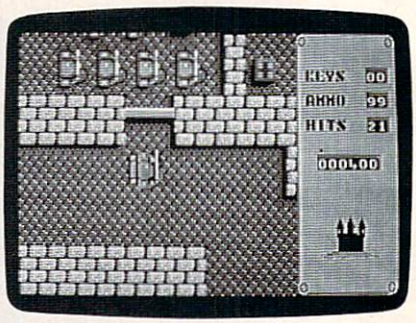
The castle has four floors. To get from one to the other, you must find an elevator pass. There is one on each floor, and each is indispensable (they disappear once used). Once you find a prisoner, you must lead him to the elevator and take him out the main entrance on the ground floor. The prisoners are even dumber than the Nazi soldiers, so prepare to be slightly exasperated.

Once you have rescued all three prisoners (one on each floor except the ground floor), you must find and activate the four detonators. If you succeed, and if you make it back to the entrance on the ground floor, the fortress explodes. Your mission is accomplished. At this point the game is saved to disk automatically, and you can work your way through a more difficult fortress.

Save The Prisoners, Not The Game

Here lies one of the game's problems: You are allowed to save the game to disk only after working your way through all four floors rescuing prisoners and then working through all four floors again to activate the detonators. If you quit before accomplishing this, or if you get yourself destroyed, you have to start from scratch.

There are two things wrong with this approach. First, even with experience it takes two or three hours to complete the entire mission. Second, playing *Eagle's Nest* for three straight hours is more than a little tedious.



Nonstop arcade action and strategy are featured in Into The Eagle's Nest.

Don't get me wrong. *Into the Eagle's Nest* is extremely enjoyable, and very strong in its ability to make you want to finish the job. But few people have the time required to get through an entire mission in one sitting, and fewer still would enjoy it all the way through. Allowing you to save the game after rescuing each prisoner would be a superior option, but better still would be a save option after reaching the elevator on each floor. A menu appears at that point anyway, asking you to choose the next floor, so why not allow a Save choice as well? Tackled in half-hour chunks, *Into the Eagle's Nest* would draw players back again and again.

Graphically attractive and well designed, *Into the Eagle's Nest* is a good, solid arcade game with an interesting mission. It would be nice to have smarter Nazis, a stronger sense of secrecy as you sneak your way along the corridors, and a friendlier save-game feature, but even as is the game should appeal to shoot-'em-up fans of all varieties.

Into the Eagle's Nest
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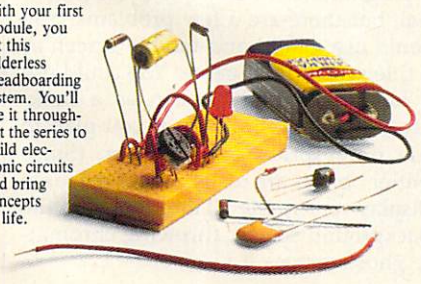

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Digi-Paint For The Amiga

Rhett Anderson

Requirements: Amiga with 512K or more RAM.

Up until now, the best paint programs for the Amiga have allowed you to choose 32 colors from a palette of 4096 for your pictures. While 32 colors are more than any other home computer can handle, it's only natural to wish for more. *Digi-Paint*, a new paint program from NewTek, gives you almost unlimited freedom—all 4096 colors can be used on the screen at once.

Digi-Paint may be the first program that makes you feel as if you are actually painting. It's possible to make your pictures look like oil paintings, watercolor paintings, or chalk drawings. For the most adventurous artists, it's a whole new medium: painting with light. Jaggies—those stairstep squares that appear in other paint programs when you draw diagonal lines—disappear completely in *Digi-Paint*.

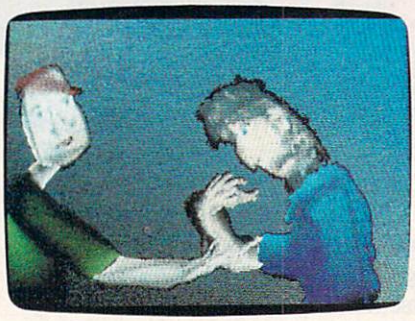
Digi-Paint works in the Amiga's hold-and-modify graphics mode. My hat is off to the author of the program, because it is a difficult mode in which to program. Each pixel can either be chosen from a palette of 16 colors, or retain the color of its neighbor to the left, only with the red, blue, or green value modified. For fast response in this unusual graphics mode, *Digi-Paint* is written entirely in machine language. According to the manual, it uses speed-optimized code to find the best color transition from pixel to pixel. I found *Digi-Paint's* algorithm to produce clear and clean pictures.

The default palette—which contains several grays, a blue, a red, a yellow, a green, and a couple of flesh tones—works very well with most pictures. If you like, you can alter the palette color-by-color. You might, for example, want to include a variety of blues, greens, and purples for an undersea image.

There are two versions of the program. One lets you draw in medium resolution (320 × 200); the other, in high resolution (320 × 400). Although you may not be impressed by these numbers, the huge amount of colors available makes the apparent resolution much higher. This is similar to the way a color television works—although the resolution is not spectacularly high, the great number of colors available makes it easy to fake reality.

It does take a while to get used to having so many colors to choose from. When you first use the program you may find yourself getting bogged down in color selection: "Which blue is best?" *Digi-Paint's* dynamic color selection is a great help. You don't see all 4096 colors at once—only a fraction of them. By clicking on a color, you get a new group of colors close to the color you selected. After you get used to this system, you'll fly through reds, browns, yellows, greens, blues, and grays. If you would prefer to choose colors in a more conventional way, you can use the red, blue, and green sliders next to the dynamic color menus.

Digitized pictures can be altered in a variety of interesting ways with Digi-Paint, *a 4096-color, hold-and-modify paint program for the Amiga.*



Digi-Paint's *dithered gradient-fill and shading options were used to create this bit of original art.*

Pictures can be taken from any paint program that supports the IFF graphics standard. For this screen, several drawings from a Deluxe Paint *art disk were superimposed onto the reviewer's artwork.*

Pictures From Anywhere

An important consideration in reviewing any Amiga paint program is compatibility. Thankfully, *Digi-Paint* goes above and beyond the call of duty. *Digi-Paint* is fully IFF-compatible. (IFF is a file format standard developed by Electronic Arts and Commodore.) Since virtually all paint programs for the Amiga generate IFF files, you can read them into *Digi-Paint*. Amazingly, *Digi-Paint* reads in pictures of all resolutions, converting them to hold-and-modify mode as it reads them in. High-resolution screens (640 pixels across) are converted into *Digi-Paint's* screen format by blending together adjacent pixels. The conversion is excellent—text that is converted is still readable. You can even combine pictures that were drawn with different palettes.

Digi-Paint works well with *Digi-View*, NewTek's video digitizer. With *Digi-View*, you capture an image from a photograph or a still scene and then load it into *Digi-Paint*. You can now alter the picture in any way you like. Add a worm coring into a still-life apple. Draw a mustache on your favorite model. Paint graffiti on your house. Take a bird from a *Deluxe Paint* art disk and place it on your shoulder. More subtle effects are possible—the *Digi-Paint* manual steps through tutorials showing how to add makeup to a black-and-white photo of a woman, and how to add a third eye to the forehead of a little girl. Both of these digitized photos are included on the *Digi-Paint* disk.

While you can get nearly any picture in any format *into Digi-Paint*, you can only get hold-and-modify pictures out of *Digi-Paint*. This prevents you, for example, from working on a picture in *Digi-Paint* and then transferring it to *Deluxe Paint II*.

Of what use are the pictures that you get out of *Digi-Paint*? If you're interested in paint programs for art's sake, you're in luck—*Digi-Paint* is just what you've been looking for. If you're a programmer, there's plenty of potential, but there are a few problems. You could use a hold-and-modify screen as a title screen for a game. You could use a hold-and-modify screen as a background screen, but only if you plan to use only sprites and vsprites. (Since blitter objects are really part of the main display screen, they'll interfere with the background screen, throwing chromatic ghosts across it.)

A Set Of Artistic Tools

Aside from the artist and the capabilities of the medium, the tools available are the most crucial elements of a successful paint program. In this category, *Digi-Paint* scores high, though not so

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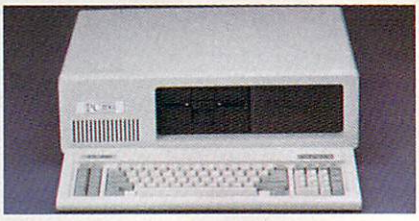

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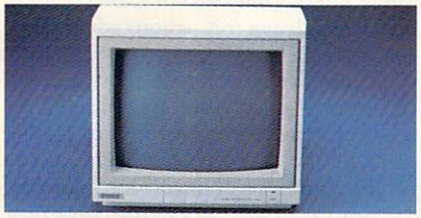

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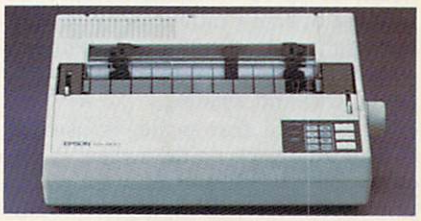

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high as *Deluxe Paint II*. Among the things you *can't* do: Rotate a brush by an arbitrary angle, scale the brush to an arbitrary size, flood-fill an empty area, add text to the screen, and distort brushes. Until a *Digi-Paint II* comes along, you can perform these operations in *Deluxe Paint II* and transfer the results to *Digi-Paint*.

There are several brushes to choose from in *Digi-Paint*. Besides the standard fixed-sized brushes, you can select an expanding circle, a variable-size rectangle, and a polygon-drawing line tool. With any brush, you can select *fill* as an option. Each brush can be used in any of the 12 available modes. Here is a list of these modes: solid, blend, tint, light-tint, minimum, maximum, add, subtract, XOR (eXclusive OR), AND, OR, and shading.

Solid, the first mode, is used to draw solid objects on the screen. Pick a color, pick a brush, and draw. Anything you draw over will disappear. Blend, tint, and light-tint let you tint an area of the screen with a certain color. Blend is the most severe of the three; light-tint is the most delicate.

Minimum, maximum, add, subtract, XOR, AND, and OR combine the brush with the background in various ways. Each of these modes work on the red, blue, and green components of the color seperately. Many, many possibilities exist. For instance, by using a white brush in XOR mode, you can create a negative image of your drawing.

Shading is the most impressive and versatile of the 12 modes. With it you can create realistic shading and highlighting, and smooth color changes. Shading works with any brush. You can even alter the shape and position of the "hot spot" within the shading area.

By using the scissor tool, you can "cut" your own brushes. This is the only way to get multicolor brushes. Any operation that can be performed with a normal brush can be done with your custom brush.

By clicking on RubThrough, you can selectively bring areas of an alternative screen into view. This is similar to Captain Kangaroo's Magic Drawing Board, only better. You can rub through in any mode and with any brush. When used with the shading mode, RubThrough can be used to mix pictures on the screen seamlessly.

Special Effects

Digi-Paint offers an interesting variety of special effects. From the effects menu you can double the screen, halve the screen, soften the screen, mirror the screen, and switch halves of the screen. Each of these effects can be performed vertically or horizontally. By using vertical soften on an interlace picture, you can remove nearly all traces of the flicker associated with interlace mode.

Digi-Paint utilizes menus and file selectors to make the user interface comfortable and quick to learn. After you save a picture, you'll notice that *Digi-Paint* picture icons feature an interesting twist—they are four-color miniature copies of your artwork.

The 56-page manual that comes with *Digi-Paint* is well-written and informative. Many difficult-to-explain features are dealt with clearly. The three tutorials included are nice, but I wish there were more.

Digi-Paint employs the increasingly popular "keyword" protection system. The program disk is unprotected, but when the program is run, it asks you for a certain word on a certain line of a certain page. The program selects the word randomly. If you fail to answer correctly, you're dumped unceremoniously back into the Workbench. While this method of protection is slightly annoying, it is better than copy-protecting the disk. NewTek has provided us with an excellent program—and they have every right to discourage illegal distribution.

Digi-Paint
NewTek
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Topeka, KS 66603
$59.95

Accolade's Comics

Robert Bixby

Requirements: Apple II series and Commodore 64.

Who among us has not become intrigued by a comic book hero? Who hasn't spent a rainy afternoon holed up with a bale of Captain Marvel or Batman magazines, wishing life could be more like the comics?

But the comics always had a few drawbacks. The art rarely rose above the mediocre, the dialog would sound moronic if anyone but Bruce Wayne and Dick Greyson spoke it, and the story lines were pretty predictable—particularly after you'd thumbed through the same classics ten weekends in a row.

Comics Comes To The Computer

With art and dialog wide open to parody, and the interactive quality of videogames, the match between comics and computers seems made in heaven. However, the translation of comics to the electronic medium has been slow.

Accolade's Comics *offers humorous dialog, animated graphics, and arcade action.*

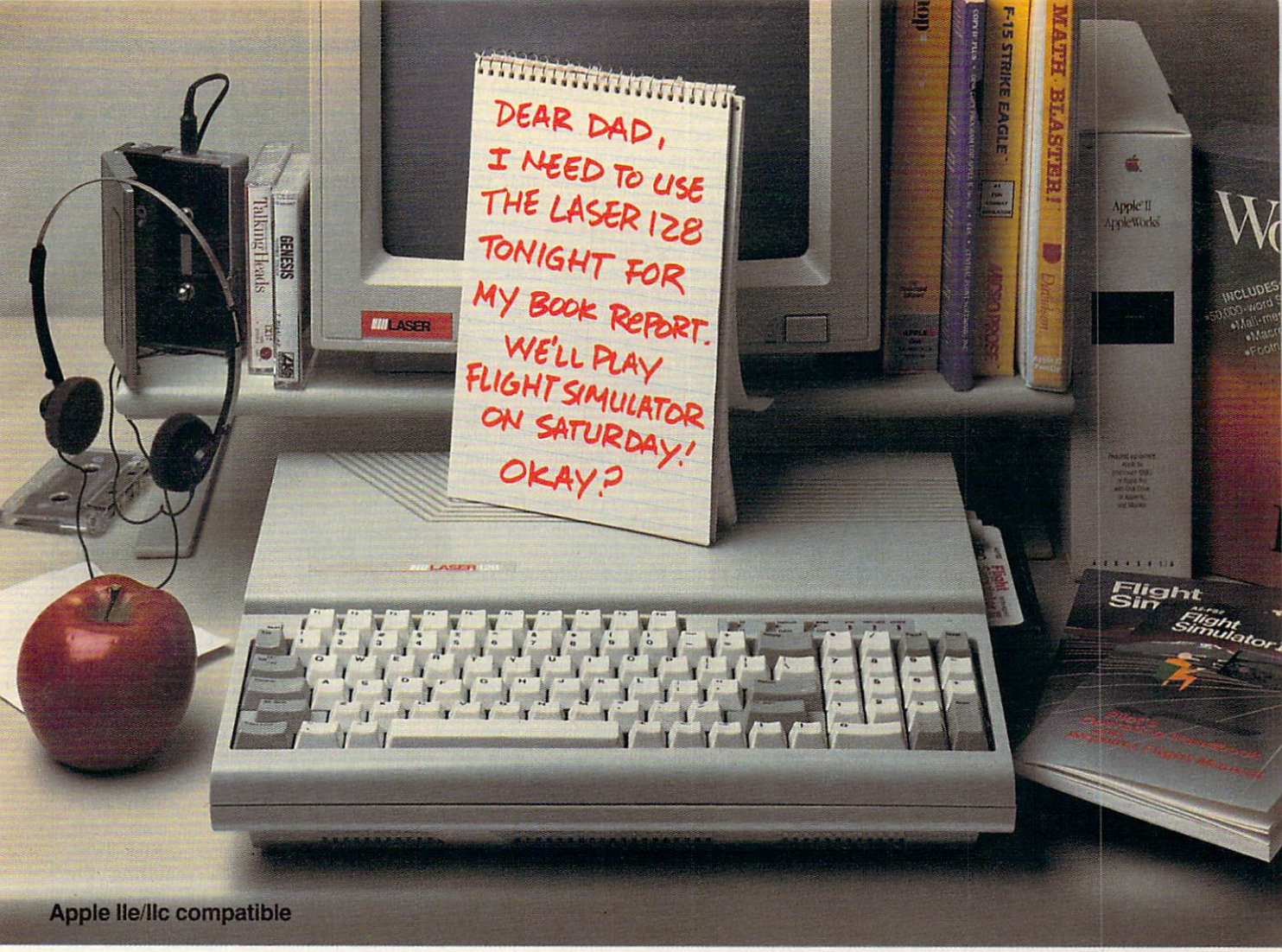
Accolade's Comics finally bridges the gap. It's representative of the new wave in adventure software. No longer are adventures morbidly grim and set in caverns peopled by ogres and halflings. This representative of the new generation of software is brightly lit and humorous, and sophisticated enough to poke fun at itself and its genre.

One might be tempted to comment that this software is not true to life. And particularly as software strives for ever greater verisimilitude, the cartoon drawings and far-out situations that Steve Keene (the hero of *Comics*) finds himself in, leave this action/adventure/role-playing game open to such criticism. But what could be more true to life than a story line that hinges on seemingly insignificant turns of phrase or choices of action? And some of the choices and turns of phrase are hilarious.

Immediately after the program boots, you're given the choice of practicing the videogame sequences or playing the adventure game. My recommendation is to get as much practice as possible with the videogames before attempting anything else.

Steve Keene On The Case

As the story opens, private spy and thrill seeker Steve Keene has been summoned to headquarters (which is cunningly disguised as a small-time pet alterations business) where the thin-skinned chief tells him of an assignment he must complete. As the conversation progresses, you have the opportunity to choose Steve Keene's banter. Will he use wisecracks or respond in a low-key, respectful manner? The decision is yours. But be careful. The chief is not only thin-skinned but also mildly paranoid (as it pays to be in the private spy business). Even if you stick to straight responses, he may get the feeling you are ribbing him, and you'd better apologize when he gets steamed. A word to the wise.



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If you survive the conversation, you might be sent on one of two missions. During the course of the missions you will have the opportunity to swap badinage with bad guys, get sapped, be eaten by a vain shark named Harry, get shot by robot copters, have gum stuck to the bottom of your shoe, and play some truly challenging arcade-style games.

One storyline requires that you track down a kidnapped professor who has just made a discovery that will benefit mankind far into the future. You are faced by such obstacles as an airheaded car salesman named Laughin' Al (who must have been a joy to create), toughs who drive Mercedes and Jaguars, a nerdy lab assistant, and even a vampire who appears incongruously from nowhere.

Errors in judgment are handled in true comic-book style. You don't simply perish (except in the arcade sequences). Rather, you are treated to a graphic representation of your demise, as you wait on death row for that fateful call from the governor, or as an ill-tempered French taxi driver throws you from his moving cab. Fortunately, loss of a life doesn't always take you back to the beginning of the adventure. As long as Steve has lives remaining, the adventure simply "rewinds" a few scenes and allows you the opportunity to make different choices along the way. If only life were like that.

Comics comes on six disk sides. Passage through an adventure will require a considerable amount of disk swapping. The panels are in colorful medium-resolution graphics (on the 64) and they load slowly, although I believe the game is assisted by a fast-load program. As each panel is loaded, it is accompanied by some kind of animation. In the chief's office, the overhead fan turns slowly, and the chief absentmindedly spins a globe while speaking. The mouths of the characters move (particularly in the early sequences) with a kind of "Clutch Cargo" motion. My guess is that for each panel, three or four panels must be loaded in order to accomplish the animation. If this is true, it is worth suggesting that any future version of *Comics* forsake the nonessential animation in order to speed up the plot.

Animated Adventure

In both humor and straight-ahead action, timing is everything. Though funny and impressive at times, the animation just doesn't move the story forward.

Fortunately, you can click the joystick fire button to stop the animation of each panel and move on to the next. Still, it can take several minutes to get through the preparatory sequences to arrive at the challenge that stopped you on a previous game.

One other suggestion I would make has to do with a feature I thought was enormously funny the first time through. Many of us remember the Fearless Fosdick pitches for Wildroot Cream Oil or the Charles Atlas ads that came with our comics. They featured a short comic and a coupon for a body building course, or a real cardboard tank. *Comics* has a section like that, complete with a coupon to cut out of your television screen.

The animation and story of this advertising section are funny and provide a break from the tension. However, I never felt I had to read the Charles Atlas ad through every time I read a comic book. In *Comics*, you have to go through it, panel by panel.

I hope there will be future versions of *Comics*. There are all kinds of themes crying out to be lampooned—western comics, superhero comics—and I'd love to see what *Comics*' creative crew would do with "Tales from the Crypt."

With features that will appeal to children and adults, videogame addicts, and adventure aficionados, *Comics* is a winner from beginning to end. Or as close to the end as I was able to get after several days of trying. I'm still trying.

If you see the kidnapped professor, tell him not to give up hope. I'll rescue him soon.

Accolade's Comics
Accolade
20813 Stevens Creek Blvd.
Cupertino, CA 95014
$39.95 Commodore 64 version
$44.95 Apple II-series version

California Games

Ervin Bobo

Requirements: Commodore 64, Apple II, Apple IIGS, IBM PC and compatibles, and Amiga.

Following the success of *Summer Games* and *Winter Games*, both based on events from the Olympics, Epyx searched for new challenges and settled on *World Games*—supposedly the events the Olympic committee forgot. For this, they combed the world and came up with events such as bull riding and log rolling. Then they apparently sat back, wondering what to do next, and discovered new sports right in their own backyard. The result is *California Games*. It's difficult to think what they might do next, for it will not be easy to top this one.

The *California Games* are, of course, ones we all know and love—although Midwesterners have few chances to practice surfing—but more than that, they are the games of our time, a part of pop culture. Besides surfing, there is skateboarding, roller skating, BMX bike racing, flying-disc throwing, and foot bagging (also known as hacky sack). For each game, a different set of joystick skills must be learned.

Award From The Sponsor

Your reward for playing well is not only a high score but also an attractive trophy from your sponsor. Sponsor? Of course. Since these are not international events—and since you must represent *somebody*—you compete on behalf of a sponsor rather than a flag. The sponsors themselves are also representatives of pop culture: Kawasaki, Ocean Pacific, Casio, and so on.

Once you've chosen a sponsor, the menu gives you the option of practicing an event, competing in an event, or competing in all events. Pick the one you think you can handle and go on from there.

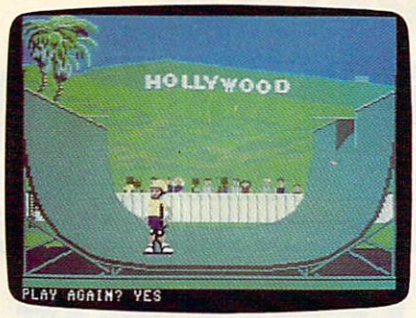
In Skateboarding, you ride a half pipe—in cross section a huge *U*—and while a good deal of your skills will be used in simply staying upright, extra points can be earned by completing stunts such as Hand Plant, Kick Turn, or Aerial Turn—each requiring the right combination of joystick movement and fire-button use. Assuming you can stay on the board, you're allowed slightly over a minute to complete as many stunts as possible. Otherwise, you're allowed three falls.

Foot Bagging was new to me, yet it was one of the easier events. In this, you juggle a small bean-bag ball with your feet and head. Start the round by tossing the bag into the air; try to keep it airborne with kicks, knee lifts, or thrusts with your head. Success is measured by how long you keep the bag in the air as well as by how you keep it there, with extra points given for making spins and jumps between kicks.

Surf's Up!

Surfing gives you the opportunity to ride the waves in style, but simply riding them will not be enough. Moving your joystick up and down takes you from trough to curl, and careful maneuvering in this part will extend your ride and earn points. More points can be earned by taking chances; making cutbacks or turning a full 360 degrees. While successful rides end by going over the top of the wave (where making a turn will allow you to catch the wave again), many will end with a wipeout, four of which are allowed.

BMX Bike Racing presents you



Skateboarding is one of many challenges in Epyx's California Games.

with a course strewn with obstacles, and, while I consider it a great feat simply to complete the course, my children insist it is even more fun if you complete it while doing backward and forward flips and 360-degree turns. I wouldn't know. At any rate, the object is to complete the course in the shortest possible time, with extra points being awarded for successful stunts.

Roller Skating should be easy, and in fact would be if there just weren't so many hazards like grass in the cracks of the sidewalk, dropped ice cream cones, and sand. With your joystick, pump back and forth to begin skating; then try to avoid all the obstacles in your way by going around them or jumping over them. Extra points are awarded for jumps, and still more points for making a full turn while jumping. You're allowed three falls. One of my favorite routines occurs here: On the third fall, your alter ego—a pony-tailed girl—lies face down, beating her fists and kicking her feet in the ultimate expression of frustration.

Flying Disc Throwing requires controlling two players. For the first, you must maneuver the joystick for a clean throw. There are variations depending on whether you want distance or altitude. Sticking to the marked scale, however, will give you more consistency.

Once the disc is thrown, it appears in a schematic at the top of the screen, which also gives you a representation of the catcher. Don't wait to begin moving the catcher back and forth in an effort to be where you think the disc will be.

In contrast to the repetitiveness of other current software entries, where the challenge seems to be to shoot an alien of a different color or to solve a mystery in a different house, this program from Epyx is both inventive and charming. To paraphrase an old Beach Boys number, I sometimes wish they all could be *California Games*.

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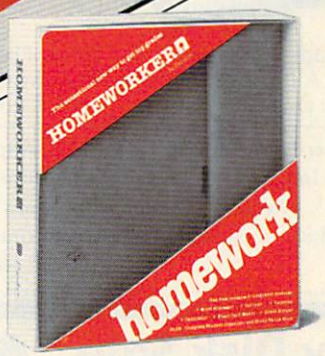

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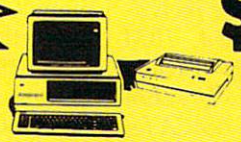

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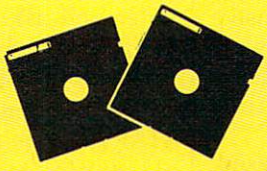

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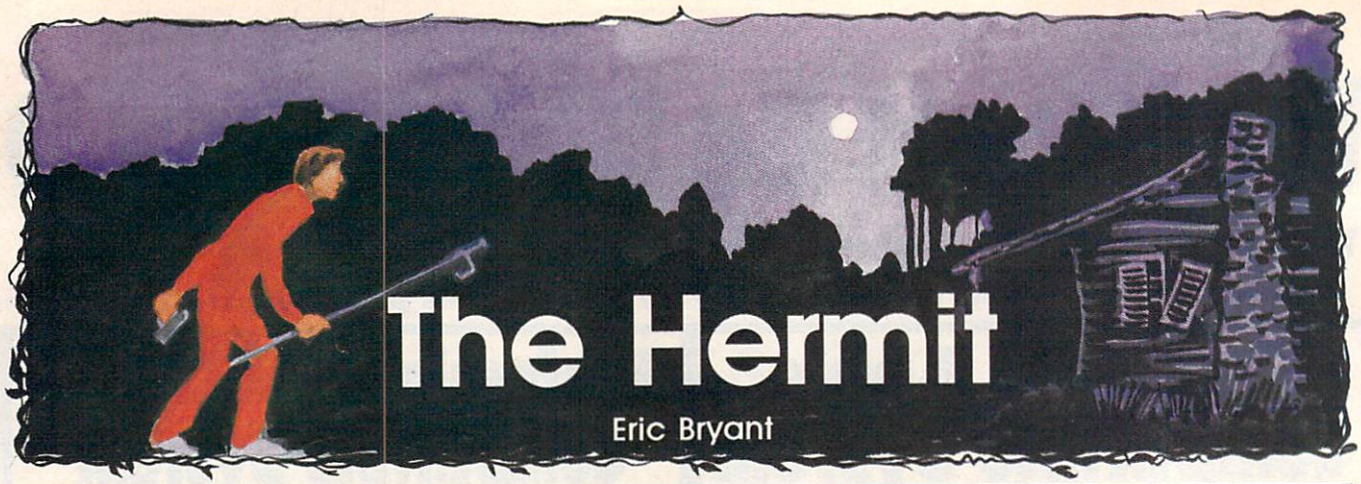

The Hermit

Eric Bryant

Explore hidden caves, discover lost treasures, and battle fierce monsters. "The Hermit," a complex text adventure, begins by placing you outside the underground domain of a most unusual recluse. Versions are included for the Commodore 64, IBM PC/PCjr, Apple II series, Amiga, and Atari 400, 800, XL, and XE. The IBM PC/PCjr version requires BASICA for the PC, GW-BASIC for compatibles, or Cartridge BASIC for the PCjr. The Atari version requires a disk drive.

In a secluded section of southern California (somewhere near Bakersfield), there once lived a nameless man. Referred to only as *the hermit* by his neighbors, rumors spread quickly about the life and possible occupation of this mysterious recluse. Many accused him of stealing, while others claimed he hoarded the riches of extensive gold and diamond mines that were hidden beneath his property. All stories, however, agreed on one fact: The hermit was rich.

The hermit is now deceased, and stories about him have dwindled. His shack, however, still stands. Was the hermit truly rich? Could his riches be somewhere on his property? Is it worth investigating?

The program presented here places you in front of the hermit's old shack—and all you've got is a grappling hook, flare gun, and flare. Your goal is to find ten treasures, to deposit them in a safe place (a spaceship), and to make off with your loot (blast off in the spaceship). As with any adventure program, however, your task is hindered by strange creatures, difficult puzzles, and wrong turns.

Interaction

Program interaction is accomplished with simple one- or two-word commands (see "Command Summary"). In two-word commands, the first word represents the action to be taken (the verb), while the second word represents the object that is to be affected (the noun). Only the first six characters of both the verb and the noun are evaluated. Because of this, you have to enter only the first six characters of any word.

Most commands are self-explanatory. The PUT command, however, is a special case. Because of the two-word limit, the command PUT BALL IN BOX is illegal. To get around this, the PUT command requires two separate inputs. For example, the command PUT BALL IN BOX should be first entered as PUT BALL. Then the computer will ask where you wish to put it; you reply with BOX, and the program performs as instructed.

The commands QUIT and RESTART also require some additional explanation. The QUIT command allows you to exit the program and displays your score and final ranking as an adventurer. Before actually exiting the program, the computer asks you if this is what you really wish to do. The command RESTART starts the adventure all over from the beginning, erasing all your deeds and failures. Again, the computer asks if this really is your intention.

Typing In The Program

Because each version is almost the same, we've published one main program (Program 1) with line changes for specific computers (except for eight-bit Ataris—see below). If you are using a Commodore 64, IBM PC/PCjr, Apple II, or Amiga, type in all of Program 1 and then type in the line changes printed in the separate listing for your computer. Program 2 contains the Commodore 64 line changes; Program 3 lists the changes for the IBM PC/PCjr and compatibles; Program 4 shows the changes necessary for the Apple II series; and Program 5 contains the changes for the Amiga. Be sure to save the complete program before you run it, and be sure the Caps Lock key is activated when running "The Hermit," except when using the Commodore 64 version.

Amiga Notes

Amiga users must enter the following commands from immediate mode (at the OK prompt) prior to entering the program:

```
CLEAR ,25000:CLEAR ,50000&
```

These commands must always be executed prior to entering or running The Hermit.

Amiga users should remember that, unlike most other versions of BASIC, Amiga Basic doesn't use line numbers. In an Amiga Basic program, line numbers are treated as labels; the numeric value of the line number is not significant. That is, if you type in the main program, then type line 20 from Program 5, the added line will not automatically be placed between the existing lines labeled 10 and 30. Instead, the line is added *at the position where it is typed.* When adding the lines from Program 5 to the main program, you must manually position the cursor in the proper spot in the listing before entering each line.

To save time in the future, you may wish to enter and save the

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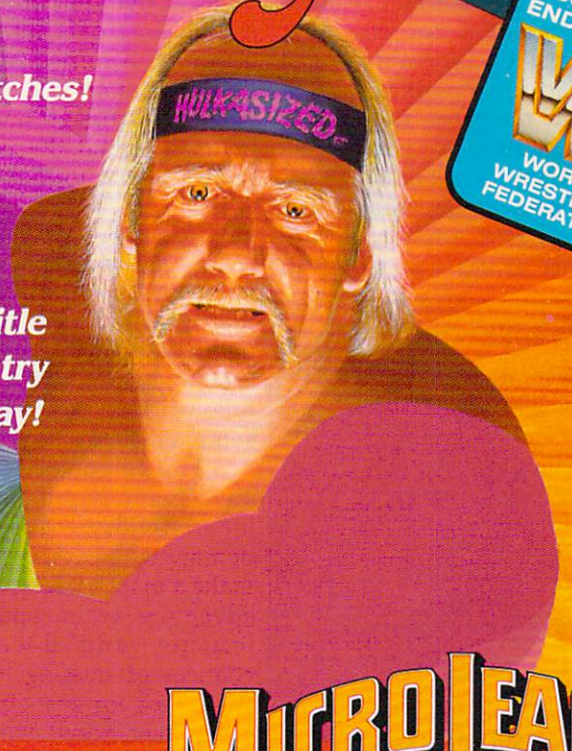

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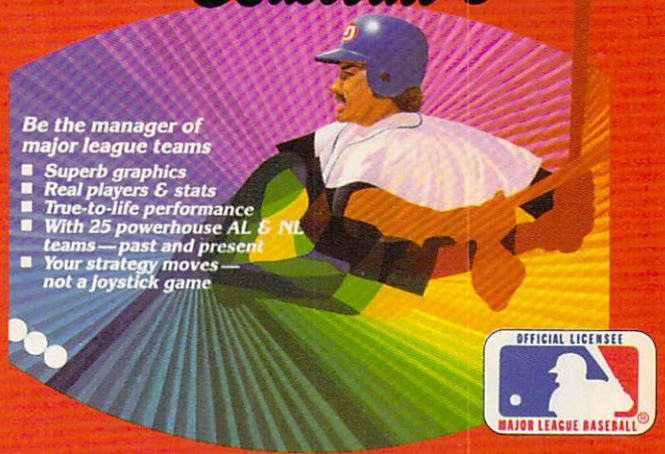

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following program line as a boot program for running The Hermit:

```
CLEAR ,25000:CLEAR ,50000&:RUN
"HERMIT"
```

Now, to run The Hermit, simply run this program. This line assumes that you saved The Hermit program using the file name HERMIT.

Atari Notes

Two separate programs are provided for the eight-bit Atari computers (400, 800, XL, and XE models). If you have one of these computers, type in and save Programs 6 and 7.

Program 6 is the main game program for The Hermit. Before running Program 6 for the first time, you must run Program 7. (You don't need to run Program 7 each time you play the game, run it only before the first time you play.) Program 7 saves important data files to disk. These data files are vital to the adventure. In fact, when you run The Hermit (Program 6), you should make sure that the disk containing these files is placed in the disk drive. The computer will access these files while you are playing the adventure.

By default, Program 7 creates its data files on the disk found in D1:. By altering the string variable DRIVE$ in line 20, you can change this. For example, if you own an Atari 130XE, you can set DRIVE$ equal to "D8:" in order to take advantage of the computer's ramdisk. (If you use the ramdisk, you must run Program 7 before each game to create the necessary data files. Remember that the contents of a ramdisk are lost whenever the computer is turned off.) If the data files are not on the disk in drive 1, you must change line 20 of Program 8 so that the main program knows where to look for its data.

Command Summary

One-Word Commands

Command	Abbreviation
NORTH	N
SOUTH	S
EAST	E
WEST	W
UP	U
DOWN	D
DIVE	none
LOOK	L
INVENTORY	I
SCORE	none
RESTART	none
QUIT	Q

Two-Word Commands

Command	Example
ATTACK	ATTACK MUMMY
BUILD	BUILD RAFT
CLOSE	CLOSE BOX
CUT	CUT VINE
DRINK	DRINK ELIXIR
DROP	DROP LANTERN
ENTER	ENTER RAFT
EXAMINE	EXAMINE PEDESTAL
EXIT	EXIT RAFT
FILL	FILL LANTERN
HIT	HIT TREE
HOOK	HOOK CLIFF
LIFT	LIFT MATTRESS
LIGHT	LIGHT LANTERN
OFFER	OFFER TRIDENT
OPEN	OPEN BOX
PUSH	PUSH REFRIGERATOR
PUT	PUT FLARE (then enter) GUN
READ	READ SIGN
RUB	RUB LAMP
SAY	SAY HELLO
SHOOT	SHOOT FLARE
TAKE	TAKE LANTERN

Hints, Tips, And Clues

If you are the type of adventurer who does not need or want help, then read no further. If on the other hand, you find yourself stuck in a seemingly impossible situation, the following paragraphs should be of some assistance.

First, a good rule of thumb in any adventure program is to examine everything—clues may be hidden anywhere. And don't forget to make a map. Making a map of your adventure realm speeds up your journey and decreases your chances of missing any treasures. Also, pick up any object you find. You never know when an object may become useful. Finally, use your imagination. Successfully traversing an adventure takes a lot of creative problem solving.

Now for specific hints: If you are stuck in the hut, push the refrigerator. To take the pouch without falling through the floor, hook the pouch with your grappling hook. Drop the metal rod on the broken piece of track before entering the coal bin. To exit the room containing the pedestal, place the sapphire on top of the pedestal (don't forget to remove the sapphire before you leave).

You may climb the cliff by hooking it with the grappling hook. Build a raft out of logs and vine. Cut the vine from the giant oak. If you lift the mattress in the sunken ship, you will find a treasure. You may have to dive twice to avoid running out of air.

To avoid the bear, fire your flare at him. Light the mummy. Use the crossbow to shoot the stick at the leopard. If you rub the lamp while in the pentacle room, a demon will appear. Offer the demon the trident (you didn't really want it anyway). Answer the sphinx's question by saying *water*. Enter the door guarded by the dragon statue by putting sand in its mouth. Hit the rock using your pick to get the launch card. And last but not least, drop all treasures in the spaceship before attempting to blast off.

For instructions on entering these programs, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

Program 1: The Hermit—Main Program

```
10 REM COPYRIGHT 1987 COMPUTE! PUBL
   ICATIONS, INC. - ALL RIGHTS RESE
   RVED
30 PRINT "          ALL RIGHTS RESER
   VED":PRINT :PRINT :PRINT
40 GOSUB 5640:GOTO 1070
50 A$=INKEY$:IF A$="" THEN 50
60 RETURN
70 IF FNC(24) THEN MC=MC+1:MM=1
80 IF FNC(47) THEN BC=BC+1:BB=1
90 IF FNC(56) THEN DC=DC+1:DD=1
100 IF FNC(67) THEN LC=LC+1:LL=1
110 IF RM>30 AND RM<34 THEN AC=AC-1
120 IF MM THEN PRINT :PRINT "THE MU
    MMY LUMBERS TOWARD YOU...."
130 IF BB THEN PRINT :PRINT "THE BE
    AR OPENS HIS ARMS, READY TO
       EMBRACE YOU.
140 IF DD THEN PRINT :PRINT "THE DE
    MON TAPS HIS FOOT IMPATIENTLY."
150 IF LL THEN PRINT :PRINT "THE LE
    OPARD STALKS TOWARD YOU...."
160 IF MC=4 THEN PRINT "THE MUMMY G
    RABS YOU AND CHOKES YOU TO   DE
    ATH.":GOTO 4580
170 IF BC=3 THEN PRINT "THE BEAR EM
    BRACES YOU. YOU FEEL YOUR    RI
    BS CRACK...."
180 IF AC<3 THEN PRINT "YOU FEEL DI
    ZZY...."
190 IF BC=3 THEN 4580
200 IF DC=4 THEN PRINT QT$;"'YOU KN
    OW WHERE TO REACH ME,'";QT$
210 IF DC=4 THEN PRINT "THE DEMON S
    AYS AND DISAPPEARS.":OL(56)=0:D
    D=0:DC=0:GOTO 410
220 IF LC=3 THEN PRINT "THE LEOPARD
     POUNCES; THAT IS THE LAST   TH
    ING YOU SEE...."
230 IF LC=3 THEN 4580
240 IF AC=0 THEN PRINT "YOU RUN OUT
     OF OXYGEN....":GOTO 4580
250 IF FNC(60) THEN PC=PC+1:SX=1
260 IF SX<>1 OR PC<>1 THEN 320
270 PRINT :PRINT QT$;"WHEN SOLID IT
     CAN SINK SHIPS;"
280 PRINT "WHEN GAS IT CAN BLOCK TH
    E VIEW;"
290 PRINT "WHEN LIQUID IT CAN WEIGH
     MANY TONS."
300 PRINT :PRINT "ANSWER MY RIDDLE
    CORRECTLY AND THOU      SHALT LI
    VE ";
310 PRINT "TO ENJOY THY TREASURES."
    ;QT$
320 IF SX THEN PRINT :PRINT "THE SP
    HINX IS WAITING PATIENTLY."
330 IF PC<>4 THEN 360
```

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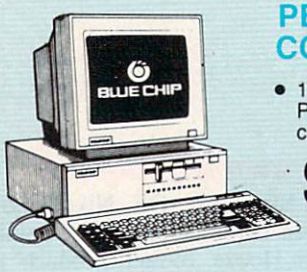

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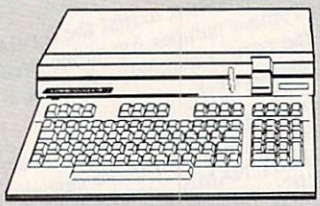

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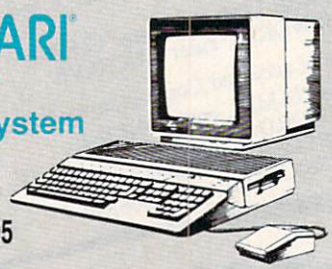

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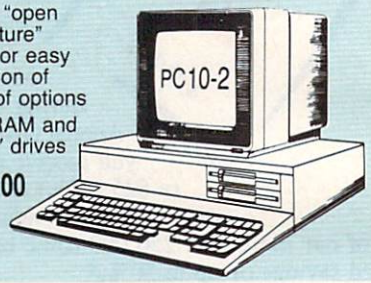

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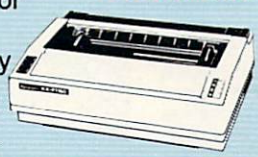

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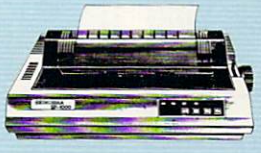

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Mark "Mac" Bowser, Sales Manager

I would personally like to thank all of our past customers for helping to make Lyco Computer one of the largest mail order companies and a leader in the industry. Also, I would like to extend my personal invitation to all computer enthusiasts who have not experienced the services that we provide. Please call our trained sales staff at our toll free number to inquire about our diverse product line and weekly specials.

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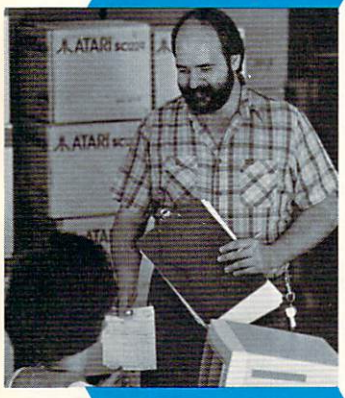

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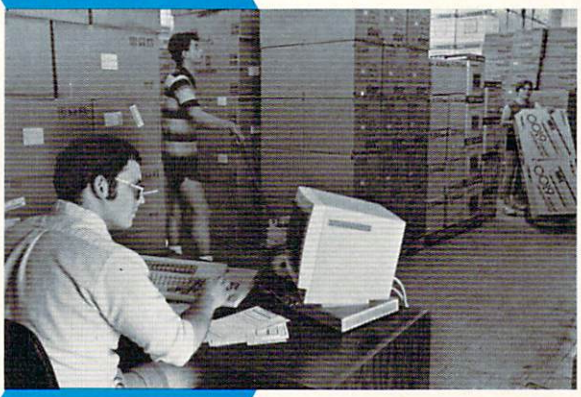

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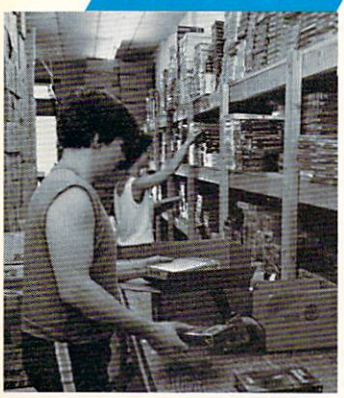

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340 PRINT "THE SPHINX POUNCES; HIS
    CLAWS EAGERLY AWAITING YOUR THR
    OAT...."
350 GOTO 4580
360 IF RM<31 OR RM>33 THEN 390
370 IF OL(14)=-5 AND FNA(11) AND OO
    (4)=1 THEN OL(14)=0
380 IF OL(15)=-6 AND FNA(12) AND OO
    (5)=1 THEN OL(15)=0
390 IF IR THEN OL(63)=RM
400 RETURN
410 GOSUB 70:Y=0:VP=0:MV=MV+1
420 PRINT :IN$="":VB$="":NN$="":ZL=
    0:QI=37:X=0:VB=0:NN=0:V=0
430 PRINT ">";
440 PRINT UL$;CL$;
450 GOSUB 50:IF (A$<" " OR A$>CHR$(
    95) OR A$=QT$) AND A$<>DL$ AND
    A$<>CR$ THEN 450
460 IF A$=DL$ AND ZL>0 THEN IN$=MID
    $(IN$,1,ZL-1):ZL=ZL-1:PRINT " "
    ;CL$;CL$;:GOTO 440
470 IF A$=CR$ AND ZL>0 THEN PRINT "
     ":PRINT :GOTO 500
480 IF A$<>CR$ AND A$<>DL$ AND ZL<Q
    I THEN IN$=IN$+A$:ZL=ZL+1:PRINT
     A$;:GOTO 440
490 GOTO 450
500 IF QQ=1 OR RS=1 THEN RETURN
510 L=LEN(IN$):FOR I=1 TO L:A$=MID$
    (IN$,I,1):IF A$<>" " THEN 540
520 IF NN$<>"" THEN PRINT "ONE OR T
    WO WORDS PLEASE.":GOTO 420
530 X=1:GOTO 560
540 IF X=0 THEN VB$=VB$+A$:GOTO 560
550 NN$=NN$+A$
560 NEXT I:VB$=LEFT$(VB$,6):NN$=LEF
    T$(NN$,6)
570 FOR I=1 TO 44:IF VB$=LEFT$(VW$(
    I),6) THEN VB=I:VP=0:GOTO 600
580 NEXT I:IF VP THEN NN$=VB$:GOTO
    600
590 IF VB=0 THEN PRINT "I DO NOT KN
    OW THAT VERB.":GOTO 420
600 FOR I=1 TO 68:IF NN$=LEFT$(NW$(
    I),6) THEN NN=I:GOTO 630
610 NEXT I:IF NN=0 AND VB<>17 THEN
    PRINT "I DO NOT KNOW THE WORD "
    ;QT$;
620 IF NN=0 AND VB<>17 THEN PRINT N
    N$;QT$;".":VP=0:GOTO 420
630 IF VB>12 AND VB<36 AND NN=68 TH
    EN PRINT VB$;" WHAT?":GOTO 420
640 IF VP THEN RETURN
650 IF (VB<13 OR VB>35) AND NN<>68
    THEN PRINT "JUST ";VW$(VB);" PL
    EASE.":GOTO 420
660 ON VB GOTO 720,720,790,790,880,
    880,920,920,1000
670 ON VB-9 GOTO 1000,1030,1030,149
    0,1690,1840,2160,2250,2310
680 ON VB-18 GOTO 2460,2550,2690,28
    20,2890,3100,3280,3380,3710
690 ON VB-27 GOTO 3790,3900,3990,40
    50,4090,4140,4200,4240,4320
700 ON VB-36 GOTO 4320,4380,4380,45
    20,4540,1070,1070,4550
710 PRINT "YOU CANNOT GO IN THAT DI
    RECTION.":GOTO 410
720 IF MV(RM,1)=0 THEN 710
730 IF BB THEN BB=0:BC=0:PRINT "YOU
     RUN FROM THE BEAR....":PRINT
740 IF LL THEN LL=0:LC=0:PRINT "YOU
     FLEE FROM THE LEOPARD....":PRI
    NT
750 IF FNC(60) THEN 340
760 IF RM=19 THEN PRINT "THE SOUTH
    DOOR CLOSES BEHIND YOU....":PRI
    NT :MV(18,2)=0
770 IF IR AND (RM=21) THEN PRINT "F
    IRST, YOU MUST EXIT THE RAFT.":
    GOTO 420
780 RM=MV(RM,1):GOTO 1070
790 IF MV(RM,2)=0 THEN 710
800 IF FNC(47) THEN PRINT "THE BEAR
     STOPS YOU.":GOTO 410
810 IF FNC(67) THEN PRINT "THE BLAC
    K LEOPARD STOPS YOU.":GOTO 410
820 IF IR AND (RM=34) THEN PRINT "F
    IRST, YOU MUST EXIT THE RAFT.":
    GOTO 410
830 IF RM=55 AND TW=1 THEN PRINT "A
    S YOU ENTER THE ARCHWAY, A JET
    OF"
840 IF RM=55 AND TW=1 THEN PRINT "F
    IRE COMES FROM THE DRAGON'S MOU
    TH AND"
850 IF RM=55 AND TW=1 THEN PRINT "E
    NGULFS YOU.":GOTO 4580
860 IF MM THEN MM=0:MC=0:PRINT "YOU
     FLEE FROM THE LUMBERING MUMMY.
    ...":PRINT
870 RM=MV(RM,2):GOTO 1070
880 IF MV(RM,3)=0 THEN 710
890 IF FNC(67) THEN PRINT "THE BLAC
    K LEOPARD STOPS YOU.":GOTO 410
900 IF IR AND (RM<27) THEN PRINT "F
    IRST, YOU MUST EXIT THE RAFT.":
    GOTO 410
910 RM=MV(RM,3):GOTO 1070
920 IF MV(RM,4)=0 THEN 710
930 IF FNC(67) THEN PRINT "THE BLAC
    K LEOPARD STOPS YOU.":GOTO 410
940 IF IR=1 AND (RM<27 OR RM>30) TH
    EN PRINT "FIRST, YOU MUST EXIT
    THE RAFT.":GOTO 410
950 IF RM=30 THEN PRINT "THAT WAY L
    EADS TO THE OCEAN; YOU TURN   B
    ACK.":GOTO 410
960 IF MM THEN MM=0:MC=0:PRINT "YOU
     FLEE FROM THE LUMBERING MUMMY.
    ...":PRINT
970 IF DD THEN DD=0
980 IF RM=29 AND IR=0 THEN PRINT "Y
    OU CANNOT SWIM THAT FAR.":GOTO
    410
990 RM=MV(RM,4):GOTO 1070
1000 IF MV(RM,5)=0 THEN 710
1010 IF RM=31 THEN PRINT "YOU RETUR
     N TO THE SURFACE FOR AIR.":PRI
     NT :AC=10
1020 RM=MV(RM,5):GOTO 1070
1030 IF MV(RM,6)=0 THEN 710
1040 IF RM=4 THEN PRINT "AS YOU DES
     CEND, THE TUNNEL CAVES IN FROM
      ABOVE.":PRINT
1050 IF RM=4 THEN SC=SC+5
1060 RM=MV(RM,6):GOTO 1070
1070 IF RM>36 AND RM<39 AND LT=0 TH
     EN PRINT "YOU ARE IN TOTAL DAR
     KNESS.":GOTO 410
1080 PRINT "YOU ARE "+RD$(RM)+"."
1090 IF RM=18 THEN PRINT "LIGHT SHI
     NES THROUGH A CRACK BETWEEN
      SOME BEAMS."
1100 IF HC AND (RM=14) THEN PRINT "
     THERE IS A ROPE TO ASCEND THE
     CLIFF      HERE."
1110 IF HC AND (RM=20) THEN PRINT "
     THERE IS A ROPE TO DESCEND THE
      CLIFF     HERE."
1120 IF IR THEN PRINT "YOU ARE ABOA
     RD A WOODEN RAFT."
1130 FOR X=1 TO 67:IF FNC(X) THEN 1
     170
1140 NEXT X
1150 IF SB AND RM=8 THEN PRINT "SMA
     SHED AGAINST THE WALL IS A COA
     L BIN."
1160 GOTO 1410
1170 FL$=LEFT$(OB$(X),1)
1180 IF FL$="*" THEN FL$=MID$(OB$(X
     ),2,1)
1190 FOR Y=1 TO 5:IF FL$=MID$(VL$,Y
     ,1) THEN A$="AN ":GOTO 1230
1200 NEXT Y
1210 A$="A "
1220 IF X=15 OR X=31 OR X=45 THEN A
     $="SOME "
1230 IF RF=1 THEN RETURN
1240 PRINT "THERE IS "+A$+OB$(X)+"
     HERE."
1250 GOSUB 1260:GOTO 1140
1260 FOR Y=1 TO 11:IF X=PO(Y) THEN
     RF=1:GOTO 1280
1270 NEXT Y:RETURN
1280 IF OO(Y)=0 THEN RF=0:RETURN
1290 Z=X:W=Y
1300 FOR I=1 TO 66:IF OL(I)=PV(W) T
     HEN 1330
1310 NEXT I
1320 RF=0:RETURN
1330 IF Y=1 OR Y=10 THEN 1390
1340 IF Y=7 OR Y=8 THEN 1400
1350 PRINT " THE ";OB$(Z);" CONTAIN
     S:"
1360 FOR X=1 TO 66:IF OL(X)=PV(W) T
     HEN GOSUB 1170:PRINT "  ";A$;O
     B$(X)
1370 NEXT X
1380 X=Z:Y=W:RF=0:RETURN
1390 PRINT " ON THE ";OB$(Z);" THER
     E IS:":GOTO 1360
1400 PRINT " LOADED INTO THE ";OB$(
     Z);" THERE IS:":GOTO 1360
1410 FOR X=1 TO 6:IF MV(RM,X)>0 THE
     N V=V+1
1420 NEXT X
1430 IF V=0 THEN 410
1440 PRINT :PRINT "YOU FIND THAT TH
     ERE ";
1450 IF V>1 THEN PRINT "ARE EXITS "
     :GOTO 1470
1460 PRINT "IS AN EXIT ";
1470 FOR X=1 TO 6:IF MV(RM,X)>0 THE
     N PRINT DR$(X);", ";
1480 NEXT X:PRINT CL$;CL$;".":GOTO
     410
1490 IF OL(NN)<-1 AND OL(NN)>-13 TH
     EN 1590
1500 IF FNA(NN) THEN PRINT "YOU ALR
     EADY HAVE THAT.":GOTO 410
1510 IF (NN=7) AND FNC(66) THEN 168
     0
1520 IF (NN=39) AND HC AND (RM=14)
     THEN HC=0:MV(14,5)=0:MV(20,6)=
     0:GOTO 1580
1530 IF (NN=39) AND HC AND (RM=20)
     THEN HC=0:MV(14,5)=0:MV(20,6)=
     0:GOTO 1580
1540 IF (NN=44) AND FNC(18) THEN PR
     INT "THE VINES ARE CONNECTED T
     OGETHER.":GOTO 410
1550 IF FNB(NN) THEN PRINT "YOU DO
     NOT SEE THAT.":GOTO 410
1560 IF TF(NN)=0 THEN PRINT "IT FLO
     WS THROUGH YOUR FINGERS....":O
     L(NN)=0:GOTO 410
1570 IF TF(NN)=-1 THEN PRINT "THAT
     ITEM STAYS PUT.":GOTO 410
1580 PRINT "TAKEN.":OL(NN)=-1:GOTO
     1640
1590 FOR I=1 TO 11:IF OL(NN)=PV(I)
     THEN Y=I
1600 NEXT I
1610 IF FNC(PO(Y)) AND (OO(Y)=1) TH
     EN OI(Y)=OI(Y)-1:GOTO 1560
1620 IF FNA(PO(Y)) AND (OO(Y)=1) TH
     EN OI(Y)=OI(Y)-1:GOTO 1560
1630 GOTO 1550
1640 IF LEFT$(OB$(NN),1)="*" THEN P
     RINT :PRINT "YOU HAVE A TREASU
     RE!"
1650 IF (LEFT$(OB$(NN),1)="*") AND
     (RM=44) THEN SC=SC-10
1660 IF NN=11 AND OL(14)=-5 AND RM=
     44 THEN SC=SC-10
1670 GOTO 410
1680 PRINT "YOU GRAB THE POUCH AND
     THE CIRCLE OPENS INTO A PIT...
     ":GOTO 4580
1690 IF OL(NN)<-1 THEN 1780
1700 IF NOT FNA(NN) THEN PRINT "YOU
      DO NOT HAVE THAT.":GOTO 410
1710 PRINT "DROPPED.":OL(NN)=RM
1720 IF (NN=38) AND FNC(42) THEN 18
     20
1730 IF (NN=14) OR (NN=62) THEN PRI
     NT "IT SOAKS INTO THE GROUND..
     .":OL(NN)=0
1740 IF NN=15 THEN PRINT "IT IS BLO
     WN AWAY BY THE WIND...":OL(NN)
     =0
1750 IF LEFT$(OB$(NN),1)="*" AND RM
     =44 THEN SC=SC+10
1760 IF NN=11 AND OL(14)=-5 AND RM=
     44 THEN SC=SC+10
1770 GOTO 410
1780 FOR I=1 TO 11:IF OL(NN)=PV(I)
     THEN Y=I
1790 NEXT I
1800 IF FNA(PO(Y)) AND (OO(Y)=1) TH
     EN 1710
1810 GOTO 1700
1820 PRINT "YOU REPLACE THE BROKEN
     TRACK WITH THE   ROD.":OL(42)=
     0:OL(38)=0
1830 GOTO 410
1840 IF FNB(NN) AND (NOT FNA(NN)) T
     HEN 1550
1850 FOR I=1 TO 11:IF NN=PO(I) THEN
      Y=I:PF=1
1860 NEXT I
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1870 IF Y=0 THEN 1910
1880 IF FNC(PO(Y)) THEN 1910
1890 IF FNA(PO(Y)) THEN 1910
1900 IF NOT FNA(PO(Y)) AND (OO(Y)<>
     1) THEN NN=0:GOTO 1700
1910 IF NN>26 AND NN<>50 THEN PRINT
      "YOU SEE NOTHING SPECIAL ABOU
     T IT.":GOTO 410
1920 IF NN=4 THEN PRINT "ITS MOUTH
     IS OPEN WIDE AND SMOKE IS
     COMING FROM IT."
1930 IF NN=5 THEN PRINT "IT IS A PL
     ASTIC CARD."
1940 IF NN<6 THEN PRINT "IT HAS SOM
     ETHING WRITTEN ON IT."
1950 IF NN=6 AND FL THEN PRINT "IT
     IS FILLED WITH OIL.":GOTO 410
1960 IF NN=6 AND BK THEN PRINT "IT
     IS SMASHED.":GOTO 410
1970 IF (NN=6) AND (LT=0) THEN PRIN
     T "YOU SEE NOTHING SPECIAL ABO
     UT IT.":GOTO 410
1980 IF NN=6 THEN PRINT "IT IS LIT.
     "
1990 IF NN=9 THEN PRINT "IT HAS SEV
     ERAL GEMS ON THE HILT."
2000 IF NN=10 THEN PRINT "IT RESEMB
     LES A QUARREL."
2010 IF NN=14 THEN PRINT "IT HAS A
     MILKY WHITE COLOR."
2020 IF NN=15 THEN PRINT "IT IS A P
     URE WHITE."
2030 IF NN=16 THEN PRINT "IT HAS AN
      INSCRIPTION: 'SB-910' ON ITS
         STARBOARD."
2040 IF NN=17 THEN PRINT "IT HAS AN
      ORANGE BUTTON ON IT WHICH SAY
     S:'LAUNCH.'"
2050 IF NN=18 THEN PRINT "IT HAS LO
     NG VINES HANGING FROM ITS
      BRANCHES."
2060 IF NN=20 THEN PRINT "IT HAS A
     SINGLE DRAWER."
2070 IF NN=22 THEN PRINT "IT HAS 'S
     IGNAL FLARE' WRITTEN ON IT IN
      BLACK INK."
2080 IF NN=23 THEN PRINT "IT HAS A
     WORN MATTRESS."
2090 IF NN=24 THEN PRINT "IT IS ENC
     ASED IN OLD BANDAGES."
2100 IF PF AND ((NN=2) OR (NN=13) O
     R (NN=19) OR (NN=26)) THEN NO=
     1
2110 IF PF AND NO=1 THEN PRINT "IT
     LOOKS ORDINARY.":NO=0:GOTO 214
     0
2120 IF PF THEN PRINT "IT IS ";:IF
     OO(Y)=0 THEN PRINT "CLOSED."
2130 IF OO(Y) THEN PRINT "OPEN."
2140 IF PF THEN X=NN:PF=0:GOSUB 126
     0
2150 GOTO 410
2160 IF NOT FNA(NN) AND (TF(NN)=1)
     THEN 1700
2170 IF NN>5 THEN PRINT "THERE IS N
     OTHING WRITTEN ON THAT.":GOTO
     410
2180 IF NN=1 THEN PRINT "IT READS:
     'THE TRAPDOOR IS UNDER....'":G
     OTO 410
2190 IF NN=2 THEN PRINT "IT READS:
     'TO ESCAPE, OFFER THE SAPPHIRE
      TO RA.'":GOTO 410
2200 IF (NN=4) AND TW THEN PRINT "T
     HE STATUE'S BASE READS: 'DO NO
     T ENTER.'";:GOTO 410
2210 IF NN=4 THEN PRINT "THE STATUE
     'S BASE READS: 'ENTER.'":GOTO
     410
2220 IF NN=5 THEN PRINT "IT READS:
     'THIS CARD ACTIVATES SPACESHIP
     S B-910.'":GOTO 410
2230 PRINT "THE BOOK IS ON DEMONOLO
     GY. THERE IS ONLY ONE PAGE INT
     ACT. IT READS:";
2240 PRINT " '...DEMON":PRINT "MUST
      BE SUMMONED IN PENTACLE.'":GO
     TO 410
2250 PRINT "YOU SAY, ";QT$;NN$;QT$;
     "."
2260 IF FNC(60) AND (NN=62) THEN 22
     80
2270 PRINT "NOTHING HAPPENS.":GOTO
     410
2280 PRINT "THE SPHINX CRIES OUT AN
     D JUMPS INTO THE PIT, FALLING
     TO HIS DEATH."
2290 PRINT "HE HAS LEFT BEHIND A ST
     AR RUBY.":OL(61)=RM:SC=SC+40:S
     X=0
2300 OL(60)=0:PC=0:GOTO 410
2310 IF (NN=25) AND FNC(20) THEN OL
     (25)=RM:GOTO 2350
2320 IF ((NOT FNA(NN)) AND (TF(NN)=
     1)) OR ((FNB(NN)) AND (TF(NN)=
     -1)) THEN 1700
2330 IF (NN=28) AND FNC(28) THEN PR
     INT "OPENED.":MV(4,6)=5:OL(28)
     =0:GOTO 410
2340 IF (NN=25) AND FNB(20) THEN 23
     10
2350 FOR I=1 TO 11:IF NN=PO(I) THEN
      Y=I
2360 NEXT I:IF Y=0 THEN PRINT "THER
     E IS NO WAY TO OPEN THAT.":GOT
     O 410
2370 IF NN=1 OR NN=19 OR NN=26 THEN
      PRINT "THERE IS NO WAY TO OPE
     N THAT.":GOTO 410
2380 IF OO(Y)=1 THEN PRINT "IT IS A
     LREADY OPENED.":GOTO 410
2390 IF OO(Y)=1 THEN PRINT "IT IS A
     LREADY OPENED.":GOTO 410
2400 PRINT "OPENED.":OO(Y)=1
2410 X=NN:GOSUB 1260
2420 IF NN=50 AND OL(24)=-11 THEN 2
     440
2430 GOTO 410
2440 PRINT :PRINT "THE MUMMY OPENS
     ITS EYES AND LETS OUT   A DEEP
      MOAN."
2450 OL(24)=RM:GOTO 410
2460 IF NOT FNA(NN) AND (TF(NN)=1)
     THEN PRINT "IT IS NOT HERE.":G
     OTO 410
2470 IF NN=28 AND MV(4,6)=5 THEN PR
     INT "CLOSED.":OL(28)=RM:MV(4,6
     )=0:GOTO 410
2480 IF (NN=25) AND FNB(25) THEN 24
     60
2490 FOR I=1 TO 11:IF NN=PO(I) THEN
      Y=I
2500 NEXT I:IF Y=0 THEN PRINT "THER
     E IS NO WAY TO CLOSE THAT.":GO
     TO 410
2510 IF NN=1 OR NN=19 OR NN=26 THEN
      PRINT "THERE IS NO WAY TO CLO
     SE THAT.":GOTO 410
2520 IF OO(Y)=0 THEN PRINT "IT IS A
     LREADY CLOSED.":GOTO 410
2530 IF (NN=25) AND FNC(25) THEN OL
     (25)=0
2540 PRINT "CLOSED.":OO(Y)=0:GOTO 4
     10
2550 IF FNB(NN) THEN PRINT "YOU DO
     NOT SEE THAT HERE.":GOTO 410
2560 IF NN=63 THEN PRINT "YOU ARE A
     BOARD THE RAFT.":IR=1
2570 IF IR THEN MV(21,2)=28:MV(34,1
     )=28:GOTO 410
2580 IF NN=59 THEN PRINT "YOU PLUNG
     E INTO THE PIT....":GOTO 4580
2590 IF NN=35 THEN PRINT "YOU SLIDE
      DOWN THE CHUTE....":PRINT :RM
     =18:GOTO 1070
2600 IF NN<>16 AND NN<>41 AND NN<>5
     0 THEN PRINT "YOU CANNOT ENTER
      THAT.":GOTO 410
2610 IF NN=16 THEN PRINT "YOU ENTER
      THE SPACESHIP....":PRINT :RM=
     44:GOTO 1070
2620 IF NN=50 THEN PRINT "IT IS TOO
      SMALL FOR YOU.":GOTO 410
2630 PRINT "YOUR WEIGHT STARTS THE
     COAL BIN TO      MOVE DOWN THE
      TRACK."
2640 IF OL(42)=8 THEN PRINT "UNFORT
     UNATELY THE TRACKS ARE BROKEN
     AND YOU ARE";
2650 IF OL(42)=8 THEN PRINT " THROW
     N AGAINST THE WALL....":GOTO 4
     580
2660 PRINT "AFTER A BRIEF RIDE YOU
     STOP AT THE END  OF THE TRACK.
     ":PRINT
2670 IF RM=7 THEN RM=12:OL(41)=12:P
     RINT :GOTO 1070
2680 IF RM=12 THEN RM=7:OL(41)=7:PR
     INT :GOTO 1070
2690 IF (NN<>6) AND (NN<>24) THEN P
     RINT "YOU CANNOT LIGHT THAT.":
     GOTO 410
2700 IF NN=6 THEN IF NOT FNA(6) THE
     N 1700
2710 IF NN=24 THEN IF FNB(24) THEN
     1550
2720 IF NN=24 THEN 2780
2730 IF LT THEN PRINT "IT IS ALREAD
     Y LIT.":GOTO 410
2740 IF BK THEN PRINT "THE LANTERN
     IS SMASHED.":GOTO 410
2750 IF FL=0 THEN PRINT "THE LANTER
     N IS NOT FILLED WITH OIL.":GOT
     O 410
2760 IF NOT FNA(31) THEN PRINT "YOU
      HAVE NOTHING TO LIGHT IT WITH
     .":GOTO 410
2770 PRINT "OK, THE LANTERN IS LIT.
     ":LT=1:FL=0:GOTO 410
2780 IF NOT FNA(6) OR (LT=0) THEN P
     RINT "YOU HAVE NOTHING TO LIGH
     T IT WITH.":GOTO 410
2790 PRINT "YOU THROW YOUR LANTERN
     AT THE MUMMY AND IT BREAKS, EN
     GULFING THE ";
2800 PRINT "MUMMY IN":PRINT "FLAMES
     . THE LANTERN LIES SMASHED ON
     THE FLOOR."
2810 OL(52)=-11:OI(11)=1:MM=0:OL(24
     )=0:OL(6)=39:LT=0:BK=1:GOTO 41
     0
2820 IF NOT FNA(9) THEN PRINT "YOU
     HAVE NOTHING TO CUT IT WITH.":
     GOTO 410
2830 IF NN<>44 THEN PRINT "YOU CANN
     OT CUT THAT.":GOTO 410
2840 IF FNB(18) THEN PRINT "FROM WH
     ERE?":GOTO 410
2850 IF OL(44)<>-13 THEN PRINT "THE
      OTHER VINES HANG HIGH ABOVE T
     HE      GROUND."
2860 IF OL(44)<>-13 THEN 410
2870 PRINT "OK, YOU CUT A LONG PIEC
     E OF VINE FROM   THE TREE.":OL
     (44)=-1
2880 GOTO 410
2890 IF (NN=15) AND (OL(NN)=-6) AND
      (FNA(12)) AND OO(5) THEN 2910
2900 IF NOT FNA(NN) THEN 1700
2910 VP=1:XX=NN:PRINT "WHERE DO YOU
      WISH TO PUT IT?":GOSUB 420
2920 YY=NN:NN=XX:FOR Y=1 TO 11:IF Y
     Y=PO(Y) THEN ZZ=Y
2930 NEXT Y
2940 IF (NN=15) AND (YY<>58) THEN Z
     Z=0
2950 IF YY=58 THEN 3060
2960 IF (YY=13) AND (NN<>5) THEN ZZ
     =0
2970 IF (YY=19) AND (NN<>10) THEN Z
     Z=0
2980 IF (YY=21) AND (NN<>22) THEN Z
     Z=0
2990 IF ZZ=0 THEN PRINT "YOU CANNOT
      PUT THAT THERE.":GOTO 410
3000 IF FNB(YY) AND NOT FNA(YY) THE
     N PRINT "IT IS NOT HERE.":GOTO
      410
3010 IF OO(ZZ)=0 THEN PRINT "IT IS
     NOT OPEN.":GOTO 410
3020 IF OI(ZZ)=MI(ZZ) THEN PRINT "I
     T DOES NOT FIT.":GOTO 410
3030 PRINT "DONE.":OL(NN)=PV(ZZ):OI
     (ZZ)=OI(ZZ)+1
3040 IF YY<>2 OR NN<>36 THEN 410
3050 PRINT "A DOOR TO THE SOUTH CRE
     AKS OPEN.":MV(18,2)=19:GOTO 41
     0
3060 IF FNB(4) THEN PRINT "IT IS NO
     T HERE.":GOTO 410
3070 PRINT "IT DISAPPEARS INTO THE
     MOUTH....":OL(NN)=0
3080 IF NN=15 THEN TW=0
3090 GOTO 410
3100 IF NN=64 AND RM=44 THEN 3190
3110 IF FNB(NN) THEN 1690
3120 IF NN<>27 AND NN<>41 AND NN<>6
     4 THEN PRINT "NOTHING HAPPENS.
     ":GOTO 410
3130 IF NN=41 THEN PRINT "YOU PUSH
     THE COAL BIN AND IT ROLLS
      AWAY...."
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3140 IF NN=41 THEN OL(41)=0
3150 IF NN=41 AND OL(42) THEN PRINT
     "YOU HEAR A SMASH IN THE DIST
     ANCE.":SB=1
3160 IF NN=41 THEN 410
3170 IF (NN=27) AND TR THEN PRINT "
     YOU CANNOT MOVE IT ANY FARTHER
     .":GOTO 410
3180 IF NN=27 THEN PRINT "YOU PUSH
     IT TO REVEAL A TRAPDOOR
     UNDERNEATH!"
3190 IF NN=27 THEN OL(28)=RM:TR=1:G
     OTO 410
3200 IF OL(5)<>-7 THEN PRINT "NOTHI
     NG HAPPENS.":GOTO 410
3210 PRINT "THERE IS A GIANT EXPLOS
     ION AND THE";
3220 PRINT "SPACESHIP LAUNCHES THRO
     UGH THE CEILING  OF THE CAVERN
     ."
3230 IF SC=170 THEN SC=SC+30:GOTO 3
     260
3240 PRINT "UNFORTUNATELY YOU HAVE
     NOT OBTAINED ALL THE TREASURES
      AND YOU LAND";
3250 PRINT " IN THE CAVERN";:PRINT
     "AGAIN.":GOTO 410
3260 PRINT :PRINT "CONGRATULATIONS!
      YOU HAVE ALL TEN":PRINT "TREA
     SURES!"
3270 PRINT :GOTO 4590
3280 IF NOT FNA(39) THEN PRINT "YOU
      DO NOT HAVE ANYTHING TO HOOK
     IT      WITH."
3290 IF NOT FNA(39) THEN 410
3300 IF NN=40 AND (RM=14 OR RM=20)
     THEN 3340
3310 IF (NN=7) AND FNC(66) THEN 336
     0
3320 IF FNB(NN) AND (NOT FNA(NN)) T
     HEN PRINT "IT IS NOT HERE.":GO
     TO 410
3330 PRINT "YOU CANNOT HOOK THAT.":
     GOTO 410
3340 PRINT "YOU HOOK THE GRAPPLING
     HOOK ON THE SMALL CLIFF."
3350 OL(39)=0:HC=1:MV(14,5)=20:MV(2
     0,6)=14:GOTO 410
3360 PRINT "YOU HOOK THE POUCH AND
     PULL IT INTO YOUR HANDS."
3370 OL(7)=-1:OL(66)=0:GOTO 410
3380 IF NN=22 THEN 3400
3390 IF FNB(NN) AND NOT FNA(NN) THE
     N 1550
3400 IF NOT FNA(19) AND NOT FNA(21)
      THEN PRINT "YOU DON'T HAVE AN
     YTHING TO";
3410 IF NOT FNA(19) AND NOT FNA(21)
      THEN PRINT " SHOOT IT":PRINT
     "WITH.":GOTO 410
3420 IF FNA(NN) THEN PRINT "YOU CAN
     NOT SHOOT AN ITEM OF INVENTORY
     .":GOTO 410
3430 IF FNA(19) AND FNA(21) THEN 34
     60
3440 IF FNA(19) THEN 3510
3450 IF FNA(21) THEN 3610
3460 PRINT "WHICH TO USE, YOUR FLAR
     E (G)UN, OR YOUR (C)ROSSBOW?"
3470 GOSUB 50:IF A$<>"" AND A$<>"G"
      AND A$<>"C" THEN 410
3480 IF A$="C" THEN PRINT :GOTO 351
     0
3490 IF A$="G" THEN PRINT :GOTO 361
     0
3500 GOTO 3470
3510 IF OL(10)<>-8 THEN PRINT "IT I
     S NOT LOADED.":GOTO 410
3520 IF NN=22 THEN PRINT "YOU CANNO
     T SHOOT A FLARE FROM A":PRINT
     "CROSSBOW.":GOTO 410
3530 IF (NN=24) OR (NN=47) OR (NN=5
     6) OR (NN=60) OR (NN=67) THEN
     3560
3540 PRINT "ON CONTACT WITH IT, THE
      STICK BREAKS     INTO SPLINTER
     S.":OL(10)=0
3550 GOTO 410
3560 IF NN=24 OR NN=56 OR NN=60 THE
     N PRINT "IT DOES NOT SEEM AFFE
     CTED.":GOTO 3600
3570 IF NN=67 THEN 3590
3580 PRINT "ON CONTACT THE CROSSBOW
      BREAKS INTO      SPLINTERS.":O
     L(10)=0
3590 PRINT "THE STICK PLUNGES INTO
     THE CREATURE'S     THROAT.":OL(
     NN)=0:LL=0
3600 OL(10)=0:OL(67)=0:GOTO 410
3610 IF NN<>22 THEN PRINT "YOU CAN
     ONLY SHOOT THE FLARE, NOT AN
       OBJECT.":GOTO 410
3620 IF OL(22)<>-12 THEN PRINT "IT
     IS NOT LOADED.":GOTO 410
3630 IF OO(8) THEN PRINT "IT EXPLOD
     ES IN YOUR FACE....":GOTO 4580
3640 PRINT "THE FLARE SHOOTS INTO T
     HE AIR, SHOWERING YOU WITH SPA
     RKS."
3650 IF FNC(47) THEN PRINT :GOTO 36
     70
3660 OL(22)=0:GOTO 410
3670 PRINT "STALACTITES START TO FA
     LL TO THE GROUND, AND ONE HITS
      THE BEAR IN";
3680 PRINT " THE BACK OF HIS";:PRIN
     T "NECK, BREAKING HIS SPINE.":
     OL(47)=0:BB=0
3690 GOTO 3660
3700 IF NOT FNA(NN) AND FNB(NN) THE
     N PRINT "IT IS NOT HERE.":GOTO
      410
3710 IF NOT FNA(NN) THEN 1700
3720 IF (NN=49) AND (FNA(51)) AND D
     D=0 THEN 3740
3730 PRINT "NOTHING HAPPENS.":GOTO
     410
3740 PRINT "THERE IS A PUFF OF SMOK
     E AND A DEMON     APPEARS."
3750 IF RM=52 THEN OL(56)=RM:GOTO 3
     780
3760 PRINT "YOU ARE UNPROTECTED AND
      THE DEMON":PRINT "APPROACHES
     YOU";
3770 PRINT " - CLAWS":PRINT "GRASPI
     NG FOR YOUR HEART....":GOTO 45
     80
3780 PRINT QT$;"SO WHAT DO YOU HAVE
      FOR ME?";QT$:GOTO 420
3790 IF NN=14 THEN 3850
3800 IF NN=62 AND RM>27 AND RM<31 T
     HEN PRINT "THE WATER HAS PECUL
     IAR TASTE.":GOTO 410
3810 IF (NN=62) AND (RM>30 AND RM<3
     4) THEN PRINT "SUDDENLY THE WA
     TER RUSHES INTO";:DR=1
3820 IF DR THEN PRINT " YOUR":PRINT
      "OPEN MOUTH AND YOU DROWN....
     ":DR=0:GOTO 4580
3830 IF NOT FNA(NN) THEN 1700
3840 PRINT "YOU CANNOT DRINK THAT."
     :GOTO 410
3850 IF NOT FNA(11) THEN 1700
3860 IF OL(14)<>-5 THEN 1700
3870 IF OO(4)=0 THEN PRINT "THE VIA
     L IS CLOSED.":GOTO 410
3880 PRINT "ALL YOUR WOUNDS ARE HEA
     LED INSTANTLY."
3890 OL(14)=0:GOTO 410
3900 IF NOT FNA(NN) THEN 1700
3910 IF FNC(24) OR FNC(47) OR FNC(5
     6) OR FNC(60) THEN 3940
3920 IF FNC(67) THEN 3940
3930 PRINT "THERE IS NO ONE HERE TO
      ACCEPT YOUR      OFFERING.":GO
     TO 410
3940 IF FNB(56) THEN PRINT "IT DOES
      NOT ACCEPT YOUR OFFERING.":GO
     TO 410
3950 IF NN<>65 THEN PRINT QT$;"NO,
     THAT WON'T DO.";QT$:GOTO 410
3960 PRINT "THE DEMON ACCEPTS YOUR
     OFFERING AND      GIVES YOU A G
     OLDEN ANKH."
3970 PRINT QT$;"IRONIC ISN'T IT?";Q
     T$;" HE SAYS BEFORE":OL(65)=0
3980 PRINT "DISAPPEARING.":OL(57)=-
     1:OL(56)=0:SC=SC+15:DD=0:DC=0:
     GOTO 410
3990 IF NOT FNA(NN) AND (TF(NN)>0)
     THEN 1700
4000 IF NN<>54 THEN 3730
4010 IF NOT FNA(34) THEN 3730
4020 PRINT "AFTER REPEATED BLOWS WI
     TH THE PICK, YOU CHIP AWAY THE
      ROCK TO";
4030 PRINT " REVEAL A PLASTIC":PRIN
     T "CARD INSIDE IT.":OL(54)=0:O
     L(5)=-1
4040 GOTO 410
4050 IF NN=24 OR NN=47 OR NN=56 OR
     NN=60 OR NN=67 THEN 4070
4060 PRINT "ATTACKING THAT IS FUTIL
     E.":GOTO 410
4070 IF NOT FNA(19) THEN PRINT "ATT
     ACKING WITHOUT A WEAPON IS SUI
     CIDE.":GOTO 410
4080 PRINT "YOU HAVE A CROSSBOW - U
     SE IT.":GOTO 410
4090 IF NOT FNA(NN) THEN 1550
4100 IF NN<>6 THEN PRINT "YOU CANNO
     T FILL THAT.":GOTO 410
4110 IF NOT FNA(29) THEN PRINT "YOU
      HAVE NO OIL.":GOTO 410
4120 PRINT "YOU FILL THE LANTERN WI
     TH OIL FROM THE  BLADDER."
4130 FL=1:OL(29)=0:OL(30)=-1:NW$(29
     )="XXYYZZ":NW$(30)="BLADDER":G
     OTO 410
4140 IF NN=48 AND RM=33 THEN 4170
4150 IF FNB(NN) THEN 1550
4160 GOTO 2270
4170 IF ML THEN 2270
4180 PRINT "SEVERAL THINGS FLOAT FR
     OM UNDERNEATH IT.";
4190 OL(12)=RM:OL(49)=RM:ML=1:GOTO
     410
4200 IF NN<>63 THEN PRINT "YOU CANN
     OT BUILD THAT.":GOTO 410
4210 IF FNA(44) AND FNA(45) THEN 42
     30
4220 PRINT "YOU DO NOT HAVE THE MAT
     ERIAL TO MAKE    IT.":GOTO 410
4230 PRINT "YOU BUILD A RAFT.":OL(4
     4)=0:OL(45)=0:OL(63)=RM:GOTO 4
     10
4240 IF NN=16 OR NN=63 THEN 4260
4250 PRINT "YOU WERE NEVER IN IT!":
     GOTO 410
4260 IF NN=16 THEN PRINT "YOU EXIT
     THE SPACESHIP....":PRINT :RM=4
     3:GOTO 1070
4270 IF IR=0 THEN 4250
4280 PRINT "YOU EXIT THE RAFT.":IR=
     0:MV(21,2)=0:MV(34,1)=0
4290 IF RM>27 AND RM<31 THEN 4550
4300 IF RM=34 AND CR=0 THEN SC=SC+1
     0:CR=1
4310 GOTO 410
4320 PRINT "YOU ARE CARRYING:"
4330 FOR X=1 TO 65:IF FNA(X) THEN R
     F=1:GOSUB 1170:RF=0:PRINT " ";
     A$;OB$(X):GOSUB 1260
4340 IF FNA(X) THEN IN=IN+1
4350 NEXT X
4360 IF IN=0 THEN PRINT "ABSOLUTELY
      NOTHING"
4370 IN=0:GOTO 410
4380 PRINT "DO YOU REALLY WISH TO Q
     UIT?":QQ=1:GOSUB 420
4390 IF LEFT$(IN$,1)="Y" THEN 4410
4400 PRINT "OK.":QQ=0:RS=0:GOTO 420
4410 PRINT "YOU HAVE ACHIEVED A SCO
     RE OF";SC
4420 PRINT :PRINT "OUT OF A POSSIBL
     E 200 IN";MV;"MOVES.":PRINT
4430 PRINT "THIS PUTS YOU IN THE RA
     NK OF:"
4440 FOR X=1 TO 6:IF SC<=MS(X) THEN
      RK$=RK$(X):X=7
4450 NEXT X
4460 PRINT :PRINT QT$;RK$;" ADVENTU
     RER";QT$
4470 IF SS THEN SS=0:GOTO 420
4480 PRINT :PRINT "PRESS A KEY WHEN
      READY."
4490 GOSUB 50
4500 IF QQ THEN END
4510 RUN
4520 PRINT "DO YOU REALLY WISH TO R
     ESTART?":RS=1:GOSUB 420
4530 GOTO 4390
4540 SS=1:GOTO 4410
4550 IF RM<>29 THEN PRINT "AS YOU D
     IVE INTO THE WATER THE CURRENT
     ":WH=1
4560 IF WH THEN PRINT "WASHES YOU W
     EST - INTO THE SEA.":WH=0:GOTO
      4580
4570 PRINT "YOU DIVE INTO THE RIVER
     ....":PRINT :RM=31:IR=0:GOTO 1
     070
4580 PRINT :PRINT :PRINT "YOU HAVE
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     DIED.":PRINT
4590 PRINT "DO YOU WISH TO QUIT OR
     RESTART?":QQ=1:GOSUB 420:QQ=0
4600 IF IN$<>"QUIT" AND IN$<>"RESTA
     RT" THEN 4590
4610 IF IN$="QUIT" THEN QQ=1
4620 IF IN$="RESTART" THEN RS=1
4630 GOTO 4410
4640 DATA 0,2,0,0,0,0,"AT THE FRONT
      DOOR"
4650 DATA 1,0,3,4,0,0
4660 DATA "IN THE LIVING ROOM. IT I
     S       SPARSELY FURNISHED"
4670 DATA 0,0,0,2,0,0,"IN THE BEDRO
     OM"
4680 DATA 0,0,2,0,0,0
4690 DATA "IN THE KITCHEN. EMPTY CA
     BINETS  LINE THE NORTH WALL"
4700 DATA 0,9,6,0,0,0,"IN A ROUGHLY
      CARVED TUNNEL"
4710 DATA 0,0,7,5,0,0,"IN A ROUGHLY
      CARVED TUNNEL"
4720 DATA 0,8,0,6,0,0,"IN AN INCLIN
     ED TUNNEL. A TRACK   RUNS TO T
     HE SOUTH"
4730 DATA 7,0,0,0,0,0
4740 DATA "AT A STONE WALL. THE TRA
     CK RUNS OVER IT, HEADING TO TH
     E SOUTH"
4750 DATA 5,11,0,10,0,0
4760 DATA "IN A TUNNEL. THE WALLS G
     LITTER  WITH IRON PYRITE"
4770 DATA 0,0,9,0,0,0,"IN A NATURAL
      CAVE WHICH IS USED FOR STORAG
     E"
4780 DATA 9,0,0,0,0,0,0,"IN A CHAMBER
     "
4790 DATA 0,14,13,15,0,0
4800 DATA "AT THE END OF A TUNNEL.
     THE      TRACK ALSO ENDS HERE,"
4810 DATA 0,0,0,12,0,0
4820 DATA "IN A TUNNEL. TO THE EAST
      THE    TUNNEL IS BLOCKED BY A
      BOULDER"
4830 DATA 12,0,0,0,0,0,"AT THE BOTT
     OM OF A SMALL CLIFF"
4840 DATA 0,16,12,0,0,0,"IN A CURVE
     D TUNNEL"
4850 DATA 15,17,0,0,0,0,"IN A TUNNE
     L"
4860 DATA 16,0,0,0,0,0,0,"AT A DEAD E
     ND"
4870 DATA 0,0,0,0,0,0,0,"IN AN ABANDO
     NED MINE SHAFT"
4880 DATA 18,0,17,0,0,0,"IN AN ABAN
     DONED MINE SHAFT"
4890 DATA 0,21,0,0,0,0,"ON A CLIFF"
4900 DATA 20,0,23,22,0,0,"ON THE SH
     ORE OF A RIVER"
4910 DATA 0,0,21,0,0,0,"ON THE SHOR
     E OF A RIVER"
4920 DATA 0,0,24,21,0,0,"ON A DIRT
     PATH"
4930 DATA 27,26,25,23,0,0
4940 DATA "ON A PATH IN THE CENTER
     OF AN    UNDERGROUND VILLAGE"
4950 DATA 0,0,0,24,0,0,"IN A HUT US
     ED AS A MEETING      PLACE"
4960 DATA 24,0,0,0,0,0,"IN THE HEAL
     ER'S HUT"
4970 DATA 0,24,0,0,0,0,"IN A DEMOLI
     SHED HUT"
4980 DATA 21,34,29,30,0,0,"IN THE M
     IDDLE OF A RIVER"
4990 DATA 0,0,0,28,0,0
5000 DATA "UPSTREAM IN A RIVER. THR
     OUGH THE CLEAR WATER YOU SEE A
      SHIP"
5010 DATA 0,0,28,1,0,0,"DOWNSTREAM
     IN A RIVER"
5020 DATA 0,32,0,0,29,0,"UNDERWATER
     . THE CURRENT PUSHES  YOU SOUT
     H"
5030 DATA 31,0,33,0,0,0,"IN A SUNKE
     N SHIP"
5040 DATA 0,0,0,32,0,0,"IN THE CREW
     'S QUARTERS"
5050 DATA 0,36,0,35,0,0,"ON THE SHO
     RE OF A RIVER"
5060 DATA 0,0,34,0,0,0,"ON THE SHOR
     E OF A RIVER"
5070 DATA 34,37,0,0,0,0
5080 DATA "IN A LARGE CAVERN. STALA
     CTITES  HANG FROM ABOVE"
5090 DATA 36,38,0,0,0,0,"IN A DARK
     TUNNEL"
5100 DATA 37,41,39,0,0,0,"IN A DARK
      TUNNEL"
5110 DATA 0,40,0,38,0,0
5120 DATA "IN A BURIAL CHAMBER. THE
      SMELL  OF DECAY FILLS THE AIR
     "
5130 DATA 39,0,0,41,0,0,"IN A CURVE
     D TUNNEL"
5140 DATA 38,42,40,0,0,0,"IN A SMAL
     L CHAMBER"
5150 DATA 41,49,45,43,0,0,"IN A SMA
     LL AMPHITHEATER"
5160 DATA 0,0,42,0,0,0,"IN A GIGANT
     IC CAVERN"
5170 DATA 0,0,0,0,0,0,"ABOARD A SPA*
     CESHIP"
5180 DATA 0,0,46,42,0,0,"IN A HALLW
     AY"
5190 DATA 48,0,47,45,0,0,"IN A HALL
     WAY"
5200 DATA 0,0,0,46,0,0,"IN A DRESSI
     NG ROOM"
5210 DATA 0,46,0,0,0,0,"IN THE LIB
     RARY ROOM"
5220 DATA 42,50,0,0,0,0,"IN A CORRI
     DOR"
5230 DATA 49,54,51,53,0,0,"SMALL CH
     AMBER"
5240 DATA 0,0,52,50,0,0,"IN A CORRI
     DOR"
5250 DATA 0,0,0,51,0,0,"IN THE HEXA
     GON-SHAPED ROOM"
5260 DATA 0,0,50,0,0,0
5270 DATA "IN AN EAST/WEST TUNNEL.
     A CAVE-IN BLOCKS THE WESTWARD
     EXIT"
5280 DATA 50,55,0,0,0,0,"IN A CORRI
     DOR"
5290 DATA 54,56,0,0,0,0,"AT THE END
      OF THE CORRIDOR"
5300 DATA 55,0,0,0,0,0,"IN A LARGE
     CHAMBER"
5310 DATA N,NORTH,S,SOUTH,E,EAST,W,
     WEST,U,UP,D,DOWN,TAKE,DROP,EXA
     MINE,READ,SAY
5320 DATA OPEN,CLOSE,ENTER,LIGHT,CU
     T,PUT,PUSH,HOOK,SHOOT,RUB,DRIN
     K,OFFER
5330 DATA HIT,ATTACK,FILL,LIFT,BUIL
     D,EXIT,INVENTORY,I,QUIT,Q,REST
     ART
5340 DATA SCORE,LOOK,L,DIVE
5350 DATA SIGN,-1,PEDESTAL,-1,BOOK,
     1,STATUE,-1,CARD,1,LANTERN,1,P
     OUCH,1
5360 DATA BACKPACK,1,KNIFE,1,STICK,
     1,VIAL,1,BOX,1,SLOT,-1,ELIXIR,
     0
5370 DATA SAND,0,SPACESHIP,-1,PANEL
     ,-1,TREE,-1,CROSSBOW,1
5380 DATA DRESSER,-1,GUN,1,FLARE,1,
     BUNK,-1,MUMMY,-1,DRAWER,-1,BED
     ,-1
5390 DATA REFRIGERATOR,-1,TRAPDOOR,
     -1,BLADDER,1,BLADDER,1,FLINT,1
     ,SKELETON,-1
5400 DATA CIRCLE,-1,PICK,1,CHUTE,-1
     ,SAPPHIRE,1,GOLD,1,ROD,1,HOOK,
     1,CLIFF,-1
5410 DATA BIN,-1,TRACK,-1,DIAMOND,1
     ,VINE,1,LOGS,1,STALACTITES,-1,
     BEAR,-1
5420 DATA MATTRESS,-1,LAMP,1,SARCOP
     HAGUS,-1,HANDKERCHIEF,1,FACEMA
     SK,1,XYZZ,-1
5430 DATA ROCK,1,PENTACLE,-1,DEMON,
     -1,ANKH,1,MOUTH,-1,PIT,-1,SPHI
     NX,-1,RUBY,1
5440 DATA WATER,0,RAFT,-1,BUTTON,-1
     ,TRIDENT,1,POUCH,1,LEOPARD,-1,
     "",0
5450 DATA SIGN,4,JADE PEDESTAL,18,L
     EATHER BOUND BOOK,48,DRAGON ST
     ATUE,55
5460 DATA LAUNCH CARD,0,OIL LANTERN
     ,-10,LEATHER POUCH,0,BACKPACK,
     13
5470 DATA *JEWELED KNIFE*,-2,SHARPE
     NED STICK,10,YELLOW VIAL,26,ME
     TAL BOX,0
5480 DATA SLOT,44,*ELIXIR OF LIFE*,
     -5,WHITE SAND,-6,SPACESHIP,43
5490 DATA CONTROL PANEL,44,GIANT OA
     K TREE,24,CROSSBOW,35,WOODEN D
     RESSER,47
5500 DATA FLARE GUN,-1,FLARE,-1,BUN
     K,33,MUMMY,-11,DRAWER,0,BED,3,
     REFRIGERATOR,4
5510 DATA TRAPDOOR,0,OIL SOAKED BLA
     DDER,6,BLADDER,0,FLINT & STEEL
     ,-2
5520 DATA SKELETON,13,"LARGE CIRCLE
      ON THE FLOOR   ",11,PICK,17,C
     HUTE,16
5530 DATA *SAPPHIRE*,18,*GOLD NUGGE
     T*,7,METAL ROD,10,GRAPPLING HO
     OK & ROPE,-1
5540 DATA CLIFF,0,COAL BIN,7,BROKEN
      TRACK,8,*SMALL DIAMOND*,-4,VI
     NE,-13,LOGS,27
5550 DATA STALACTITES,0,LARGE BEAR,
     36,MATTRESS,0,*GOLDEN LAMP*,0,
     SARCOPHAGUS,39
5560 DATA *GOLDEN HANDKERCHIEF*,-9,
     *GOLDEN FACEMASK*,0,XYZZ,0,LAR
     GE ROCK,53
5570 DATA PENTACLE ON THE FLOOR,52,
     DEMON,0,*GOLDEN ANKH*,0,MOUTH,
     0,PIT,56
5580 DATA SPHINX,56,*STAR RUBY*,0,W
     ATER,0,RAFT,0,BUTTON,0,TRIDENT
     ,18
5590 DATA "POUCH HANGING FROM A ROP
     E   ",11,BLACK LEOPARD,42,"",0
5600 DATA AMATEUR,10,NOVICE,50,AVER
     AGE,100,INTELLECTUAL,150,PRO,1
     99,MASTER,200
5610 DATA 2,7,8,11,12,13,19,21,25,2
     6,50,1,1,4,1,1,1,1,5,6,3,1,0
     ,0,0,0,1,1,0,0
5620 DATA 1,0,-3,-4,-2,-5,-6,-7,-8,
     -12,-9,-10,-11
5630 DATA NORTH,SOUTH,EAST,WEST,UP,
     DOWN
5640 DIM MV(56,6),RD$(56),VW$(44),N
     W$(68),TF(68),OB$(68),OL(68)
5650 DIM PO(11),MI(11),OI(11),OO(11
     ),PV(11),RK$(6)
5660 FOR X=1 TO 56:FOR Y=1 TO 6:REA
     D MV(X,Y):NEXT Y:READ RD$(X):N
     EXT X
5670 FOR X=1 TO 44:READ VW$(X):NEXT
      X
5680 FOR X=1 TO 68:READ NW$(X),TF(X
     ):NEXT X
5690 FOR X=1 TO 68:READ OB$(X),OL(X
     ):NEXT X
5700 FOR X=1 TO 6:READ RK$(X),MS(X)
     :NEXT X
5710 FOR X=1 TO 11:READ PO(X):NEXT
     X
5720 FOR X=1 TO 11:READ MI(X):NEXT
     X
5730 FOR X=1 TO 11:READ OO(X):NEXT
     X
5740 FOR X=1 TO 11:READ PV(X):NEXT
     X
5750 FOR X=1 TO 6:READ DR$(X):NEXT
     X
5760 RM=1:VL$="AEIOU":OI(2)=1:OI(3)
     =2:OI(4)=1:OI(5)=1:OL(21)=-1:T
     W=1
5770 OL(22)=-1:AC=10:CR=0:MV=-1:OI(
     2)=1:OI(3)=2:OI(4)=1:OI(5)=1:O
     I(9)=1
5780 OI(10)=1:DEF FNA(X)=(OL(X)=-1)
     :DEF FNB(X)=(OL(X)<>RM)
5790 DEF FNC(X)=(OL(X)=RM):QT$=CHR$
     (34):CR$=CHR$(13)
5810 RETURN
```

Program 2: Commodore 64 Line Changes

```
5800 UL$=CHR$(164):CL$=CHR$
     (157):DL$=CHR$(20)
```

Program 3: IBM PC/PCjr Line Changes

```
20 KEY OFF:SCREEN 0,0,0:WIDTH 40:FO
   R I=1 TO 25:PRINT :NEXT I:PRINT
   "   COPYRIGHT 1987 COMPUTE! PUB.
   , INC."
```

```
5800 UL$=CHR$(95):CL$=CHR$(29):DL$=
     CL$+" "+CL$
```

Program 4: Apple II Line Changes

```
20 PRINT CHR$ (27); CHR$ (17)
   : FOR I = 1 TO 25: PRINT :
    NEXT I: PRINT "   COPYRIG
   HT 1987 COMPUTE! PUB., INC
   ."
5800 UL$ = CHR$ (95):CL$ = CH
     R$ (8):DL$ = CL$
```

Program 5: Amiga Line Changes

```
20 WIDTH 40:FOR I=1 TO 25:PRINT
:NEXT I:PRINT "   COPYRIGHT 1987
COMPUTE! PUB., INC."
440 PRINT UL$;
460 IF a$=DL$ AND ZL>0 THEN IN$=
MID$(IN$,1,ZL-1):ZL=ZL-1:PRINT C
L$;CL$;:GOTO 440
470 IF a$=CR$ AND ZL>0 THEN PRIN
T CL$:PRINT :GOTO 500
480 IF a$<>CR$ AND a$<>DL$ AND Z
L<QI THEN IN$=IN$+a$:ZL=ZL+1:PRI
NT CL$;a$;:GOTO 440
5800 UL$=CHR$(95):CL$=CHR$(8):DL
$=CHR$(8)
```

Program 6: The Hermit For Atari 400, 800, XL, And XE

```
AN 10 REM COPYRIGHT 1987 COM
      PUTE! PUBLICATIONS, IN
      C. - ALL RIGHTS RESERV
      ED
GG 20 DIM DRIVE$(3):DRIVE$="
      D1:"
BA 30 OPEN #1,4,0,"K:":POKE
      82,0:POKE 83,39:FOR I=
      1 TO 25:PRINT :NEXT I:
      PRINT "{3 SPACES}COPYR
      IGHT 1987 COMPUTE! PUB
      L., INC."
IM 40 PRINT "{8 SPACES}ALL R
      IGHTS RESERVED":PRINT
      :PRINT :PRINT "PLEASE
      WAIT...";
LF 50 GOSUB 4700:POKE 752,25
      5:GOTO 1110
HG 60 GET #1,A:A$=CHR$(A)
EH 70 RETURN
EP 80 IF OL(24)=RM THEN MC=M
      C+1:MM=1
CJ 90 IF OL(47)=RM THEN BC=B
      C+1:BB=1
FJ 100 IF OL(56)=RM THEN DC=
       DC+1:DD=1
HM 110 IF OL(67)=RM THEN LC=
       LC+1:LL=1
EJ 120 IF RM>30 AND RM<34 TH
       EN AC=AC-1
JK 130 IF MM THEN PRINT :PRI
       NT "THE MUMMY LUMBERS
        TOWARD YOU...."
GE 140 IF BB THEN PRINT :PRI
       NT "THE BEAR OPENS HI
       S ARMS, READY TO
       {7 SPACES}EMBRACE YOU
       ."
JK 150 IF DD THEN PRINT :PRI
       NT "THE DEMON TAPS HI
       S FOOT IMPATIENTLY."
MF 160 IF LL THEN PRINT :PRI
       NT "THE LEOPARD STALK
       S TOWARD YOU...."
AP 170 IF MC=4 THEN PRINT "T
       HE MUMMY GRABS YOU AN
       D CHOKES YOU TO
       {3 SPACES}DEATH.":GOT
       O 4640
DJ 180 IF BC=3 THEN PRINT "T
       HE BEAR EMBRACES YOU.
        YOU FEEL YOUR
       {4 SPACES}RIBS CRACK.
       ..."
IH 190 IF AC<3 THEN PRINT "Y
       OU FEEL DIZZY...."
BD 200 IF BC=3 THEN 4640
OL 210 IF DC=4 THEN PRINT QT
       $;"'YOU KNOW WHERE TO
        REACH ME,'";QT$
AA 220 IF DC=4 THEN PRINT "T
       HE DEMON SAYS AND DIS
       APPEARS.":OL(56)=0:DD
       =0:DC=0:GOTO 420
FB 230 IF LC=3 THEN PRINT "T
       HE LEOPARD POUNCES; T
       HAT IS THE LAST
       {3 SPACES}THING YOU S
       EE...."
CB 240 IF LC=3 THEN 4640
GJ 250 IF AC=0 THEN PRINT "Y
       OU RUN OUT OF OXYGEN.
       ...":GOTO 4640
JG 260 IF OL(60)=RM THEN PC=
       PC+1:SX=1
CC 270 IF SX<>1 OR PC<>1 THE
       N 330
EJ 280 PRINT :PRINT QT$;"WHE
       N SOLID IT CAN SINK S
       HIPS;"
KK 290 PRINT "WHEN GAS IT CA
       N BLOCK THE VIEW;"
OI 300 PRINT "WHEN LIQUID IT
        CAN WEIGH MANY TONS.
       "
AH 310 PRINT :PRINT "ANSWER
       MY RIDDLE CORRECTLY A
       ND THOU{5 SPACES}SHAL
       T LIVE ";
HD 320 PRINT "TO ENJOY THY T
       REASURES.";QT$
OJ 330 IF SX THEN PRINT :PRI
       NT "THE SPHINX IS WAI
       TING PATIENTLY."
DA 340 IF PC<>4 THEN 370
BA 350 PRINT "THE SPHINX POU
       NCES; HIS CLAWS EAGER
       LY AWAITING YOUR THRO
       AT...."
KA 360 GOTO 4640
AP 370 IF RM<31 OR RM>33 THE
       N 400
CH 380 IF OL(14)=-5 AND OL(1
       1)=-1 AND OO(4)=1 THE
       N OL(14)=0
CN 390 IF OL(15)=-6 AND OL(1
       2)=-1 AND OO(5)=1 THE
       N OL(15)=0
BO 400 IF IR THEN OL(63)=RM
HF 410 RETURN
OE 420 GOSUB 80:Y=0:VP=0:MV=
       MV+1
NC 430 PRINT :IN$="":VB$="":
       NN$="":ZL=0:QI=37:X=0
       :VB=0:NN=0:V=0
OC 440 PRINT ">";
BE 450 PRINT UL$;CL$;
IO 460 GOSUB 60:IF (A$<" " O
       R A$>CHR$(95) OR A$=Q
       T$) AND A$<>DL$ AND A
       $<>CL$ AND A$<>CR$ TH
       EN 460
OL 470 IF (A$<>CL$ AND A$<>D
       L$) OR ZL=0 THEN 500
FB 480 ZL=ZL-1:PRINT " ";CL$
       ;CL$;:IF ZL THEN IN$=
       IN$(1,ZL):GOTO 450
OF 490 IN$="":GOTO 450
DI 500 IF A$=CR$ AND ZL>0 TH
       EN PRINT " ":PRINT :G
       OTO 530
OM 510 IF A$<>CR$ AND A$<>DL
       $ AND A$<>CL$ AND ZL<
       QI THEN ZL=ZL+1:IN$(Z
       L)=A$:PRINT A$;:GOTO
       450
GK 520 GOTO 460
PK 530 IF QQ=1 OR RS=1 THEN
       RETURN
DB 540 L=LEN(IN$):FOR I=1 TO
        L:A$=IN$(I,I):IF A$<
       >" " THEN 570
KF 550 IF NN$<>"" THEN PRINT
        "ONE OR TWO WORDS PL
       EASE.":GOTO 430
HC 560 X=1:GOTO 590
CH 570 IF X=0 THEN VB$(LEN(V
       B$)+1)=A$:GOTO 590
JM 580 NN$(LEN(NN$)+1)=A$
BH 590 NEXT I:IF LEN(VB$)>6
       THEN VB$=VB$(1,6)
FJ 600 IF LEN(NN$)>6 THEN NN
       $=NN$(1,6)
BB 610 FOR I=1 TO 44:X=I*7-6
       :S$=VW$(X+1,X+ASC(VW$
       (X))):IF VB$=S$ THEN
       VB=I:VP=0:GOTO 640
IE 620 NEXT I:IF VP THEN NN$
       =VB$:GOTO 640
NB 630 IF VB=0 THEN PRINT "I
        DO NOT KNOW THAT VER
       B.":GOTO 430
MH 640 FOR I=1 TO 67:X=I*7-6
       :S$=NW$(X+1,X+ASC(NW$
       (X))):IF NN$=S$ THEN
       NN=I:GOTO 670
IO 650 NEXT I:IF NN$="" THEN
        NN=I:GOTO 670
LB 660 IF NN=0 AND VB<>17 TH
       EN PRINT "I DO NOT KN
       OW THE WORD ";QT$;NN$
       ;QT$;".":VP=0:GOTO 43
       0
AD 670 IF VB>12 AND VB<36 AN
       D NN=68 THEN PRINT VB
       $;" WHAT?":GOTO 430
OC 680 IF VP THEN RETURN
DB 690 IF (VB<13 OR VB>35) A
       ND NN<>68 THEN X=VB*7
       -6:PRINT "JUST ";VW$(
       X+1,X+ASC(VW$(X)));"
       PLEASE.":GOTO 430
AD 700 ON VB GOTO 760,760,83
       0,830,920,920,960,960
       ,1040
NO 710 ON VB-9 GOTO 1040,107
       0,1070,1540,1740,1890
       ,2210,2300,2360
CG 720 ON VB-18 GOTO 2510,26
       00,2740,2870,2940,315
       0,3330,3430,3760
BM 730 ON VB-27 GOTO 3840,39
       50,4040,4100,4140,420
       0,4260,4300,4380
CG 740 ON VB-36 GOTO 4380,44
       40,4440,4580,4600,111
       0,1110,4610
GD 750 PRINT "YOU CANNOT GO
       IN THAT DIRECTION.":G
       OTO 420
GC 760 IF ASC(MV$(RM*6-6+1))
       =0 THEN 750
KI 770 IF BB THEN BB=0:BC=0:
       PRINT "YOU RUN FROM T
       HE BEAR....":PRINT
OP 780 IF LL THEN LL=0:LC=0:
       PRINT "YOU FLEE FROM
       THE LEOPARD....":PRIN
       T
CE 790 IF OL(60)=RM THEN 350
CN 800 IF RM=19 THEN PRINT "
       THE SOUTH DOOR CLOSES
```

```
        BEHIND YOU....":PRIN
        T :MV$(104,104)="{,}"
KA 810  IF IR AND (RM=21) THE
        N PRINT "FIRST, YOU M
        UST EXIT THE RAFT.":G
        OTO 430
KK 820  RM=ASC(MV$(RM*6-6+1))
        :GOTO 1110
GB 830  IF ASC(MV$(RM*6-6+2))
        =0 THEN 750
CG 840  IF OL(47)=RM THEN PRI
        NT "THE BEAR STOPS YO
        U.":GOTO 420
HD 850  IF OL(67)=RM THEN PRI
        NT "THE BLACK LEOPARD
         STOPS YOU.":GOTO 420
KI 860  IF IR AND (RM=34) THE
        N PRINT "FIRST, YOU M
        UST EXIT THE RAFT.":G
        OTO 420
EE 870  IF RM=55 AND TW=1 THE
        N PRINT "AS YOU ENTER
         THE ARCHWAY, A JET O
        F"
KI 880  IF RM=55 AND TW=1 THE
        N PRINT "FIRE COMES F
        ROM THE DRAGON'S MOUT
        H AND"
OC 890  IF RM=55 AND TW=1 THE
        N PRINT "ENGULFS YOU.
        ":GOTO 4640
CB 900  IF MM THEN MM=0:MC=0:
        PRINT "YOU FLEE FROM
        THE LUMBERING MUMMY..
        ..":PRINT
KL 910  RM=ASC(MV$(RM*6-6+2))
        :GOTO 1110
GC 920  IF ASC(MV$(RM*6-6+3))
        =0 THEN 750
HC 930  IF OL(67)=RM THEN PRI
        NT "THE BLACK LEOPARD
         STOPS YOU.":GOTO 420
KI 940  IF IR AND (RM<27) THE
        N PRINT "FIRST, YOU M
        UST EXIT THE RAFT.":G
        OTO 420
LA 950  RM=ASC(MV$(RM*6-6+3))
        :GOTO 1110
GH 960  IF ASC(MV$(RM*6-6+4))
        =0 THEN 750
HG 970  IF OL(67)=RM THEN PRI
        NT "THE BLACK LEOPARD
         STOPS YOU.":GOTO 420
PL 980  IF IR=1 AND (RM<27 OR
         RM>30) THEN PRINT "F
        IRST, YOU MUST EXIT T
        HE RAFT.":GOTO 420
JP 990  IF RM=30 THEN PRINT "
        THAT WAY LEADS TO THE
         OCEAN, YOU TURN
        {3 SPACES}BACK.":GOTO
         420
EJ 1000 IF MM THEN MM=0:MC=0
        :PRINT "YOU FLEE FRO
        M THE LUMBERING MUMM
        Y....":PRINT
PN 1010 IF DD THEN DD=0
LF 1020 IF RM=29 AND IR=0 TH
        EN PRINT "YOU CANNOT
         SWIM THAT FAR.":GOT
        O 420
NH 1030 RM=ASC(MV$(RM*6-6+4)
        ):GOTO 1110
IO 1040 IF ASC(MV$(RM*6-6+5)
        )=0 THEN 750
BD 1050 IF RM=31 THEN PRINT
        "YOU RETURN TO THE S
        URFACE FOR AIR.":PRI
        NT :AC=10
NL 1060 RM=ASC(MV$(RM*6-6+5)
        ):GOTO 1110
JC 1070 IF ASC(MV$(RM*6-6+6)
        )=0 THEN 750
HB 1080 IF RM=4 THEN PRINT "
        AS YOU DESCEND, THE
        TUNNEL CAVES IN FROM
        ABOVE.":PRINT
GB 1090 IF RM=4 THEN SC=SC+5
NH 1100 RM=ASC(MV$(RM*6-6+6)
        ):GOTO 1110
BE 1110 IF RM>36 AND RM<39 A
        ND LT=0 THEN PRINT "
        YOU ARE IN TOTAL DAR
        KNESS.":GOTO 420
IH 1120 IF RM<>LR THEN GOSUB
         4910
BG 1130 PRINT "YOU ARE ";RM$
        ;"."
HG 1140 IF RM=18 THEN PRINT
        "LIGHT SHINES THROUG
        H A CRACK BETWEEN
        {4 SPACES}SOME BEAMS
        ."
LJ 1150 IF HC AND (RM=14) TH
        EN PRINT "THERE IS A
         ROPE TO ASCEND THE
        CLIFF{5 SPACES}HERE.
        "
PP 1160 IF HC AND (RM=20) TH
        EN PRINT "THERE IS A
         ROPE TO DESCEND THE
         CLIFF{4 SPACES}HERE
        ."
NJ 1170 IF IR THEN PRINT "YO
        U ARE ABOARD A WOODE
        N RAFT."
GE 1180 FOR X=1 TO 67:IF OL(
        X)=RM THEN 1220
GC 1190 NEXT X
OO 1200 IF SB AND RM=8 THEN
        PRINT "SMASHED AGAIN
        ST THE WALL IS A COA
        L BIN."
MI 1210 GOTO 1460
HI 1220 I=X*29-28:FL$=OB$(I+
        1,I+1)
FG 1230 IF FL$="*" THEN FL$=
        OB$(I+2,I+2)
OA 1240 FOR Y=1 TO 5:IF FL$=
        VL$(Y,Y) THEN A$="AN
        ":GOTO 1280
GA 1250 NEXT Y
PA 1260 A$="A "
NG 1270 IF X=15 OR X=31 OR X
        =45 THEN A$="SOME "
GP 1280 IF RF=1 THEN RETURN
BP 1290 PRINT "THERE IS ";A$
        ;OB$(I+1,I+ASC(OB$(I
        ));" HERE."
EH 1300 GOSUB 1310:GOTO 1190
IO 1310 FOR Y=1 TO 11:IF X=P
        O(Y) THEN RF=1:GOTO
        1330
HI 1320 NEXT Y:RETURN
FJ 1330 IF OO(Y)=0 THEN RF=0
        :RETURN
NO 1340 Z=X:W=Y
PK 1350 FOR I=1 TO 66:IF OL(
        I)=PV(W) THEN 1380
FC 1360 NEXT I
OK 1370 RF=0:RETURN
LC 1380 IF Y=1 OR Y=10 THEN
        1440
JB 1390 IF Y=7 OR Y=8 THEN 1
        450
NC 1400 I=Z*29-28:PRINT " TH
        E ";OB$(I+1,I+ASC(OB
        $(I)));" CONTAINS:"
HK 1410 FOR X=1 TO 66:IF OL(
        X)=PV(W) THEN GOSUB
        1220:I=X*29-28:PRINT
         "  ";A$;OB$(I+1,I+A
        SC(OB$(I)))
FO 1420 NEXT X
DH 1430 X=Z:Y=W:RF=0:RETURN
GB 1440 I=Z*29-28:PRINT " ON
        THE ";OB$(I+1,I+ASC
        (OB$(I)));" THERE IS
        :":GOTO 1410
KI 1450 I=Z*29-28:PRINT " LO
        ADED INTO THE ";OB$(
        I+1,I+ASC(OB$(I)));"
         THERE IS:":GOTO 141
        0
CB 1460 FOR X=1 TO 6:IF ASC(
        MV$(RM*6-6+X))>0 THE
        N V=V+1
GD 1470 NEXT X
OE 1480 IF V=0 THEN 420
GI 1490 PRINT :PRINT "YOU FI
        ND THAT THERE ";
LK 1500 IF V>1 THEN PRINT "A
        RE EXITS ":GOTO 1520
DI 1510 PRINT "IS AN EXIT ";
PC 1520 FOR X=1 TO 6:I=X*6-5
        :IF ASC(MV$(RM*6-6+X
        ))>0 THEN PRINT DR$(
        I+1,I+ASC(DR$(I)));"
        , ";
HO 1530 NEXT X:PRINT CL$;CL$
        ;".":GOTO 420
JP 1540 IF OL(NN)<-1 AND OL(
        NN)>-13 THEN 1640
AI 1550 IF OL(NN)=-1 THEN PR
        INT "YOU ALREADY HAV
        E THAT.":GOTO 420
LN 1560 IF (NN=7) AND OL(66)
        =RM THEN 1730
EN 1570 IF (NN=39) AND HC AN
        D (RM=14) THEN HC=0:
        MV$(83,83)="{,}":MV(
        20,6)=0:GOTO 1630
BB 1580 IF (NN=39) AND HC AN
        D (RM=20) THEN HC=0:
        MV$(83,83)="{,}":MV$
        (120,120)="{,}":GOTO
         1630
FO 1590 IF (NN=44) AND OL(18
        )=RM THEN PRINT "THE
         VINES ARE CONNECTED
         TOGETHER.":GOTO 420
LN 1600 IF OL(NN)<>RM THEN P
        RINT "YOU DO NOT SEE
         THAT.":GOTO 420
OB 1610 IF TF(NN)=0 THEN PRI
        NT "IT FLOWS THROUGH
         YOUR FINGERS....":O
        L(NN)=0:GOTO 420
JO 1620 IF TF(NN)=-1 THEN PR
        INT "THAT ITEM STAYS
         PUT.":GOTO 420
NM 1630 PRINT "TAKEN.":OL(NN
        )=-1:GOTO 1690
EK 1640 FOR I=1 TO 11:IF OL(
        NN)=PV(I) THEN Y=I
FE 1650 NEXT I
NA 1660 IF OL(PO(Y))=RM AND
        (OO(Y)=1) THEN OI(Y)
        =OI(Y)-1:GOTO 1610
JA 1670 IF OL(PO(Y))=-1 AND
        (OO(Y)=1) THEN OI(Y)
        =OI(Y)-1:GOTO 1610
MP 1680 GOTO 1600
MD 1690 I=NN*29-28:IF OB$(I+
        1,I+1)="*" THEN PRIN
        T :PRINT "YOU HAVE A
         TREASURE!"
OF 1700 I=NN*29-28:IF (OB$(I
        +1,I+1)="*") AND (RM
        =44) THEN SC=SC-10
JD 1710 IF NN=11 AND OL(14)=
        -5 AND RM=44 THEN SC
        =SC-10
JJ 1720 GOTO 420
FP 1730 PRINT "YOU GRAB THE
        POUCH, AND THE CIRCL
        E OPENS INTO A PIT..
        .":GOTO 4640
HI 1740 IF OL(NN)<-1 THEN 18
        30
```

```
MJ 1750 IF OL(NN)<>-1 THEN P
        RINT "YOU DO NOT HAV
        E THAT.":GOTO 420
HJ 1760 PRINT "DROPPED.":OL(
        NN)=RM
PD 1770 IF (NN=38) AND OL(42
        )=RM THEN 1870
OC 1780 IF (NN=14) OR (NN=62
        ) THEN PRINT "IT SOA
        KS INTO THE GROUND..
        .":OL(NN)=0
PD 1790 IF NN=15 THEN PRINT
        "IT IS BLOWN AWAY BY
         THE WIND...":OL(NN)
        =0
EC 1800 I=NN*29-28:IF OB$(I+
        1,I+1)="*" AND RM=44
         THEN SC=SC+10
JC 1810 IF NN=11 AND OL(14)=
        -5 AND RM=44 THEN SC
        =SC+10
JK 1820 GOTO 420
EL 1830 FOR I=1 TO 11:IF OL(
        NN)=PV(I) THEN Y=I
FF 1840 NEXT I
AE 1850 IF OL(PO(Y))=-1 AND
        (OO(Y)=1) THEN 1760
NF 1860 GOTO 1750
NI 1870 PRINT "YOU REPLACE T
        HE BROKEN TRACK WITH
         THE{3 SPACES}ROD.":
        OL(42)=0:OL(38)=0
KA 1880 GOTO 420
CL 1890 IF OL(NN)<>RM AND OL
        (NN)<>-1 THEN 1600
JE 1900 FOR I=1 TO 11:IF NN=
        PO(I) THEN Y=I:PF=1
FD 1910 NEXT I
CA 1920 IF Y=0 THEN 1960
GM 1930 IF OL(PO(Y))=RM THEN
         1960
CM 1940 IF OL(PO(Y))=-1 THEN
         1960
PK 1950 IF OL(PO(Y))<>-1 AND
         (OO(Y)<>1) THEN NN=
        0:GOTO 1750
DA 1960 IF NN>26 AND NN<>50
        THEN PRINT "YOU SEE
        NOTHING SPECIAL ABOU
        T IT.":GOTO 420
IL 1970 IF NN=4 THEN PRINT "
        ITS MOUTH IS OPEN WI
        DE AND SMOKE IS
        {5 SPACES}COMING FRO
        M IT."
EB 1980 IF NN=5 THEN PRINT "
        IT IS A PLASTIC CARD
        ."
CM 1990 IF NN<6 THEN PRINT "
        IT HAS SOMETHING WRI
        TTEN ON IT."
AF 2000 IF NN=6 AND FL THEN
        PRINT "IT IS FILLED
        WITH OIL.":GOTO 420
DG 2010 IF NN=6 AND BK THEN
        PRINT "IT IS SMASHED
        .":GOTO 420
CF 2020 IF (NN=6) AND (LT=0)
         THEN PRINT "YOU SEE
         NOTHING SPECIAL ABO
        UT IT.":GOTO 420
LD 2030 IF NN=6 THEN PRINT "
        IT IS LIT."
PL 2040 IF NN=9 THEN PRINT "
        IT HAS SEVERAL GEMS
        ON THE HILT."
FK 2050 IF NN=10 THEN PRINT
        "IT RESEMBLES A QUAR
        REL."
AD 2060 IF NN=14 THEN PRINT
        "IT HAS A MILKY WHIT
        E COLOR."
PM 2070 IF NN=15 THEN PRINT
        "IT IS A PURE WHITE.
        "
IG 2080 IF NN=16 THEN PRINT
        "IT HAS THE INSCRIPT
        ION: 'SB-910' ON
        {4 SPACES}ITS STARBO
        ARD."
JJ 2090 IF NN=17 THEN PRINT
        "IT HAS AN ORANGE BU
        TTON ON IT WHICH SAY
        S:'LAUNCH.'"
FG 2100 IF NN=18 THEN PRINT
        "IT HAS LONG VINES H
        ANGING FROM ITS
        {6 SPACES}BRANCHES."
PN 2110 IF NN=20 THEN PRINT
        "IT HAS A SINGLE DRA
        WER."
OL 2120 IF NN=22 THEN PRINT
        "IT HAS 'SIGNAL FLAR
        E' WRITTEN ON IT IN
         BLACK INK."
DE 2130 IF NN=23 THEN PRINT
        "IT HAS A WORN MATTR
        ESS."
JK 2140 IF NN=24 THEN PRINT
        "IT IS ENCASED IN OL
        D BANDAGES."
DO 2150 IF PF AND ((NN=2) OR
         (NN=13) OR (NN=19)
        OR (NN=26)) THEN NO=
        1
AK 2160 IF PF AND NO=1 THEN
        PRINT "IT LOOKS ORDI
        NARY.":NO=0:GOTO 219
        0
MJ 2170 IF PF THEN PRINT "IT
         IS ";:IF OO(Y)=0 TH
        EN PRINT "CLOSED."
AC 2180 IF OO(Y) THEN PRINT
        "OPEN."
AN 2190 IF PF THEN X=NN:PF=0
        :GOSUB 1310
JD 2200 GOTO 420
MJ 2210 IF OL(NN)<>-1 AND (T
        F(NN)=1) THEN 1750
MB 2220 IF NN>5 THEN PRINT "
        THERE IS NOTHING WRI
        TTEN ON THAT.":GOTO
        420
BL 2230 IF NN=1 THEN PRINT "
        IT READS: 'THE TRAPD
        OOR IS UNDER....'":G
        OTO 420
JC 2240 IF NN=2 THEN PRINT "
        IT READS: 'TO ESCAPE
        , OFFER THE SAPPHIRE
        TO RA.'":GOTO 420
OL 2250 IF (NN=4) AND TW THE
        N PRINT "THE STATUE'
        S BASE READS: 'DO NO
        T ENTER.';:GOTO 420
FO 2260 IF NN=4 THEN PRINT "
        THE STATUE'S BASE RE
        ADS: 'ENTER.'":GOTO
        420
CF 2270 IF NN=5 THEN PRINT "
        IT READS: 'THIS CARD
         ACTIVATES SPACESHIP
        SB-910.'":GOTO 420
NE 2280 PRINT "THE BOOK IS O
        N DEMONOLOGY. THERE
        IS ONLYONE PAGE INTA
        CT. IT READS:";
EG 2290 PRINT " '...DEMON":P
        RINT "MUST BE SUMMON
        ED IN PENTACLE.'":GO
        TO 420
FM 2300 PRINT "YOU SAY, ";QT
        $;NN$;QT$;"."
NP 2310 IF OL(60)=RM AND (NN
        =62) THEN 2330
PF 2320 PRINT "NOTHING HAPPE
        NS.":GOTO 420
HA 2330 PRINT "THE SPHINX CR
        IES OUT AND JUMPS IN
        TO THE PIT, FALLING
        TO HIS DEATH."
LA 2340 PRINT "HE HAS LEFT B
        EHIND A STAR RUBY.":
        OL(61)=RM:SC=SC+40:S
        X=0
MM 2350 OL(60)=0:PC=0:GOTO 4
        20
HP 2360 IF (NN=25) AND OL(20
        )=RM THEN OL(25)=RM:
        GOTO 2400
JM 2370 IF ((OL(NN)<>-1) AND
         ((TF(NN)=1)) OR (OL
        (NN)<>RM) AND (TF(NN
        )=-1)) THEN 1750
PC 2380 IF (NN=28) AND OL(28
        )=RM THEN PRINT "OPE
        NED.":MV$(24,24)=CHR
        $(5):OL(28)=0:GOTO 4
        20
CC 2390 IF (NN=25) AND OL(20
        )<>RM THEN 2360
FC 2400 FOR I=1 TO 11:IF NN=
        PO(I) THEN Y=I
LN 2410 NEXT I:IF Y=0 THEN P
        RINT "THERE IS NO WA
        Y TO OPEN THAT.":GOT
        O 420
AG 2420 IF NN=1 OR NN=19 OR
        NN=26 THEN PRINT "TH
        ERE IS NO WAY TO OPE
        N THAT.":GOTO 420
DL 2430 IF OO(Y)=1 THEN PRIN
        T "IT IS ALREADY OPE
        NED.":GOTO 420
DM 2440 IF OO(Y)=1 THEN PRIN
        T "IT IS ALREADY OPE
        NED.":GOTO 420
HF 2450 PRINT "OPENED.":OO(Y
        )=1
HM 2460 X=NN:GOSUB 1310
IJ 2470 IF NN=50 AND OL(24)=
        -11 THEN 2490
JN 2480 GOTO 420
ED 2490 PRINT :PRINT "THE MU
        MMY OPENS ITS EYES A
        ND LETS OUT
        {3 SPACES}A DEEP MOA
        N."
PO 2500 OL(24)=RM:GOTO 420
FF 2510 IF OL(NN)<>-1 AND (T
        F(NN)=1) THEN PRINT
        "IT IS NOT HERE.":GO
        TO 420
GK 2520 IF NN=28 AND MV$(24,
        24)=CHR$(5) THEN PRI
        NT "CLOSED.":OL(28)=
        RM:MV$(24,24)="{,}":
        GOTO 420
CA 2530 IF (NN=25) AND OL(25
        )<>RM THEN 2510
FH 2540 FOR I=1 TO 11:IF NN=
        PO(I) THEN Y=I
AG 2550 NEXT I:IF Y=0 THEN P
        RINT "THERE IS NO WA
        Y TO CLOSE THAT.":GO
        TO 420
EP 2560 IF NN=1 OR NN=19 OR
        NN=26 THEN PRINT "TH
        ERE IS NO WAY TO CLO
        SE THAT.":GOTO 420
DO 2570 IF OO(Y)=0 THEN PRIN
        T "IT IS ALREADY CLO
        SED.":GOTO 420
OA 2580 IF (NN=25) AND OL(25
        )=RM THEN OL(25)=0
IB 2590 PRINT "CLOSED.":OO(Y
        )=0:GOTO 420
OC 2600 IF OL(NN)<>RM THEN P
        RINT "YOU DO NOT SEE
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        THAT HERE.":GOTO 42
        0
JH 2610 IF NN=63 THEN PRINT
        "YOU ARE ABOARD THE
        RAFT.":IR=1
FA 2620 IF IR THEN MV$(122,1
        22)=CHR$(28):MV$(199
        ,199)=CHR$(28):GOTO
        420
GK 2630 IF NN=59 THEN PRINT
        "YOU PLUNGE INTO THE
         PIT....":GOTO 4640
NA 2640 IF NN=35 THEN PRINT
        "YOU SLIDE DOWN THE
        CHUTE....":PRINT :RM
        =18:GOTO 1110
BL 2650 IF NN<>16 AND NN<>41
         AND NN<>50 THEN PRI
        NT "YOU CANNOT ENTER
         THAT.":GOTO 420
MM 2660 IF NN=16 THEN PRINT
        "YOU ENTER THE SPACE
        SHIP....":PRINT :RM=
        44:GOTO 1110
FL 2670 IF NN=50 THEN PRINT
        "IT IS TOO SMALL FOR
         YOU.":GOTO 420
AI 2680 PRINT "YOUR WEIGHT S
        TARTS THE COAL BIN T
        O{6 SPACES}MOVE DOWN
         THE TRACK."
EM 2690 IF OL(42)=8 THEN PRI
        NT "UNFORTUNATELY TH
        E TRACKS ARE BROKEN
        AND YOU ARE";
BC 2700 IF OL(42)=8 THEN PRI
        NT " THROWN AGAINST
        THE WALL....":GOTO 4
        640
EK 2710 PRINT "AFTER A BRIEF
         RIDE YOU STOP AT TH
        E END  OF THE TRACK.
        ":PRINT
AD 2720 IF RM=7 THEN RM=12:O
        L(41)=12:PRINT :GOTO
         1110
NI 2730 IF RM=12 THEN RM=7:O
        L(41)=7:PRINT :GOTO
        1110
DJ 2740 IF (NN<>6) AND (NN<>
        24) THEN PRINT "YOU
        CANNOT LIGHT THAT.":
        GOTO 420
CA 2750 IF NN=6 THEN IF OL(6
        )<>-1 THEN 1750
LM 2760 IF NN=24 THEN IF OL(
        24)<>RM THEN 1600
JK 2770 IF NN=24 THEN 2830
FL 2780 IF LT THEN PRINT "IT
         IS ALREADY LIT.":GO
        TO 420
LL 2790 IF BK THEN PRINT "TH
        E LANTERN IS SMASHED
        .":GOTO 420
OB 2800 IF FL=0 THEN PRINT "
        THE LANTERN IS NOT F
        ILLED WITH OIL.":GOT
        O 420
OF 2810 IF OL(31)<>-1 THEN P
        RINT "YOU HAVE NOTHI
        NG TO LIGHT IT WITH.
        ":GOTO 420
JF 2820 PRINT "OK, THE LANTE
        RN IS LIT.":LT=1:FL=
        0:GOTO 420
LI 2830 IF OL(6)<>-1 OR (LT=
        0) THEN PRINT "YOU H
        AVE NOTHING TO LIGHT
         IT WITH.":GOTO 420
KN 2840 PRINT "YOU THROW YOU
        R LANTERN AT THE MUM
        MY AND IT BREAKS, EN
        GULFING THE ";
BC 2850 PRINT "MUMMY IN":PRI
        NT "FLAMES. THE LANT
        ERN LIES SMASHED ON
        THE FLOOR."
KG 2860 OL(52)=-11:OI(11)=1:
        MM=0:OL(24)=0:OL(6)=
        39:LT=0:BK=1:GOTO 42
        0
DE 2870 IF OL(9)<>-1 THEN PR
        INT "YOU HAVE NOTHIN
        G TO CUT IT WITH.":G
        OTO 420
PD 2880 IF NN<>44 THEN PRINT
         "YOU CANNOT CUT THA
        T.":GOTO 420
MH 2890 IF OL(18)<>RM THEN P
        RINT "FROM WHERE?":G
        OTO 420
LP 2900 IF OL(44)<>-13 THEN
        PRINT "THE OTHER VIN
        ES HANG"
HP 2910 IF OL(44)<>-13 THEN
        420
IH 2920 PRINT "OK, YOU CUT A
         LONG PIECE OF VINE
        FROM{3 SPACES}THE TR
        EE.":OL(44)=-1
JN 2930 GOTO 420
DP 2940 IF (NN=15) AND (OL(N
        N)=-6) AND (OL(12)=-
        1) AND OO(5) THEN 29
        60
LL 2950 IF OL(NN)<>-1 THEN 1
        750
MC 2960 VP=1:XX=NN:PRINT "WH
        ERE DO YOU WISH TO P
        UT IT?":GOSUB 430
IH 2970 YY=NN:NN=XX:FOR Y=1
        TO 11:IF YY=PO(Y) TH
        EN ZZ=Y
GL 2980 NEXT Y
AA 2990 IF (NN=15) AND (YY<>
        58) THEN ZZ=0
KC 3000 IF YY=58 THEN 3110
LG 3010 IF (YY=13) AND (NN<>
        5) THEN ZZ=0
OJ 3020 IF (YY=19) AND (NN<>
        10) THEN ZZ=0
OG 3030 IF (YY=21) AND (NN<>
        22) THEN ZZ=0
BA 3040 IF ZZ=0 THEN PRINT "
        YOU CANNOT PUT THAT
        THERE.":GOTO 420
NM 3050 IF OL(YY)<>RM AND OL
        (YY)<>-1 THEN PRINT
        "IT IS NOT HERE.":GO
        TO 420
PL 3060 IF OO(ZZ)=0 THEN PRI
        NT "IT IS NOT OPEN."
        :GOTO 420
KB 3070 IF OI(ZZ)=MI(ZZ) THE
        N PRINT "IT DOES NOT
         FIT.":GOTO 420
KH 3080 PRINT "DONE.":OL(NN)
        =PV(ZZ):OI(ZZ)=OI(ZZ
        )+1
JO 3090 IF YY<>2 OR NN<>36 T
        HEN 420
OE 3100 PRINT "A DOOR TO THE
         SOUTH CREAKS OPEN."
        :MV$(104,104)=CHR$(1
        9):GOTO 420
BC 3110 IF OL(4)<>RM THEN PR
        INT "IT IS NOT HERE.
        ":GOTO 420
KP 3120 PRINT "IT DISAPPEARS
         INTO THE MOUTH...."
        :OL(NN)=0
NM 3130 IF NN=15 THEN TW=0
JH 3140 GOTO 420
KK 3150 IF NN=64 AND RM=44 T
        HEN 3240
PF 3160 IF OL(NN)<>RM THEN 1
        740
MH 3170 IF NN<>27 AND NN<>41
         AND NN<>64 THEN PRI
        NT "NOTHING HAPPENS.
        ":GOTO 420
JF 3180 IF NN=41 THEN PRINT
        "YOU PUSH THE COAL B
        IN AND IT ROLLS
        {6 SPACES}AWAY...."
IH 3190 IF NN=41 THEN OL(41)
        =0
LP 3200 IF NN=41 AND OL(42)
        THEN PRINT "YOU HEAR
         A SMASH IN THE DIST
        ANCE.":SB=1
FI 3210 IF NN=41 THEN 420
CB 3220 IF (NN=27) AND TR TH
        EN PRINT "YOU CANNOT
         MOVE IT ANY FARTHER
        .":GOTO 420
JA 3230 IF NN=27 THEN PRINT
        "YOU PUSH IT TO REVE
        AL A TRAPDOOR
        {8 SPACES}UNDERNEATH
        !"
FC 3240 IF NN=27 THEN OL(28)
        =RM:TR=1:GOTO 420
LF 3250 IF OL(5)<>-7 THEN PR
        INT "NOTHING HAPPENS
        .":GOTO 420
NJ 3260 PRINT "THERE IS A GI
        ANT EXPLOSION AND TH
        E"
PA 3270 PRINT "SPACESHIP LAU
        NCHES THROUGH THE CE
        ILING  OF THE CAVERN
        ."
CH 3280 IF SC=170 THEN SC=SC
        +30:GOTO 3310
JJ 3290 PRINT "UNFORTUNATELY
         YOU HAVE NOT OBTAIN
        ED ALL THE TREASURES
         AND YOU LAND";
KL 3300 PRINT " IN THE CAVER
        N";:PRINT "AGAIN.":G
        OTO 420
MI 3310 PRINT :PRINT "CONGRA
        TULATIONS! YOU HAVE
        ALL TEN":PRINT "TREA
        SURES!"
JH 3320 PRINT :GOTO 4650
GK 3330 IF OL(39)<>-1 THEN P
        RINT "YOU DO NOT HAV
        E ANYTHING TO HOOK I
        T{5 SPACES}WITH."
EO 3340 IF OL(39)<>-1 THEN 4
        20
NJ 3350 IF NN=40 AND (RM=14
        OR RM=20) THEN 3390
LK 3360 IF (NN=7) AND OL(66)
        =RM THEN 3410
AG 3370 IF OL(NN)<>RM AND (O
        L(NN)<>-1) THEN PRIN
        T "IT IS NOT HERE.":
        GOTO 420
PI 3380 PRINT "YOU CANNOT HO
        OK THAT.":GOTO 420
AN 3390 PRINT "YOU HOOK THE
        GRAPPLING HOOK ON TH
        E SMALLCLIFF."
KF 3400 OL(39)=0:HC=1:MV$(83
        ,83)=CHR$(20):MV$(12
        0,120)=CHR$(14):GOTO
         420
PJ 3410 PRINT "YOU HOOK THE
        POUCH AND PULL IT IN
        TO YOURHANDS."
IP 3420 OL(7)=-1:OL(66)=0:GO
        TO 420
JB 3430 IF NN=22 THEN 3450
CE 3440 IF OL(NN)<>RM AND OL
        (NN)<>-1 THEN 1600
EA 3450 IF OL(19)<>-1 AND OL
        (21)<>-1 THEN PRINT
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        "YOU DON'T HAVE ANYT
        HING TO";
CM 3460 IF OL(19)<>-1 AND OL
        (21)<>-1 THEN PRINT
        " SHOOT IT":PRINT "W
        ITH.":GOTO 420
CF 3470 IF OL(NN)=-1 THEN PR
        INT "YOU CANNOT SHOO
        T AN ITEM OF INVENTO
        RY.":GOTO 420
AE 3480 IF OL(19)=-1 AND OL(
        21)=-1 THEN 3510
EN 3490 IF OL(19)=-1 THEN 35
        60
DP 3500 IF OL(21)=-1 THEN 36
        60
NL 3510 PRINT "WHICH TO USE,
         YOUR FLARE (G)UN, O
        R YOUR (C)ROSSBOW?"
NH 3520 GOSUB 60:IF A$<>"" A
        ND A$<>"G" AND A$<>"
        C" THEN 420
IA 3530 IF A$="C" THEN PRINT
         :GOTO 3560
IG 3540 IF A$="G" THEN PRINT
         :GOTO 3660
NA 3550 GOTO 3520
JD 3560 IF OL(10)<>-8 THEN P
        RINT "IT IS NOT LOAD
        ED.":GOTO 420
LM 3570 IF NN=22 THEN PRINT
        "YOU CANNOT SHOOT A
        FLARE FROM A":PRINT
        "CROSSBOW.":GOTO 420
LN 3580 IF (NN=24) OR (NN=47
        ) OR (NN=56) OR (NN=
        60) OR (NN=67) THEN
        3610
IH 3590 PRINT "ON CONTACT WI
        TH IT, THE STICK BRE
        AKS{4 SPACES}INTO SP
        LINTERS.":OL(10)=0
JI 3600 GOTO 420
OB 3610 IF NN=24 OR NN=56 OR
         NN=60 THEN PRINT "I
        T DOES NOT SEEM AFFE
        CTED.":GOTO 3650
JM 3620 IF NN=67 THEN 3640
HB 3630 PRINT "ON CONTACT TH
        E CROSSBOW BREAKS IN
        TO{5 SPACES}SPLINTER
        S.":OL(10)=0
HJ 3640 PRINT "THE STICK PLU
        NGES INTO THE CREATU
        RE'S{4 SPACES}THROAT
        .":OL(NN)=0:LL=0
JB 3650 OL(10)=0:OL(67)=0:GO
        TO 420
FL 3660 IF NN<>22 THEN PRINT
         "YOU CAN ONLY SHOOT
         THE FLARE, NOT AN
        {4 SPACES}OBJECT.":G
        OTO 420
MD 3670 IF OL(22)<>-12 THEN
        PRINT "IT IS NOT LOA
        DED.":GOTO 420
HG 3680 IF OO(8) THEN PRINT
        "IT EXPLODES IN YOUR
         FACE....":GOTO 4640
OC 3690 PRINT "THE FLARE SHO
        OTS INTO THE AIR, SH
        OWERINGYOU WITH SPAR
        KS."
IH 3700 IF OL(47)=RM THEN PR
        INT :GOTO 3720
JB 3710 OL(22)=0:GOTO 420
DL 3720 PRINT "STALACTITES S
        TART TO FALL TO THE
        GROUND AND ONE HITS
        THE BEAR IN";
JJ 3730 PRINT " THE BACK OF
        HIS";:PRINT "NECK, B
        REAKING HIS SPINE.":
        OL(47)=0:BB=0
NC 3740 GOTO 3710
LH 3750 IF OL(NN)<>-1 AND OL
        (NN)<>RM THEN PRINT
        "IT IS NOT HERE.":GO
        TO 420
LL 3760 IF OL(NN)<>-1 THEN 1
        750
NC 3770 IF (NN=49) AND (OL(5
        1)=-1) AND DD=0 THEN
         3790
AA 3780 PRINT "NOTHING HAPPE
        NS.":GOTO 420
PP 3790 PRINT "THERE IS A PU
        FF OF SMOKE AND A DE
        MON{4 SPACES}APPEARS
        ."
EA 3800 IF RM=52 THEN OL(56)
        =RM:GOTO 3830
AP 3810 PRINT "YOU ARE UNPRO
        TECTED AND THE DEMON
        ":PRINT "APPROACHES
        YOU";
EO 3820 PRINT " - CLAWS":PRI
        NT "GRASPING FOR YOU
        R HEART....":GOTO 46
        40
PD 3830 PRINT QT$;"SO WHAT D
        O YOU HAVE FOR ME?";
        QT$:GOTO 430
JH 3840 IF NN=14 THEN 3900
BI 3850 IF NN=62 AND RM>27 A
        ND RM<31 THEN PRINT
        "THE WATER HAS PECUL
        IAR TASTE.":GOTO 420
ME 3860 IF (NN=62) AND (RM>3
        0 AND RM<34) THEN PR
        INT "SUDDENLY THE WA
        TER RUSHES INTO";:DR
        =1
KA 3870 IF DR THEN PRINT " Y
        OUR":PRINT "OPEN MOU
        TH AND YOU DROWN....
        ":DR=0:GOTO 4640
LO 3880 IF OL(NN)<>-1 THEN 1
        750
EF 3890 PRINT "YOU CANNOT DR
        INK THAT.":GOTO 420
HN 3900 IF OL(11)<>-1 THEN 1
        750
IF 3910 IF OL(14)<>-5 THEN 1
        750
IH 3920 IF OO(4)=0 THEN PRIN
        T "THE VIAL IS CLOSE
        D.":GOTO 420
BH 3930 PRINT "ALL YOUR WOUN
        DS ARE HEALED INSTAN
        TLY."
JH 3940 OL(14)=0:GOTO 420
LM 3950 IF OL(NN)<>-1 THEN 1
        750
AK 3960 IF OL(24)=RM OR OL(4
        7)=RM OR OL(56)=RM O
        R OL(60)=RM THEN 399
        0
JL 3970 IF OL(67)=RM THEN 39
        90
IF 3980 PRINT "THERE IS NO O
        NE HERE TO ACCEPT YO
        UR{5 SPACES}OFFERING
        .":GOTO 420
BD 3990 IF OL(56)<>RM THEN P
        RINT "IT DOES NOT AC
        CEPT YOUR OFFERING."
        :GOTO 420
AP 4000 IF NN<>65 THEN PRINT
         QT$;"NO, THAT WON'T
         DO.";QT$:GOTO 420
CE 4010 PRINT "THE DEMON ACC
        EPTS YOUR OFFERING A
        ND{5 SPACES}GIVES YO
        U A GOLDEN ANKH."
KB 4020 PRINT QT$;"IRONIC IS
        N'T IT?";QT$;" HE SA
        YS BEFORE":OL(65)=0
AC 4030 PRINT "DISAPPEARING.
        ":OL(57)=-1:OL(56)=0
        :SC=SC+15:DD=0:DC=0:
        GOTO 420
MM 4040 IF OL(NN)<>-1 AND (T
        F(NN)>0) THEN 1750
NI 4050 IF NN<>54 THEN 3780
IF 4060 IF OL(34)<>-1 THEN 3
        780
JA 4070 PRINT "AFTER REPEATE
        D BLOWS WITH THE PIC
        K, YOU CHIP AWAY THE
         ROCK TO";
EL 4080 PRINT " REVEAL A PLA
        STIC":PRINT "CARD IN
        SIDE IT.":OL(54)=0:O
        L(5)=-1
JM 4090 GOTO 420
BK 4100 IF NN=24 OR NN=47 OR
         NN=56 OR NN=60 OR N
        N=67 THEN 4120
PK 4110 PRINT "ATTACKING THA
        T IS FUTILE.":GOTO 4
        20
DC 4120 IF OL(19)<>-1 THEN P
        RINT "ATTACKING WITH
        OUT A WEAPON IS SUIC
        IDE.":GOTO 420
FL 4130 PRINT "YOU HAVE A CR
        OSSBOW - USE IT.":GO
        TO 420
KO 4140 IF OL(NN)<>-1 THEN 1
        600
PE 4150 IF NN<>6 THEN PRINT
        "YOU CANNOT FILL THA
        T.":GOTO 420
JD 4160 IF OL(NN)<>-1 THEN P
        RINT "YOU HAVE NO OI
        L.":GOTO 420
AH 4170 PRINT "YOU FILL THE
        LANTERN WITH OIL FRO
        M THE  BLADDER."
PM 4180 FL=1:OL(29)=0:OL(30)
        =-1:NW$(197,197)=CHR
        $(6):NW$(198,203)="X
        XYYZZ":NW$(204,204)=
        CHR$(6):NW$(205,210)
        ="BLADDE"
JN 4190 GOTO 420
KH 4200 IF NN=48 AND RM=33 T
        HEN 4230
ON 4210 IF OL(NN)<>RM THEN 1
        600
MI 4220 GOTO 2320
OH 4230 IF ML THEN 2320
BI 4240 PRINT "SEVERAL THING
        S FLOAT FROM UNDERNE
        ATH IT.";
KP 4250 OL(12)=RM:OL(49)=RM:
        ML=1:GOTO 420
HC 4260 IF NN<>63 THEN PRINT
         "YOU CANNOT BUILD T
        HAT.":GOTO 420
AM 4270 IF OL(44)=-1 AND OL(
        45)=-1 THEN 4290
AJ 4280 PRINT "YOU DO NOT HA
        VE THE MATERIAL TO M
        AKE{4 SPACES}IT.":GO
        TO 420
BE 4290 PRINT "YOU BUILD A R
        AFT.":OL(44)=0:OL(45
        )=0:OL(63)=RM:GOTO 4
        20
HB 4300 IF NN=16 OR NN=63 TH
        EN 4320
KH 4310 PRINT "YOU WERE NEVE
        R IN IT!":GOTO 420
IC 4320 IF NN=16 THEN PRINT
        "YOU EXIT THE SPACES
        HIP....":PRINT :RM=4
        3:GOTO 1110
FI 4330 IF IR=0 THEN 4310
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LP 4340 PRINT "YOU EXIT THE
        RAFT.":IR=0:MV$(122,
        122)="{,}":MV$(199,1
        99)="{,}"
KN 4350 IF RM>27 AND RM<31 T
        HEN 4610
NF 4360 IF RM=34 AND CR=0 TH
        EN SC=SC+10:CR=1
JN 4370 GOTO 420
AO 4380 PRINT "YOU ARE CARRY
        ING:"
JB 4390 FOR X=1 TO 65:IF OL(
        X)=-1 THEN RF=1:GOSU
        B 1220:RF=0:I=X*29-2
        8:PRINT " ";A$;OB$(I
        +1,I+ASC(OB$(I))):GO
        SUB 1310
CM 4400 IF OL(X)=-1 THEN IN=
        IN+1
GA 4410 NEXT X
HI 4420 IF IN=0 THEN PRINT "
         ABSOLUTELY NOTHING"
NI 4430 IN=0:GOTO 420
PB 4440 PRINT "DO YOU REALLY
         WISH TO QUIT?":QQ=1
        :GOSUB 430
MO 4450 IF IN$(1,1)="Y" THEN
         4470
AB 4460 PRINT "OK.":QQ=0:RS=
        0:GOTO 430
BN 4470 PRINT "YOU HAVE ACHI
        EVED A SCORE OF ";SC
JM 4480 PRINT :PRINT "OUT OF
         A POSSIBLE 200 IN "
        ;MV;" MOVES.":PRINT
JG 4490 PRINT "THIS PUTS YOU
         IN THE RANK OF:"
GJ 4500 FOR X=1 TO 6:IF SC<=
        MS(X) THEN I=X*13-12
        :S$=RK$(I+1,I+ASC(RK
        $(I))):X=7
GB 4510 NEXT X
BN 4520 PRINT :PRINT QT$;S$;
        " ADVENTURER";QT$
EN 4530 IF SS THEN SS=0:GOTO
         430
PB 4540 PRINT :PRINT "PRESS
        A KEY WHEN READY."
LE 4550 GOSUB 60
GN 4560 IF QQ THEN CLOSE #1:
        POKE 752,0:END
MF 4570 RUN
NL 4580 PRINT "DO YOU REALLY
         WISH TO RESTART?":R
        S=1:GOSUB 430
NI 4590 GOTO 4450
CA 4600 SS=1:GOTO 4470
IA 4610 IF RM<>29 THEN PRINT
         "AS YOU DIVE INTO T
        HE WATER THE CURRENT
        ":WH=1
NL 4620 IF WH THEN PRINT "WA
        SHES YOU WEST - INTO
         THE SEA.":WH=0:GOTO
         4640
NH 4630 PRINT "YOU DIVE INTO
         THE RIVER....":PRIN
        T :RM=31:IR=0:GOTO 1
        110
FJ 4640 PRINT :PRINT :PRINT
        "YOU HAVE DIED.":PRI
        NT
DK 4650 PRINT "DO YOU WISH T
        O QUIT OR RESTART?":
        QQ=1:GOSUB 430:QQ=0
IK 4660 IF IN$<>"QUIT" AND I
        N$<>"RESTART" THEN 4
        650
BO 4670 IF IN$="QUIT" THEN Q
        Q=1
AE 4680 IF IN$="RESTART" THE
        N RS=1
NL 4690 GOTO 4470
ED 4700 DIM TF(68),OL(68),MI
        (11),OI(11),OO(11),P
        V(11),PO(11),MS(6)
LJ 4710 DIM MV$(56*6),OB$(67
        *29),NW$(67*7),VW$(4
        6*7),RK$(13*6),DR$(6
        *6)
EI 4720 DIM RM$(62),PO$(11),
        IN$(37),VB$(37),NN$(
        37),QT$(1),UL$(1),CL
        $(1),DL$(1),FL$(1),C
        R$(1),A$(16),VL$(5),
        S$(64)
NC 4730 TRAP 4990:S$=DRIVE$:
        S$(LEN(S$)+1)="HERMI
        T.BEG":OPEN #2,4,0,S
        $
FK 4740 FOR X=1 TO 56:FOR Y=
        1 TO 6:INPUT #2;I:MV
        $(X*6-6+Y)=CHR$(I):N
        EXT Y:NEXT X
JG 4750 FOR X=1 TO 44:I=X*7-
        6:INPUT #2;S$:VW$(I)
        =CHR$(LEN(S$)):VW$(I
        +1)=S$:NEXT X
DC 4760 FOR X=1 TO 67:I=X*7-
        6:INPUT #2;S$:NW$(I)
        =CHR$(LEN(S$)):NW$(I
        +1)=S$:INPUT #2;I:TF
        (X)=I:NEXT X
HE 4770 FOR X=1 TO 67:I=X*29
        -28:INPUT #2;S$:OB$(
        I)=CHR$(LEN(S$)):OB$
        (I+1)=S$:INPUT #2;I:
        OL(X)=I:NEXT X
EN 4780 FOR X=1 TO 6:INPUT #
        2;S$:I=X*13-12:RK$(I
        )=CHR$(LEN(S$)):RK$(
        I+1)=S$:INPUT #2;I:M
        S(X)=I:NEXT X
AC 4790 FOR X=1 TO 11:INPUT
        #2;I:PO(X)=I:NEXT X
PB 4800 FOR X=1 TO 11:INPUT
        #2;I:MI(X)=I:NEXT X
PK 4810 FOR X=1 TO 11:INPUT
        #2;I:OO(X)=I:NEXT X
AD 4820 FOR X=1 TO 11:INPUT
        #2;I:PV(X)=I:NEXT X
DD 4830 FOR X=1 TO 6:INPUT #
        2;S$:I=X*6-5:DR$(I)=
        CHR$(LEN(S$)):DR$(I+
        1)=S$:NEXT X
DN 4840 CLOSE #2:PRINT "{UP}
        ":TRAP 32768
KB 4850 RM=1:LR=0:VL$="AEIOU
        ":OI(2)=1:OI(3)=2:OI
        (4)=1:OI(5)=1:OL(21)
        =-1:TW=1
KK 4860 OL(22)=-1:AC=10:CR=0
        :MV=-1:OI(2)=1:OI(3)
        =2:OI(4)=1:OI(5)=1:O
        I(9)=1
IL 4870 OI(10)=1
LA 4880 QT$=CHR$(34):CR$=CHR
        $(155)
IM 4890 UL$=CHR$(95):CL$=CHR
        $(30):DL$=CHR$(126)
KN 4900 RETURN
IM 4910 LR=RM:TRAP 4940:S$=D
        RIVE$:S$(LEN(S$)+1)=
        "HERMIT.DAT":OPEN #2
        ,4,0,S$
IO 4920 FOR I=1 TO RM:INPUT
        #2;RM$:NEXT I
DA 4930 CLOSE #2:TRAP 32768:
        RETURN
FO 4940 CLOSE #2:TRAP 32768:
        PRINT :PRINT :PRINT
        "***DISK ERROR***
        {BELL}"
ML 4950 PRINT "MAKE SURE THA
        T THE DISK CONTAININ
        G THE  FILE HERMIT.D
        AT IS IN ";DRIVE$:PR
        INT
FE 4960 PRINT "PRESS RETURN
        TO CONTINUE";
BD 4970 GOSUB 60:IF A$<>CR$
        THEN 4970
GK 4980 PRINT :PRINT :GOTO 4
        910
GD 4990 CLOSE #2:TRAP 32768:
        PRINT :PRINT :PRINT
        "***DISK ERROR***
        {BELL}"
LD 5000 PRINT "MAKE SURE THA
        T THE DISK CONTAININ
        G THE  FILE HERMIT.B
        EG IS IN ";DRIVE$:PR
        INT
EH 5010 PRINT "PRESS RETURN
        TO CONTINUE";
DI 5020 GOSUB 60:IF A$<>CHR$
        (155) THEN 5020
EL 5030 PRINT :PRINT :RUN
```

Program 7: The Hermit Data File Creator For Atari 400, 800, XL, And XE

```
LD 10 REM THE HERMIT'S DATA
      FILE CREATOR
BD 15 REM COPYRIGHT 1987 COM
      PUTE! PUBLICATIONS, IN
      C.  ALL RIGHTS RESERVE
      D.
BE 16 PRINT "{CLEAR}":POSITI
      ON 10,5:PRINT "COPYRIG
      HT 1987":POSITION 6,6:
      PRINT "COMPUTE! PUBLIC
      ATIONS, INC."
LO 17 POSITION 8,7:PRINT "AL
      L RIGHTS RESERVED.":FO
      R I=1 TO 1500:NEXT I
PG 20 DIM S$(255),DRIVE$(3):
      DRIVE$="D1:"
JH 30 PRINT "{CLEAR}WORKING.
      ..";
OM 40 S$=DRIVE$:S$(LEN(DRIVE
      $)+1)="HERMIT.BEG":OPE
      N #1,8,0,S$:S$(LEN(DRI
      VE$)+1)="HERMIT.DAT":O
      PEN #2,8,0,S$
GC 50 FOR X=1 TO 56:FOR Y=1
      TO 6:READ I:PRINT #1;I
      :NEXT Y:READ S$:PRINT
      #2;S$:NEXT X:CLOSE #2
IJ 60 FOR X=1 TO 44:READ S$:
      PRINT #1;S$:NEXT X
PI 70 FOR X=1 TO 134:READ S$
      :PRINT #1;S$:READ I:PR
      INT #1;I:NEXT X
JH 80 FOR X=1 TO 6:READ S$:P
      RINT #1;S$:READ I:PRIN
      T #1;I:NEXT X
DA 90 FOR X=1 TO 44:READ I:P
      RINT #1;I:NEXT X
IC 100 FOR X=1 TO 6:READ S$:
       PRINT #1;S$:NEXT X
FM 110 CLOSE #1
EG 120 PRINT "{CLEAR}DONE.":
       END
AL 130 DATA 0,2,0,0,0,0,AT T
       HE FRONT DOOR
MP 140 DATA 1,0,3,4,0,0,IN T
       HE LIVING ROOM. IT IS
       {7 SPACES}SPARSELY FU
       RNISHED
FK 150 DATA 0,0,0,2,0,0,IN T
       HE BEDROOM
CD 160 DATA 0,0,2,0,0,0,IN T
       HE KITCHEN. EMPTY CAB
       INETS  LINE THE NORTH
        WALL
HG 170 DATA 0,9,6,0,0,0,IN A
       ROUGHLY CARVED TUNNE
```

```
L
ME 180 DATA 0,0,7,5,0,0,0,IN A
 ROUGHLY CARVED TUNNE
L
GP 190 DATA 0,8,0,6,0,0,0,IN A
N INCLINED TUNNEL. A
TRACK{3 SPACES}RUNS T
O THE SOUTH
JK 200 DATA 7,0,0,0,0,0,0,AT A
 STONE WALL. THE TRAC
K RUNS OVER THE WALL
TO THE SOUTH
OJ 210 DATA 5,11,0,10,0,0,0,IN
 A TUNNEL. THE WALLS
GLITTER  WITH IRON PY
RITE
CJ 220 DATA 0,0,9,0,0,0,0,IN A
 NATURAL CAVE WHICH I
S USED FOR STORAGE
KK 230 DATA 9,0,0,0,0,0,0,IN A
 CHAMBER
HB 240 DATA 0,14,13,15,0,0,0,A
T THE END OF A TUNNEL
. THE{5 SPACES}TRACK
ALSO ENDS HERE
MJ 250 DATA 0,0,0,12,0,0,0,IN
A TUNNEL. TO THE EAST
 THE{4 SPACES}TUNNEL
IS BLOCKED BY A BOULD
ER
AL 260 DATA 12,0,0,0,0,0,0,AT
THE BOTTOM OF A SMALL
 CLIFF
LM 270 DATA 0,16,12,0,0,0,0,IN
 A CURVED TUNNEL
PI 280 DATA 15,17,0,0,0,0,0,IN
 A TUNNEL
MP 290 DATA 16,0,0,0,0,0,0,AT
A DEAD END
BG 300 DATA 0,0,0,0,0,0,0,IN A
N ABANDONED MINE SHAF
T
II 310 DATA 18,0,17,0,0,0,0,IN
 AN ABANDONED MINE SH
AFT
EM 320 DATA 0,21,0,0,0,0,0,ON
A CLIFF
NA 330 DATA 20,0,23,22,0,0,0,O
N THE SHORE OF A RIVE
R
GJ 340 DATA 0,0,21,0,0,0,0,ON
THE SHORE OF A RIVER
IB 350 DATA 0,0,24,21,0,0,0,ON
 A DIRT PATH
HB 360 DATA 27,26,25,23,0,0,0,
ON A PATH IN THE CENT
ER OF AN{4 SPACES}UND
ERGROUND VILLAGE
EP 370 DATA 0,0,0,24,0,0,0,IN
A HUT USED AS A MEETI
NG{6 SPACES}PLACE
KH 380 DATA 24,0,0,0,0,0,0,IN
THE HEALER'S HUT
LL 390 DATA 0,24,0,0,0,0,0,IN
A DEMOLISHED HUT
DD 400 DATA 21,34,29,30,0,0,0,
IN THE MIDDLE OF A RI
VER
EL 410 DATA 0,0,0,0,28,0,0,0,UPS
TREAM IN A RIVER. THR
OUGH THECLEAR WATER Y
OU SEE A SHIP
KH 420 DATA 0,0,0,28,01,0,0,0,DO
WNSTREAM IN A RIVER
DE 430 DATA 0,32,0,0,0,29,0,0,UN
DERWATER. THE CURRENT
 PUSHES  YOU SOUTH
CE 440 DATA 31,0,0,33,0,0,0,0,IN
 A SUNKEN SHIP
KK 450 DATA 0,0,0,0,32,0,0,0,IN
THE CREW'S QUARTERS
KK 460 DATA 0,0,36,0,35,0,0,0,ON
 THE SHORE OF A RIVER
HB 470 DATA 0,0,0,34,0,0,0,0,ON
 THE SHORE OF A RIVER
HP 480 DATA 34,37,0,0,0,0,0,0,IN
 A LARGE CAVERN. STAL
ACTITES  HANG FROM AB
OVE
CD 490 DATA 0,36,38,0,0,0,0,0,IN
 A DARK TUNNEL
FC 500 DATA 37,41,39,0,0,0,0,0,I
N A DARK TUNNEL
IO 510 DATA 0,40,0,38,0,0,0,0,IN
 A BURIAL CHAMBER. TH
E SMELL  OF DECAY FIL
LS THE AIR
MB 520 DATA 39,0,0,41,0,0,0,0,IN
 A CURVED TUNNEL
MC 530 DATA 38,42,40,0,0,0,0,0,I
N A SMALL CHAMBER
IK 540 DATA 41,49,45,43,0,0,0,0,
IN A SMALL AMPHITHEAT
ER
OP 550 DATA 0,0,42,0,0,0,0,0,IN
 A GIGANTIC CAVERN
GH 560 DATA 0,0,0,0,0,0,0,0,ABOA
RD A SPACESHIP
DI 570 DATA 0,0,46,42,0,0,0,0,IN
 A HALLWAY
HJ 580 DATA 48,0,47,45,0,0,0,0,I
N A HALLWAY
IO 590 DATA 0,0,0,46,0,0,0,0,IN
 A DRESSING ROOM
NM 600 DATA 0,46,0,0,0,0,0,0,IN
THE LIBRARY ROOM
IA 610 DATA 42,50,0,0,0,0,0,0,IN
 A CORRIDOR
CJ 620 DATA 49,54,51,53,0,0,0,
SMALL CHAMBER
ID 630 DATA 0,0,52,50,0,0,0,0,IN
 A CORRIDOR
LD 640 DATA 0,0,0,51,0,0,0,0,IN
THE HEXAGON-SHAPED RO
OM
EJ 650 DATA 0,0,50,0,0,0,0,0,IN
 AN EAST/WEST TUNNEL.
 A CAVE-IN BLOCKS THE
WESTWARD EXIT
IJ 660 DATA 50,55,0,0,0,0,0,0,IN
 A CORRIDOR
HK 670 DATA 54,56,0,0,0,0,0,0,AT
 THE END OF THE CORRI
DOR
EP 680 DATA 55,0,0,0,0,0,0,0,IN
 A LARGE CHAMBER
NP 690 DATA N,NORTH,S,SOUTH,
E,EAST,W,WEST,U,UP,D,
DOWN,TAKE,DROP,EXAMIN
,READ,SAY
OJ 700 DATA OPEN,CLOSE,ENTER
,LIGHT,CUT,PUT,PUSH,H
OOK,SHOOT,RUB,DRINK,O
FFER
NN 710 DATA HIT,ATTACK,FILL,
LIFT,BUILD,EXIT,INVEN
T,I,QUIT,Q,RESTART
FM 720 DATA SCORE,LOOK,L,DIV
E
CE 730 DATA SIGN,-1,PEDEST,-
1,BOOK,1,STATUE,-1,CA
RD,1,LANTER,1,POUCH,1
CF 740 DATA BACKPA,1,KNIFE,1
,STICK,1,VIAL,1,BOX,1
,SLOT,-1,ELIXIR,0
AO 750 DATA SAND,0,SPACES,-1
,PANEL,-1,TREE,-1,CRO
SSB,1
JK 760 DATA DRESSE,-1,GUN,1,
FLARE,1,BUNK,-1,MUMMY
,-1,DRAWER,-1,BED,-1
EP 770 DATA REFRIG,-1,TRAPDO
,-1,BLADDE,1,BLADDE,1
,FLINT,1,SKELET,-1
BD 780 DATA CIRCLE,-1,PICK,1
,CHUTE,-1,SAPPHI,1,GO
LD,1,ROD,1,HOOK,1,CLI
FF,-1
EA 790 DATA BIN,-1,TRACK,-1,
DIAMON,1,VINE,1,LOGS,
1,STALAC,-1,BEAR,-1
KP 800 DATA MATTRE,-1,LAMP,1
,SARCOP,-1,HANDKE,1,F
ACEMA,1,XYZZ,-1
MF 810 DATA ROCK,1,PENTAC,-1
,DEMON,-1,ANKH,1,MOUT
H,-1,PIT,-1,SPHINX,-1
,RUBY,1
NI 820 DATA WATER,0,RAFT,-1,
BUTTON,-1,TRIDEN,1,PO
UCH,1,LEOPAR,-1
CM 830 DATA SIGN,4,JADE PEDE
STAL,18,LEATHER BOUND
 BOOK,48,DRAGON STATU
E,55
LN 840 DATA LAUNCH CARD,0,OI
L LANTERN,-10,LEATHER
 POUCH,0,BACKPACK,13
IA 850 DATA *JEWELED KNIFE*,
-2,SHARPENED STICK,10
,YELLOW VIAL,26,METAL
 BOX,0
NP 860 DATA SLOT,44,*ELIXIR
OF LIFE*,-5,WHITE SAN
D,-6,SPACESHIP,43
PD 870 DATA CONTROL PANEL,44
,GIANT OAK TREE,24,CR
OSSBOW,35,WOODEN DRES
SER,47
NN 880 DATA FLARE GUN,-1,FLA
RE,-1,BUNK,33,MUMMY,-
11,DRAWER,0,BED,3,REF
RIGERATOR,4
OG 890 DATA TRAPDOOR,0,OIL S
OAKED BLADDER,6,BLADD
ER,0,FLINT & STEEL,-2
JO 900 DATA SKELETON,13,LARG
E CIRCLE ON THE FLOOR
{3 SPACES},11,PICK,17
,CHUTE,16
ME 910 DATA *SAPPHIRE*,18,*G
OLD NUGGET*,7,METAL R
OD,10,GRAPPLING HOOK
& ROPE,-1
FF 920 DATA CLIFF,0,COAL BIN
,7,BROKEN TRACK,8,*SM
ALL DIAMOND*,-4,VINE,
-13,LOGS,27
FH 930 DATA STALACTITES,0,LA
RGE BEAR,36,MATTRESS,
0,*GOLDEN LAMP*,0,SAR
COPHAGUS,39
MJ 940 DATA *GOLDEN HANDKERC
HIEF*,-9,*GOLDEN FACE
MASK*,0,XYZZ,0,LARGE
ROCK,53
AO 950 DATA PENTACLE ON THE
FLOOR,52,DEMON,0,*GOL
DEN ANKH*,0,MOUTH,0,P
IT,56
IB 960 DATA SPHINX,56,*STAR
RUBY*,0,WATER,0,RAFT,
0,BUTTON,0,TRIDENT,18
JA 970 DATA POUCH HANGING FR
OM A ROPE{3 SPACES},1
1,BLACK LEOPARD,42
NC 980 DATA AMATEUR,10,NOVIC
E,50,AVERAGE,100,INTE
LLECTUAL,150,PRO,199,
MASTER,200
IL 990 DATA 2,7,8,11,12,13,1
9,21,25,26,50,1,1,4,1
,1,1,1,1,5,6,3,1,0,0,
0,0,1,1,0,0
AN 1000 DATA 1,0,-3,-4,-2,-5
,-6,-7,-8,-12,-9,-10
,-11
CD 1010 DATA NORTH,SOUTH,EAS
T,WEST,UP,DOWN
```

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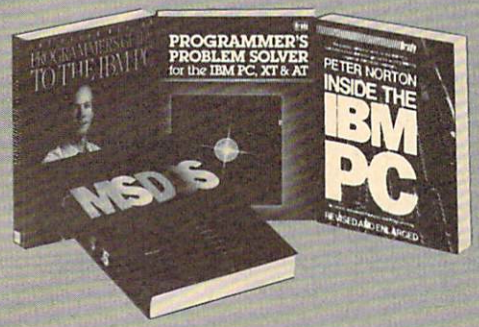

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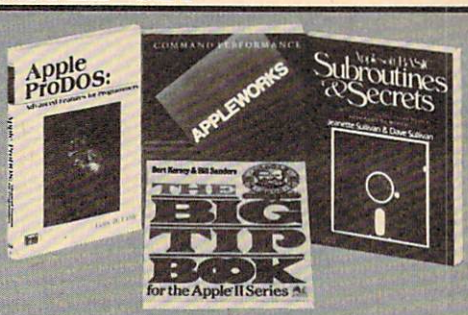

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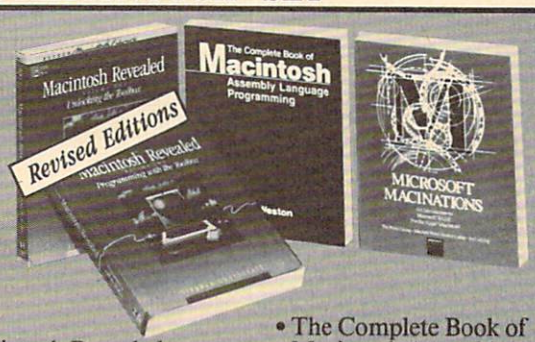

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The World Inside the Computer

Fred D'Ignazio, Associate Editor

It's A Hammer! It's A Sandbox! It's A Refrigerator! No! It's A Computer!

When I'm hungry, I head to the refrigerator, grab the handle, yank it back, and voilà! The door opens, and I get to gobble up whatever's inside.

Refrigerators are not something I normally spend much time thinking about. I have a certain image of my refrigerator, and that image conforms to the real world (99.9 percent of the time the refrigerator works exactly as I think it should). My image of the refrigerator is clear and it's also constant. Tomorrow I won't wake up and find that my refrigerator now works like a wind tunnel or a Corvette. I can depend on my refrigerator. It holds few surprises (except when we leave leftovers inside too long).

Computers are different. My image of a computer is not clear, and it's certainly not constant. And I propose, dear reader, that your image may be even fuzzier and more fickle than mine.

Ancient Image

Let's try a test: Ten years ago (in 1977), what was your image of a computer? Did you think of computers as game machines, children's tutors, and capable of disappearing into wristwatches, microwave ovens, and pay telephones? How about ten years before that? (Had you even heard of computers in 1967? Were you even alive then?)

How about me? In 1967, I was reading science-fiction books about computers that lived under mountains and took over the world. By 1977, my science-fiction vision had come true: I was a programmer buried deep under the Pentagon programming a monstrous mainframe computer known as the Honeywell 6000. The manuals for that computer weighed over 500 pounds. I would have laughed if you had told me that a decade later toddlers, handicapped people, and octogenarians would be operating desktop computers which were more powerful than the behemoth that I got to see only because I had four top-secret security badges.

Now let's think about computers of today. When you hear the word *computer*, which image comes to mind—toy, tutor, or tool? Is it one of these or all of the above? Does it depend on your mood or the day of the week? Or what your parents, teacher, or boss just ordered you to do?

People use the word *computer* lightly, as if they knew what they were talking about. But don't be fooled. I think we're all mixed up. I don't think anyone is sure what a computer is. Or if they are sure, I think they're wrong.

I think it's time we stopped accepting our current images of computers and began questioning those images. Is thinking about computers any more productive than thinking about refrigerators? Yes, for two reasons. First, as I said, we're not really sure what computers are today, and we don't have a clue about what they'll be tomorrow. Second, our image of computers limits the use we get out of them. For example, if we see computers only as electronic typewriters, then that's all we can imagine doing with them. Or if we see them only as data display devices, then it's unlikely that we'll ever use them to learn speed reading, conduct a flight simulation, send electronic mail, or teach our children.

Now comes the punch line: Things are going to get worse. We are sitting on the edge of a cliff—a continental divide, a great abyss. In the next ten years, computers will change more thoroughly and more profoundly than they have in the 40 years since they were invented.

Now you think you get it. You think I must be talking about the new Tandy 1000 HX. Or the IBM PS/2 Model 25. Or maybe Apple's new secret computer that we keep hearing about.

Wrong.

These new computers are chips off the old block, clones of clones. I'm talking about something you can't imagine. Something so fundamentally different that the word *computer* can't begin to describe it. It's right around the corner, and since you can't imagine it, you won't see it coming, until—SMACK!—it'll whack you on the head and send you sprawling.

Do we want this to happen? Of course not. As educators nurturing young minds, as business people planning for the future, as parents rearing our children, we need to grab a chisel right now and start carving a new image for computers—one that strains our imaginations and opens our minds wide to the new possibilities that are in store for us.

Really...Write

I often end my columns by appealing to my readers to respond. Often I do this lightheartedly, but this time I'm not kidding. I'm deadly earnest. I am desperate to know what your image of computers is, and what you imagine computers might be like just ten years from now. We all know that they'll be faster, have better graphics, more memory, and so on. But let me know what you've come up with that *isn't* predictable—that's the exciting stuff. Write:

Fred D'Ignazio
c/o COMPUTE! Magazine
324 West Wendover Ave., Suite 200
Greensboro, NC 27408

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The Beginner's Page

C. Regena

The Random Function

The random number feature is a key ingredient in computer games and educational drill programs. This month, we will discuss how you can use random numbers in your own BASIC programs.

RND is the function for getting a random number in most versions of BASIC. The RND function returns a decimal fractional value between 0 and 1 (but never exactly 0 or 1). For example, try entering **PRINT RND(1)** and see what your computer does. Try it again. You should get a different number.

Actually, the computer is too logical and methodical to produce a truly random number. The RND function returns *pseudo*random values. It takes a given *seed value* and plugs it into a formula to generate the "random" value. If you knew the algorithm and seed value, you could predict the value that RND would return. However, the formula used is sufficiently complex that the results closely approximate a random distribution.

In real life, you don't usually want fractions—you want whole numbers. For example, you may want to generate two random numbers, each from 1 to 6, to simulate the roll of two dice. Or you may want to place obstacles on a game screen at randomly selected row and column positions. In these examples, we need to use whole numbers or *integers*. To change our random decimal fraction into an integer, we need BASIC's INTeger function. The INT function yields the integer, or whole number portion of a number. For example, INT(8.7914) is equal to 8.

To generate a random integer between 0 and 9, enter this line:

```
PRINT INT(10*RND(1))
```

The computer multiplies 10 by the random decimal fraction, and then converts it into an integer. Note that if the random fraction is less than .1, the value of INT(10*RND(1)) is 0. If the random fraction is greater than or equal to .9, the value of INT(10*RND(1)) is 9. Thus, our range of random numbers is 0 to 9. To get random numbers from 1 to 10, just add 1: INT(10*RND(1))+1.

Rolling Dice

Let's try another example. In rolling one die, the possibilities are numbers from 1 to 6. To simulate a roll in BASIC, we use the statement

```
D=INT(6*RND(1))+1
```

Now let's shake two dice. Your total number will be a number from 2 (one dot on each die) to 12 (six dots per die). The formula is INT(11*RND(1))+2. In general, to choose a random integer number from A to B, inclusive, the formula is N=INT((B−A+1)*RND(1))+A.

Now let's try a short program that prints ten random numbers in the range 1–10:

```
100 FOR N=1 TO 10
110 PRINT INT(10*RND(1))+1
120 NEXT N
```

Run the program several times. If you are using an IBM PC, Atari ST, or Amiga, you get the same sequence of ten numbers each time you run the program. Knowing this sequence may help when you are debugging a program, but if you use the same sequence for a game, the game soon loses its appeal. So, for the IBM PC, Atari ST, and Amiga computers, you'll need to add the RANDOMIZE statement. RANDOMIZE needs to appear *before* any use of RND. To add it to the program above, add this line:

```
90 RANDOMIZE
```

Now, each time you run the program, you will get a different sequence of ten random numbers.

Different versions of BASIC use RANDOMIZE differently. You may need to specify a seed value that tells the computer what value it should start with. If your computer requires a seed, and you use RANDOMIZE by itself, the computer stops the program and asks you to enter a number. This number is used to generate the random number series. Having to enter a number can be a nuisance, so RANDOMIZE lets you specify a seed value like this:

```
RANDOMIZE X
```

or

```
RANDOMIZE 0
```

or

```
RANDOMIZE 532
```

However, if you use a constant number as the seed, the numbers will still be the same every time the program is run. On the Atari ST, RANDOMIZE 0 (that's a zero) makes the computer provide its own random seed. On the PC and Amiga, the statement RANDOMIZE TIMER tells the computer to use its internal clock value as a random seed. The TIMER value is almost always a different number each time the program is run.

The RND(1) function in the versions of BASIC for the Apple II and Commodore eight-bit computers does not return the same sequence of numbers each time a program is run, but it does always start with the same sequence after the computer is turned on or is reset. Although these computers do not have a RANDOMIZE command, you can still reseed the random number sequence. For the Commodore 64, a statement of the form X=RND(−TI) is equivalent to the RANDOMIZE TIMER statement described above.

In Atari eight-bit computers, the RND function returns random values generated by a hardware counter in the POKEY sound chip. Atari BASIC's RND function is therefore more truly random than in other BASICs, and no special randomization steps are required.©

Computers And The Left Hand Of Knowledge

I had lunch last week with an artist—let's call her Betty. Betty lives with a friend of mine along with his two dogs, three computers, and 15 music synthesizers. Since Betty is an artist and my friend has a Macintosh, I asked if she had ever done any computer graphic artwork. Her response surprised me. She said she had tried it once but didn't like it, so she never tried it again.

I persisted. Was the problem that she thought computers were doing the actual "creating"? No, that wasn't it. Technophobia wasn't an issue either—she did use the computer for correspondence and articles, but she just wasn't interested in using it for the creation of artwork. The reason she gave was quite simple: The computers she had seen just weren't good enough.

Not Good Enough

Betty isn't a snob and she doesn't make up excuses to hide her real feelings. From her perspective, the quality of computer graphics tools on personal computers are just too poor to be of interest to her as a professional artist. There isn't an aspect of computer art that she seems to like. The input devices are clumsy ("Drawing pictures with the rock-like mouse is a joke"), the display resolution is crude ("You can't even draw a circle without glaring 'jaggies' all over the place"), and the interface to the software is so cumbersome as to interfere with the flow of ideas from the mind to the screen.

As a technologist who is interested in the arts, I found her comments to be quite revealing. I realized that she was quite mature and rational in her feelings and that those of us who have trumpeted the benefits of computers have been willing to overlook some limitations of this technology in our excitement over its capabilities.

My First Mac

I remember the joy of setting up my first Macintosh computer complete with its ImageWriter printer. I was liberated from the typeface barriers I had known before. Instead of simple dot-matrix characters or one high-quality daisywheel typeface, I could now mix and match typefaces in my documents. The exhilaration I felt when I could italicize certain words in a document or change typefaces altogether masked one limitation I was to confront later: The quality of the printout really wasn't that good. The ImageWriter printer does a fine job for a dot-matrix impact printer, but the result is hardly typeset quality. Still, I enjoyed this tool so much that I used it for everything—letters, articles, overhead transparencies. I used it for anything requiring marks on paper.

I might not have ever known how poor this tool was if I hadn't gotten a laser printer. Once I made this purchase, my print resolution went from 75 dots per inch to 300. There was no comparison between the two. If the ImageWriter had sensitized me to the limitations of my earlier print capabilities, the laser printer showed that I still had a lot to learn.

The ImageWriter that had been my workhorse was, within one day, relegated to a corner where it is used for printing invoices and labels. The quality of the laser printer was so high that I had to redo all the ImageWriter-produced overhead transparencies whose quality was a sudden embarrassment to me.

A Lesson

This experience taught me a lesson. We accept the quality to which we are sensitized. If we don't know how good things can be, then we are really happy with what we have. As long as I was encountering progressive advances in technology, I was happy. But, with each advance, I was also being sensitized to how far we had come and to how far we still had to go.

Art And Technology

On the surface, many people might say, "So what? The function of your tools is to help you communicate. As long as you are communicating effectively, why worry about some ultimate communication vehicle. Just be happy with what you have."

This view is appropriate for many computer applications. For most of these applications, the meaning of the activity is independent of its representation. For example, the meaning of 3, three, and III is the same, even though the representation differs. Analytical computer applications (including financial calculations and most word processing tasks) involve representation independent of meaning. As a consequence, all we care about is the speed and flexibility with which the computer lets us do our tasks. We don't need fancy fonts, all we need is accuracy and ease of use.

This is not the case for the artist. For the artist, meaning and representation are inseparable—they are intertwined in such a tight manner that one cannot distinguish between the two. If this were not the case, painters would have died out with the invention of photography.

One cannot look at a painting of a pond of water lilies without sensing much more than the physical reality of the depiction. If the painting is any good, the viewer will be transported within himself to view the pond in a multisensory fashion to feel the quiet of the place, to hear the hum of the insects and the splash of the water as a fish jumps, to feel the warmth of the sun, and to experience the transpor-

tation of the spirit from the gallery to the heart of the artist who created the picture in the first place.

This is the function of art.

The question is simply this: Why is it that some artists feel capable of creating art of this caliber with a piece of charcoal and a sheet of paper and yet feel that computers just aren't good enough?

Some might argue that today's computers are serial (one step at a time) machines and that the creation of art is a holistic process. The computer belongs to the domain of the right hand, and art to the domain of the left. For this reason, the two will never mesh properly.

My problem with this argument is that it gives the computer too much credit. It suggests that the computer is more than a mere tool for expression when it is, in fact, only an alternative to the paint brush or piece of charcoal. To say that the computer is, at its core, a "left-brained" analytical tool makes as little sense as saying that a sculptor's mallet is a "right-brained" holistic tool.

The reality is that the computer is whatever kind of tool we want it to be. Those of us who want it to be a tool for the arts can turn it into one. We need all the technical help we can get in the realm of display and input technology, but mostly we need the vision to create software that allows artists to capture the soul of a scene along with its picture.

I am reminded of the story of Ansel Adams who decided to give up a career as a pianist to become a photographer. His family complained, saying that the camera couldn't express the soul. "Perhaps," Ansel replied, "but the photographer can."

Dr. Thornburg welcomes letters from readers and can be reached at P.O. Box 1317, Los Altos, CA 94023. ©

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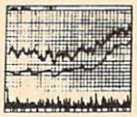

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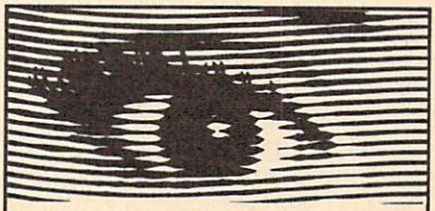

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Microscope

Sheldon Leemon

Almost as if in response to last month's column about desktop publishing, a lot of news items have come in lately relating to that field. For instance, no sooner did I jokingly refer to *The Newsroom* as the Commodore 64's answer to desktop publishing, when Berkeley Softworks announced a for-real desktop publishing program for the Commodore 64. As unlikely as it may seem—hooking up a big, expensive laser printer to a 64—before *GEOS*, a lot of people wouldn't have believed a mouse-driven OS for the 64, either.

In another sort-of-64-related desktop publishing development, Ashton-Tate announced that it will ship its *Byline* desktop publishing program for the IBM PC at the end of October. The reason this story is somewhat related to the 64 is that the author of *Byline* happens to be none other than Ken Skier, of SkiSoft, the author of the *SkiWriter* word processor for the 64. No word yet on whether owners of the 64 program will be able to upgrade.

****

One aspect of desktop publishing that's beginning to get more attention is the problem of "laser junk." In the right hands, a fancy desktop publishing system can produce beautiful, professional-quality documents. But in the wrong hands, the same setup can generate mountains of ill-composed pages with a riot of mismatched type styles.

We know of one software company, however, that's working on an ingenious solution to this problem. It's developing an expert system that works with desktop publishing software. Using this program, all you have to do to lay out a newsletter or brochure is to answer some questions about the document and tell the program where the picture and text files are stored. The program then composes the layout of each page and feeds the information to the desktop publishing program. Since the expert system was designed using a series of rules specified by publishing professionals, it is more likely than the average user to come up with a page design that's pleasing.

Expert systems are currently a hot area of artificial-intelligence (AI) research. The way these programs work is that they each use a large base of rules from which to draw inferences about problems, and then propose their solutions. These rules, sometimes numbering in the thousands, must be entered into the system by a human expert so that the program can, in effect, "learn" how that expert goes about solving such a problem. The best known examples of this type of program are those used for medical diagnosis. A program starts by asking general questions about the patient's symptoms and then asks a series of more specific questions which are designed to narrow down the possibilities.

Although expert-system programs have been available for micros for a while, such programs generally provide only an "inference engine"—the framework used for drawing conclusions based on a collection of rules. Unfortunately, it's up to the user to enter these rules. Since these programs are not geared toward the beginner, you almost need to be an expert in AI to figure out which rules to enter and how to enter them.

That's why this software company's approach is so interesting. It has identified a number of very specific problems and is tailoring turnkey expert systems to solve them. In addition to desktop publishing, the company is working on a program that writes complete résumés and cover letters, based on the user's response to a series of questions. It's also working on a *Lotus 1-2-3* add-in program that analyzes financial statements prepared with the spreadsheet.

****

Perhaps the most interesting type of AI program in the works is the kind that watches the way the user interacts with another program. For example, an upcoming *Lotus* add-in program keeps track of all the commands issued by a user. If you make a mistake in using the program, the expert system can examine its record of your actions, diagnose the problem, and suggest a solution.

Work currently being done suggests that computer programs are going to get smarter in the very near future. For example, to download a program from an information service, you need to run a terminal program and go through a completely predictable series of steps to do so. If you had a really "smart" terminal program, however, you could just tell it to download the file and have it log on and do the busywork. It's possible to accomplish this task with current terminal programs, but only by first giving the program step-by-step instructions in its own special script language—more busywork.

Another type of smart program you may see in the near future is a control program that watches the way the user operates the computer. If, for example, the program sees that you always operate the same set of programs in the same order, it may ask if you would like for the first program to be run as soon as you turn on the computer. The others would then be run automatically in sequence. Such a program might even remind you to make backups of valuable data periodically, or it could automatically make the backups. ©

Arlan R. Levitan

Just the Fax, Ma'am

Apple Computer introduced its new Applefax Modem at the MacWorld exposition in Boston, Massachusetts. Facsimile devices (called "Fax" in the business world) are essentially photocopy machines that can send copies of paper documents over regular telephone lines at high speed. As recently as three years ago, the high cost (over $10,000) of Fax machines limited their use to well-heeled businesses, although low-volume users could opt for Fax-based services such as Federal Express's instant "Zap Mail." A recent wave of high-quality, under–$2000 Fax machines from Japan put Zap Mail to bed and Fax units into the hands of most any small business. The new Apple modem allows Mac owners to transfer files from one Applefax-equipped system to another at transmission speeds of 9600 bps, and it can communicate with many regular facsimile machines as well. The Applefax comes with software that supports attended and unattended data transfers of Macintosh files and Fax documents.

The Shocking Truth

Most computer owners are aware of the dangers posed by electrical power surges and spikes, and consequently buy devices to protect their computer systems from them. Spike and surge protectors are typically connected between a computer and the AC power outlet. The underlying principle behind such a device is to quickly erect an electronic "fence" between the AC power line and your equipment when spikes and power surges are detected.

Even when equipped with such protection, most telecomputer systems have an Achilles heel. Remember that your modem plugs into the phone line as well as an AC outlet. While the normal current carried on the phone network is very low, a nearby lightning strike during an electrical storm can damage a modem, and in some cases, the computer system attached to it.

An inexpensive solution to the problem is Radio Shack's Model 43-102 Spike Protector. The unit goes between your modem and modular phone-line jack and plugs into a grounded AC outlet. It's a bargain at $12.95—about half the price of competitive products.

How Low Can You Go?

The street price of 1200-bps modems has taken another dive with many bargains popping up in unlikely places. C.O.M.B. liquidators, usually seen touting low-cost briefcases and the like in the margins of the *Wall Street Journal*, has been selling discontinued Kyocera modems that respond to the bulk of the Hayes command set. Kyocera may not be a household name, but it designed and built the popular Tandy Model 100 laptop computer. While somewhat sensitive to line noise, the Kyocera modem (which formerly listed at $295) is an adequate performer and is a great buy at C.O.M.B.'s $79 price.

The Empire Strikes Back

Last August, CompuServe set up a special section for users who wished to protest the proposed FCC rule changes for next year. These proposed changes may result in four- to five-dollar-an-hour surcharges on information service connect time. CompuServe users were given advice on what to include in the letters they write protesting the new rules. CompuServe also provided the names, addresses, and phone numbers of legislators and FCC officials, as well as facilities for sending low-cost "FCC Congress-Grams" to one's favorite Washingtonian. CompuServe graciously waived normal connect charges for time spent in the FCC section.

If the new FCC rules go into effect, the stage will soon be set for the commercial information services and alternative long-distance voice-service providers to bypass the local telephone networks by using existing cable television services. In Great Britain, two cable systems recently signed agreements with a private telecommunications firm and behind-closed-doors discussions reportedly began this summer in the U.S. Such a switch may actually be a boon to information-service subscribers, since the cable systems can handle higher speed data transmission than the present public telephone network.

Tanks For The Memories

This summer, the U.S. Naval Institute unveiled an unclassified online database intended to provide information on the world's armies, navies, air power, special and strategic forces, and weapons systems. Also included is a "Who's Who" on the battlefield, detailing unit-battle organization and high-ranking military officers.

The first phase of the system, which went online this summer, contained information on the Soviet Union and United States. By year end, information on all NATO and Warsaw Pact countries will be available, and information on the rest of the world by late spring. According to the Institute, "details of . . . armed forces, their orders of battle, and descriptions of their weapons and electronics will be immediately available at the touch of a computer key."

User reaction during initial testing of the system was said to be extremely favorable, although it is rumored that some were unduly nervous about the possibility of pushing the wrong button on their keyboards. ©

Donald B. Trivette

Silent Partners

How often have you sat around biting your nails, wishing you knew how to play bridge? Or maybe you've blown the game off as too complicated or too highbrow. In fact, it's neither. Many people who like programming computers also like bridge—they both require the same type of logic, order, and memory. Now, with Electronic Arts' *Grandslam Bridge*, you not only learn the basics along with many advanced techniques—you can play countless games, which any bridge guru will tell you is the only way to learn.

For those unfamiliar with the game, bridge is played by four players—two sets of partners—often referred to by the major compass directions: North and South against East and West. After all 52 cards are dealt, "bidding" begins. The purpose of bidding is to establish how many "tricks" you and your partner expect to take, and how many you expect to concede to your opponents. (A trick is four cards, one from each player.) There are 13 tricks in a round (52 / 4 = 13).

Bidding is a rather formal process that is the cause of most problems for beginners, but the idea is simple. If you could bid in plain English, the conversation might go something like this: "Joe, I have the ace through nine of spades, and the king and queen of hearts, and I don't have any clubs. Do you have the ace of hearts? What other cards do you have? Do you think we can take ten tricks?"

Of course you can't say this at the bridge table. Instead, you must use code words to try to convey to your partner the cards in your hand, and he must do the same. Thus, the bidding might go: One spade, pass, two diamonds, pass, two spades, pass, four spades. Notice that the opposing players have cards of so little value, they believe few tricks, if any, can be theirs. Instead of bidding, they pass. Your partner is telling you he has good diamonds. In reality, as the *Grandslam* manual and many other books explain, bidding is determined by strict convention. Each face card has a point value, and points are assigned for other factors. By adding up your point value, you determine what and how much to bid.

After *Grandslam Bridge* deals the cards, it allows you to bid your hand, and then it bids the other three. It alerts you if you try to make an invalid bid—two diamonds after a two-hearts bid, for example.

By bidding four spades, you and your partner have agreed that you'll try to take a total of ten tricks—the four you bid plus six more called the "book." You always add your bid to the six tricks of the book; thus, the most you could bid would be seven. That would mean you plan to take every trick, which is called a grand slam. It's the equivalent of a home run. For bidding and making a grand slam, you get a lot of points.

Playing The Hand

Once the bid has been established—here a "contract" of four spades—play begins. It is much like the card game "Hearts." One of the opposing players leads, putting a card on the table. Your partner puts *all* of his cards on the table—he is now the "dummy" (and usually goes for drinks and popcorn). You play his cards and your own. If he had mentioned spades first, he would be playing and you would be off popping corn. *Grandslam Bridge* plays the opponents' hands; you play your own hand and the dummy's hand. If your side loses the bid, *Grandslam* plays three hands.

Suppose your opponent leads the queen of clubs. You see that you can take the trick either by playing your partner's king of clubs, which is showing on the table (or "on the board"), or you can wait until the play reaches your hand and then play a spade. Spades are the trump suit because that's what you bid—four spades. A trump suit is higher than any other suit, and since you can't follow the suit that led (because you have no clubs in your hand), you may play a trump. Whichever strategy you use, the trick will be yours. You scoop up the four cards and place them on the table face down. You must collect nine more tricks to make your bid of four spades.

In many ways, *Grandslam Bridge* is a tougher opponent than real players—it doesn't make mistakes or silly moves, and it plays with such finesse, I wonder sometimes if it peeks at my hand. That's in its best mode; *Grandslam* also has two less-difficult levels of play. As for you, you're allowed to replay tricks (or an entire hand) if you make a mistake or change your mind about a move.

Scorekeeping is as complicated as assembly language. People usually play for years before they learn how to keep score. Fortunately, *Grandslam Bridge* does the scorekeeping, and does it in such a way that you can learn by watching.

Grandslam Bridge is not frivolous software; it's a serious program for those who want to learn the game or improve their game, or those who just want to play but can't find three partners.

Grandslam Bridge
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Bill Wilkinson

Atari's Newest Drive

After three months of pretty heavy stuff, it's time for a slightly different tack. And since my time has recently been monopolized by a project near and dear to all eight-bit Atari owners, I've decided to share some "secrets" with you. We're going to take a very close look at the new XF551 drive from Atari.

The XF551 is a sleek drive, lower and wider than a 1050, and in a style and color that matches the XE computers. Quite simply, it looks good. As you read about the internals of the drive, I hope I can convince you that Atari has really done something *right*.

The XF551 started out as the XF351—the 3 designated a 3½-inch drive. Some people are disappointed that Atari changed over to a 5¼-inch drive, but I view it as a very positive step. Current users can upgrade to this drive, yet still keep and use all their old disks. Software manufacturers don't have to produce two different versions of their software, and there are other points of compatibility.

For starters, the drive is compatible with disks created by virtually all Atari-compatible drives—in single, enhanced, and double density. Not only that, several of the different DOS systems I've tried have also worked flawlessly. And I know Atari has tested the drive with many, many pieces of commercial software with many different protection schemes. Summary: The drive works, and works well.

At a suggested price of under $200, the very fact that a true double-density drive is now available from Atari would be welcome news. But the drive is also double-*sided*. That means that each disk can hold up to 360K—nearly three times the capacity of a 1050 and four times that of an 810.

As I write this article, Atari does not have a DOS that will support this extra capacity. However, the reason this drive has monopolized my time recently is simple—I have been writing a new DOS for Atari. ADOS (as it will be known) is full-featured, with subdirectories, random access files, a combination menu/command structure, and much more. However, it is not releasable as I write this, so back to the drive.

Inside The Drive

As you may remember, I discussed SIO (Serial Input Output) as it applies to disk drives, in the September 1985 issue. I noted that the four basic SIO commands are R, W, P, and S, for Read, Write, Put, and Status, respectively. Besides these, the Atari 810 and 1050 only understand format commands.

Then, in the next issue, I explained the concept of a device configuration table, as implemented by all the makers of true double-density drives. Well, we can add Atari Corporation to that list: The XF551 supports the Percom standard configuration table. That means you can tell the drive that it's an 810, a 1050, a double-density drive, or (best of all) a double-sided double-density drive. Or, perhaps just as important, the drive can tell you what kind of disk it holds. For these capabilities, we add N and O (which I think of as iN and Out) commands on the serial bus.

But there's even more. If you send it a Read or Write or Put command with the upper bit set (the inverse video bit, in screen terms), then the XF551 transfers data in high-speed mode. To take advantage of this, you need a compatible DOS, but ADOS is nearly ready and I'm sure others will be modified to support high-speed transfers.

Last, but not least, the XF551 adds a special format command (hex $A1, an inverse-video exclamation point) that tells the drive to use a special high-speed interleave that enhances the high-speed read and write commands even more. (But note that ordinary reads and writes are even slower than usual on disks formatted in this special way, just as they are on Sparta DOS ultraskew disks used in non-US Doubler drives. I should warn you that each of these drives seems to use a slightly different high-speed scheme.)

So the drive gets my nod of approval from a software standpoint. But what about the hardware? Will the drive stand up to physical abuse, overheating, and the like? Truthfully, I have not had even the prototype long enough to make a definitive statement on this point. But I *have* had the cover off the drive, and I have looked at its construction. It looks great. The inside is as well built as the outside.

In fact, Atari has never produced a more solid piece of equipment. The drive frame is heavy-duty cast aluminum, the mechanical parts are finely polished and aligned, and the controller board appears to be adequately ventilated. Only one point of caution: Double-headed drives are more sensitive to shock and misalignment than their single-headed cousins. Treat the drive with care. Always use its cardboard protector when you move it. Make sure it has adequate ventilation. In other words, use common sense.

If this column sounds like an advertisement for the XF551, I won't apologize—I'm not getting a penny in royalties on the drive or ADOS. This glowing report is for one reason and one reason only: I just *had* to tell you that Atari has not abandoned the eight-bit market. And they've proven that fact in grand style. ©

ST Outlook

Philip I Nelson

IBM PC Emulator For Atari ST

What's made by Atari and runs your favorite IBM PC software? Six months ago, the answer would have been Atari's new PC clone. But now Avant-Garde Software has introduced a program named *pc-ditto* which emulates an IBM PC entirely in software.

Objections Sustained

Emulation—one computer mimicking another—is a controversial topic. Let's start with some popular pros and cons, airing the cons first.

- The IBM PC is an inferior machine with a slow processor, crude graphics, and a user interface that harks back to the infancy of computing. Even assuming that you could emulate such a device, what ST owner would *want* to? Let the ST be an ST.
- Software emulators give you the worst of both worlds. A PC/ST combo, for example, combines the PC's antiquated, keyboard-driven user interface with the ST's nonstandard keyboard. Strip both machines down to the lowest common denominator, and you're left with all the functionality of a VIC-20.
- PC clones are so cheap, they'll soon be peddled in shrink-wrap on the racks of grocery store checkout lines. If you really want to run IBM PC software, do what everyone else does: Buy a clone.

Objections Overruled

Now for some pros.

- The IBM PC software base is immense and mature. A software emulator provides the cheapest possible entrée to thousands of slick programs—most of which will never be released in native ST versions.
- A software emulator makes sense if you have an occasional need to run an MS-DOS application, but can't spare the dollars or desk space for an entire second system. If you had to choose a second computer, you could do worse than a PC-compatible, even one that's slow.
- Regardless of utility, there's something inherently fascinating about a software emulator. If you fire up *pc-ditto* at an ST user-group meeting, you may hear some catcalls, but there won't be a soul in the room who can resist peeking over your shoulder to see if it really works.

DOS Required

Like every PC-compatible machine, *pc-ditto* has to boot up by loading the system files IBMBIO.COM, IBMDOS.COM, and COMMAND .COM (the names of these files will differ on non-IBM systems). However, the *pc-ditto* package does not include the IBM PC system files, which belong to Microsoft or IBM, depending on whether you're talking about MS-DOS or the virtually identical PC-DOS.

Thus, your first task is to obtain a copy of DOS on a disk that your system can read. Disk compatibility creates less difficulty than you might imagine, since a 3½-inch ST drive can read and write to any 3½-inch MS-DOS disk, provided the disk was formatted on an MS-DOS machine. Many PC-compatible laptops have 3½-inch drives, as do the new Personal System/2 machines from IBM. It's also possible to buy a PC-compatible 5¼-inch external drive for the ST.

Once you supply *pc-ditto* with a DOS disk, the drive whirs briefly while the system files load. Then it appears—the famous A> prompt that inspires love and hate in so many of us. If you type DIR and press Return, the computer prints a genuine MS-DOS directory on the screen. It looks like you're in business. Could it really be this easy?

It's an old programming adage that any computer can emulate any other computer, *as long as speed is no consideration.* Like most adages, this one isn't strictly true, but it emphasizes a vital point. Much of the functionality of any computer rises from the speed at which it performs the task at hand. You wouldn't tolerate a word processor that made you wait three seconds between every keystroke, for instance. The *pc-ditto* emulator isn't that slow, but I found it sluggish enough to make most MS-DOS programs virtually unusable.

My original plan for this column was to show how you might bootstrap your way into PC compatibility at the lowest possible cost. Using *pc-ditto*, I planned to boot up GW-BASIC, type in a rudimentary telecommunications program, call an information service, and download a public domain word processor, which I would use to write a column about the joys of PC compatibility.

I am not writing this column on an emulated IBM PC, although I did go so far as to download and try out the public domain word processor, along with a dozen assorted MS-DOS applications I brought home from the office. Although I was anxious for *pc-ditto* to work well, it now lives in a box labeled "Software I Will Never Use Again."

What Price Compatibility?

Here are some figures to explain my lack of enthusiasm. They're based on the venerable Sieve of Eratosthenes benchmark program which everyone and his brother now uses to measure processing speed (even though it doesn't test much except looping speed). The first set of numbers shows the time in seconds to run a BASIC version of the Sieve, using GW-BASIC on an IBM AT, IBM XT, and a 1040ST using *pc-ditto*.

Model	Seconds
IBM AT	80
IBM XT	202
pc-ditto	1480

The last number is not a misprint. It takes *pc-ditto* over 24 minutes to run a GW-BASIC program that an XT runs in just over 2 minutes and an AT runs in less than 1½ minutes. Here are the times for running the compiled C version of the Sieve:

Model	Seconds
IBM AT	35
IBM XT	85
pc-ditto	703

In this case, the emulator takes close to 12 minutes to process code that the XT runs in 1½ minutes and the AT rips through in just over ½ minute.

All of these times represent the average of several trials, rounded to the nearest second. Speed isn't everything, of course. Sluggishness aside, I have to admit that *pc-ditto* seems to run "well-behaved" MS-DOS software without noticeable problems, although my survey was anything but scientific. Whether you're willing to tolerate a ten-to-one speed decrease is a question you'll have to answer for yourself. As with all software, it's only prudent to try before you buy. Haul your favorite MS-DOS application down to your local dealer and ask to see it demonstrated with *pc-ditto*.

Ignoring The Lessons Of History

Here's another case where the Amiga's history offers an interesting parallel. Commodore sank considerable effort into a software IBM PC emulator called the "Transformer," but eventually junked it in favor of a hardware/software solution that amounts to a PC on a card. The Amiga 2000's Bridge card contains an 8086 processor, floppy disk controller, some shared RAM, and two or three glue chips to hold everything together. The arrangement makes sense, especially given the very low price of basic PC components. You let the 8086 do its own processing, make your ports and keyboard available for I/O, and use the host processor only for supervision, as it were. You'd expect the same solution to be even easier on the ST, since it already contains a disk drive that can read and write MS-DOS disks. But the ST's closed architecture makes it hard to design such a card at a reasonable cost.©

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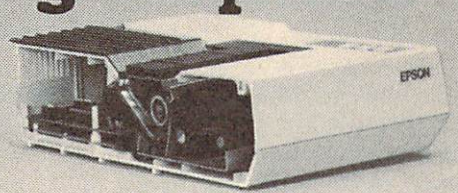

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AmigaView

Sheldon Leemon

The Latest In Pictures And Words

Andy Warhol once said that in the future, everyone would be famous for 15 minutes. To Amiga observers, however, it seems more likely that everyone will get to be in charge of the frame-grabber project for 15 minutes. Commodore first announced that it would manufacture a realtime video digitizer at the Amiga's Lincoln Center debut in 1985, where Warhol himself used it to produce an instant pop art portrait of Deborah Harry. In the following months, Commodore exhibited prototypes of the unit at trade shows. Months dragged on, and production was still nowhere in sight. Finally, when Commodore failed to bring it out within the time limits imposed by their contract, it was agreed that A-Squared, the creators of the digitizer, would distribute it.

At that point, R. J. Mical and some other members of the original Amiga design team stepped into the picture with a plan to finish the software and manufacture the hardware. They formed a company called Grab, Inc., and started taking orders. However, just a few days after the product was displayed once more—this time at the Siggraph computer graphics show—it was announced that because of artistic differences between Mical and A-Squared, Grab is no more. Mical has since gone to work for Epyx, following in the footsteps of David Morse, the charismatic founder of Amiga, who is now Epyx' president.

This latest development puts the fate of the frame grabber back into the hands of A-Squared, which is currently wrapped up in product development for the Apple IIGS market, and, thus, is likely putting the Amiga product on the back burner. One has to wonder about this since the GS market appears to have a smaller potential (and market), while the Amiga 500 could have more than a million new owners by next year. So it looks like *Live!* is finally dead, at least for now.

Word Processors: Old And New

The sad tale of the frame grabber brings to mind many other fine products that have had a confused evolution. For example, when the Amiga first appeared, Commodore commissioned a company named Arktronics to write a word processor for the machine. The result, a program called *Textcraft*, was easy to use, but did not really mesh well with the Amiga operating system. Reason? To get the software out on time, most of it had to be written before the operating system was finished. A few months after the Amiga's release in early 1986, Arktronics, which had by then become ICT, finished an extremely nice, updated version of the program called *Textcraft Plus*. It was fully multitasking. It used a window on the Workbench screen, with a size gadget. It had many nice new features, such as mail-merge. By this time, however, Commodore—for reasons possibly stemming from the staff and departmental restructuring at Commodore over the past couple of years—decided that it really didn't want to be in the software business. It wanted to encourage third parties like WordPerfect to write word processors, without having to worry about competing with Commodore itself. *Textcraft Plus* went into an extensive quality control testing phase, where it has stayed ever since.

As a result, Amiga users have been able to buy only one word processor, *Scribble*, for over a year. This is not to say that *Scribble* isn't a reasonably good word processor. It is clearly not, however, the perfect word processor for every user and for every use. Lately, with the appearance of *Pro Write*, *LPD Writer*, and *WordPerfect*, Amiga users are finally getting a bit more choice. Meanwhile, Commodore has decided to release *Textcraft Plus*. In fact, *Textcraft Plus* is going to be used in a promotion for the new Amiga 500. Commodore is planning to mail coupons to a quarter-million Commodore users group members, allowing them to buy big software bundles with the purchase of a 500. For $99, group members will get $600 worth of software, including *Textcraft Plus*, *PageSetter*, *Deluxe Paint II*, and *Marble Madness*. For $199, they'll get $1,200 worth of software, including *Word Perfect*, *Superbase*, *PageSetter Deluxe*, *Maxiplan*, and *Deluxe Video*. Commodore hopes to convert a lot of 64 owners to Amiga owners. If bargains like these don't work, they'll have to try dynamite.

While Commodore was busy "testing" *Textcraft Plus*, ICT wasn't sitting still. They were improving the program, adding features like a spell checker and onscreen fonts, and provisions for importing graphics into a document. The resulting program will be marketed by Electronic Arts as *Deluxe Write*, probably around the end of the year. One of the unique features of the program will be its superfont printing mode, which will use the highest-density graphics mode of each printer to produce the highest quality fonts possible. In a future column, we'll take a look at *Deluxe Write*, along with other upcoming word processors. ©

The Inscrutable Sphinx

Brian Flynn

This colorful puzzle game for the PC/PCjr and compatibles conjures up the mystery of ancient Egypt. In "The Inscrutable Sphinx," you pit your strategic powers against either the computer or a human opponent. A color/graphics adapter or equivalent hardware is required along with BASICA for the PC, GW-BASIC for compatibles, or Cartridge BASIC for the PCjr.

Near the ancient pyramids of Giza, not far from the river Nile, sits the inscrutable Egyptian Sphinx. Part man and part lion, this colossus has intrigued archeologists for ages. The mighty Sphinx is nearly 5000 years old, but its exact purpose seems buried forever in the sands of time.

This much we do know: The man-lion was carved out of a single sandstone knoll. It is four-fifths the length of a football field, measures 66 feet at its highest point, and is roughly 14 feet at its widest point. The Sphinx's headdress with Cobra was a sign of royalty, and its face was thought to resemble the features of Kephren, son of the great Pharaoh Cheops.

Whatever its original purpose, the ancient Sphinx reappears in all its regal splendor in this beguiling board game of wits. Indeed, you'll think you're on the Giza Plateau as you and your opponent (human or computer) alternately place Sphinxes and pyramids on the board.

The next few paragraphs will explain the rules of "The Inscrutable Sphinx." We'll see how the PC searches for an optimal move, and how to fine tune the program to take advantage of some of the features available on more recent PCs.

How To Play

The intellectual action in this game of thought takes place on a 7 × 7 board (see figure on following page). Your goal is to line up four Sphinxes in a row, in any direction, before the computer lines up four of its pyramids. To make a move, use the arrow keys to slide a Sphinx along the top edge of the board, then press ENTER or RETURN. The Sphinx will fall to the bottom of the column. The computer moves similarly.

You can go first, if you'd like, but it may not do you any good: The computer is very clever. You'll have to think ahead to win. And if you blunder badly, be warned that the PC will mercilessly exploit your mistake.

Finally, the game ends in a draw if you and the computer fill the board without success.

Enhancements

IBM PC-compatible computers come in all shapes and sizes. To take advantage of some of the enhanced features on the newer models, a few key variables appear at the beginning of the program:

```
110 ' CLEAR ,,,32768! : ' PC jr Mode (SCREEN 5)
120 ' PLAY "V8"       : ' VOLUME (0 to 15)
130   PLAY "MB"       : ' MUSIC BACKGROUND
```

Line 110: Eliminate the first tic mark or REM symbol to reserve enough RAM for Screen 5 graphics. This mode makes your game more colorful. If your computer doesn't support Screen 5, you'll get a syntax error upon striking the tic mark.

Line 120: Eliminate the first tic mark to set the level of sound to medium (V8), and change the volume to any value you'd like, using a scale of 0–15. Earlier versions of Microsoft BASIC do not support this parameter.

Line 130: If your machine locks up when it tries to play music while executing additional program lines, insert a tic mark at the beginning of this line.

Program Notes

After you've placed a Sphinx, the computer searches the board for a good move using these steps:

First, it finds the last empty square in each column.

Second, it evaluates that square from the point of view of both itself and the human player. It tallies a score based on the number of like markers in a row, assuming there are blank squares at each end of the sequence.

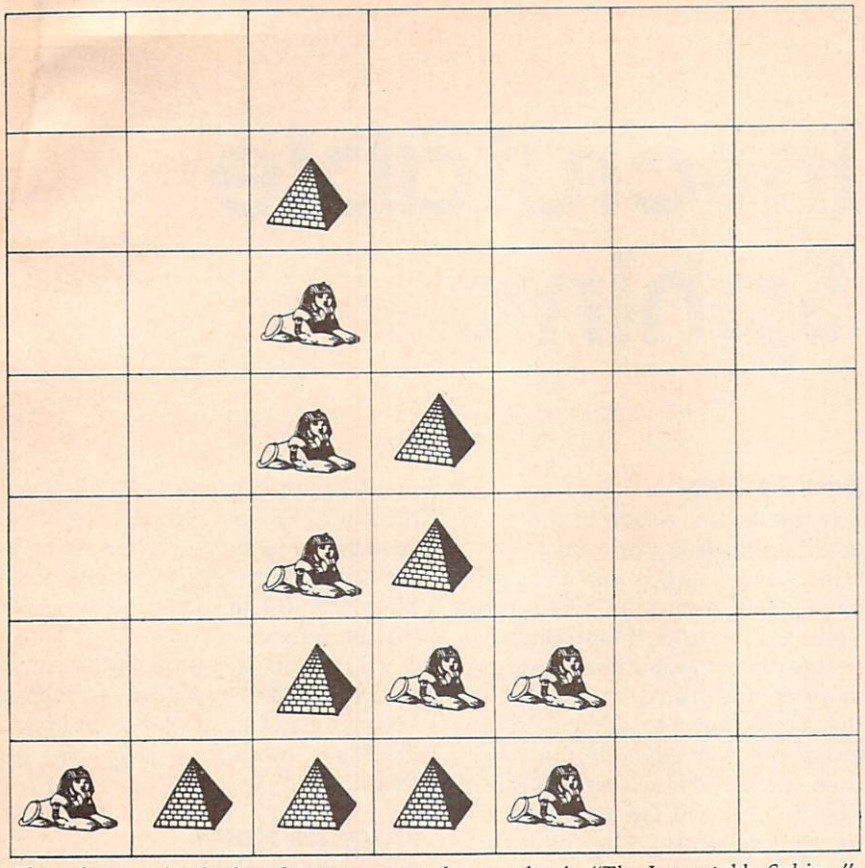
Third, it chooses as a next move that square with the highest number of points.

More concisely, to use the language of Artificial Intelligence, the computer applies an evaluation function to each possible move, and makes what it reasons to be an optimal selection. Here are the details.

The computer uses a special version of the board to facilitate its search for a good move:

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81

The center box (with corners 11, 17, 65, and 71) is the playing surface.



The rules are simple, but the strategy can be complex in "The Inscrutable Sphinx."

Each of these middle 49 squares takes on one of three values throughout the game: 0=blank, 1=computer, 2=human. Each square in the outer border, on the other hand, always holds a value of −9. This tags the square as an off-the-board position.

Two subroutines constitute the search procedure: lines 2510–2700 and lines 2760–2900. In the first subroutine, the PC finds the last empty square (SQ.END) in each of seven columns (2 through 8). For each SQ.END, or possible move, the PC generates a score for itself (J=1) and for its opponent (J=2). The computer wants to play aggressively while blocking good opportunities for the human. Whichever score is higher (human or computer) becomes the rank for that square (lines 2600 and 2620). The square's rank, in turn, is compared to the previous highest rank (lines 2630–2650), and a new best value is chosen, if appropriate.

The PC tallies a score for each square in the second subroutine, using these steps:

First, for each of four directions (horizontal, upward slant, vertical, and downward slant), the PC counts the number of like markers in a row.

Second, it determines whether or not the squares at each end of the sequence are blank (lines 2830 and 2870).

Third, it ranks the square according to the evaluation function in line 2880. The variable T represents the number of markers in a row, not counting the marker to be laid down. The binary variables F1 and S1 equal one for blank end-squares, and zero otherwise. Notice that T>2 (win on next move) gives a score of at least 1000.

The Inscrutable Sphinx

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
EG 100 'Inscrutable Sphinx
AE 101 'Copyright 1987 COMPUTE!
       Publications, Inc.   All
       rights reserved.
FL 110  '    CLEAR ,,,32768!: JR$
        = "Y": ' PC jr MODE (SCR
       EEN 5)
AC 120  '    PLAY "V8"
             : ' VOLUME (0 to 15
       )
HL 130       PLAY "MB"
             : ' MUSIC BACKGROUN
       D
EA 140  GOSUB  200: ' DO SET-UP
       WORK
AD 150  GOSUB 1500: ' PLAY
KB 160  GOSUB 3910: ' ASK TO PLA
       Y AGAIN
IM 170  IF A = 89 THEN 150
QI 180  GOSUB 3950: ' EXIT
MM 190 END
CM 200 REM DO SET-UP WORK
PF 210  GOSUB  280: ' SET SCREEN
JC 220  GOSUB  440: ' DRAW SQUAR
       ES
JB 230  GOSUB  590: ' DRAW PYRAM
       IDS
GA 240  GOSUB  700: ' DRAW SPHIN
       XES
QK 250  GOSUB 1000: ' SET VALUES
BH 260  GOSUB 1240: ' EXPLAIN RU
       LES
NK 270 RETURN
BF 280 REM SCREEN
MB 290  DEFINT A-Z
NB 300  IF JR$ = "Y" THEN SCREEN
        5 ELSE SCREEN 1
GC 310  IF JR$ = "Y" THEN COLOR
       14,1 ELSE COLOR 1,1
BG 320  KEY OFF: CLS
HO 325 PRINT TAB(13)"Copyright 1
       987":PRINT TAB(7)"COMPUTE
       ! Publications, Inc.":PRI
       NT TAB(10)"All Rights Res
       erved."
BM 330  ' TITLE
GP 340  LOCATE 12,12: PRINT "Ins
       crutable Sphinx"
HH 350  ' COLORS -- CURSOR; EVEN
        SQUARE; ODD SQUARE; PYRA
       MID;
JF 360  '              SPHINX'S BOD
       Y, HEADDRESS, LEG; BOARD
FI 370  DATA  1,1,  3,0,2,0,1,2:
       ' SCREEN 1
KN 380  DATA 14,7,11,4,8,1,5,5:
       ' SCREEN 5
BE 390  READ K1,K2,K3,K4,K5,K6,K
       7,K8
ED 400  READ A,B,C,D,E,F,G,H
EP 410  IF JR$ = "Y" THEN K1 = A
       : K2 = B: K3 = C: K4 = D:
        K5 = E
IP 420  IF JR$ = "Y" THEN K6 = F
       : K7 = G: K8 = H
ME 430 RETURN
JE 440 REM SQUARES
KD 450  DIM B(81),SQEVEN(128),SQ
       ODD(128),CURSOR.PYD(128),
       CURSOR.SPX(128)
MC 460  DIM PYRAMID1(128),PYRAMI
       D2(128),SPHINX1(128),SPHI
       NX2(128)
BD 470  ' -- CURSORS (BACKGROUND
       )
AF 480  LINE (70,100)-(92,120),K
       1,BF
EH 490  LINE (175,100)-(197,120)
       ,K1,BF
DJ 500  ' -- SQUARES
KO 510  LINE (100,100)-(122,120)
       ,K2,BF
NH 520  GET  (100,100)-(122,120)
       ,SQEVEN
DO 530  LINE (130,100)-(152,120)
       ,K3,BF
BC 540  GET  (130,100)-(152,120)
       ,SQODD
KM 550  ' -- OTHER SQUARES
GH 560  PUT (205,100),SQEVEN
BF 570  PUT (235,100),SQODD
NP 580 RETURN
QJ 590 REM PYRAMIDS
HO 600  FOR I = 0 TO 2
FN 610   X0 = I*30 + 81: Y0 = 11
       0
EK 620   PSET (X0,Y0-5),K4
```

```
OM 630    DRAW "G10 R20 H10"
NK 640    PAINT (X0,Y0),K4
GP 650    IF I = 0 THEN GET ( 70,
          100)-( 92,120),CURSOR.PYD
KL 660    IF I = 1 THEN GET (100,
          100)-(122,120),PYRAMID1
KP 670    IF I = 2 THEN GET (130,
          100)-(152,120),PYRAMID2
CE 680    NEXT I
NC 690  RETURN
JK 700  REM SPHINXES
IF 710    DATA -3,0,-2,-1,-3,0,-2,
          2,0,4,1,1,18,0,1,-1,-1,-1
EG 720    DATA -2,0,0,-3,-1,-1,0,-
          1,1,-1,2,0,0,-2,1,0,-1,-2
CE 730    DATA 0,-2,-3,0,-3,4,0,3,
          -2,0
GI 740    DATA 2,0,2,-3,1,-1,2,0,-
          1,-1,-3,0,-2,1,-1,3
IJ 750    FOR I = 0 TO 2
KD 760      RESTORE 710
MB 770      X0 = I*30 + 186: Y0 = 1
          10
PJ 780      ' -- BODY
PA 790      PSET (X0,Y0+1),K5
JL 800      FOR J = 1 TO 23
PE 810        READ X,Y
ID 820        LINE -STEP(X,Y),K5
JA 830      NEXT J
NN 840      PAINT (X0,Y0+4),K5
HG 850      ' -- HEADDRESS
MH 860      PSET (X0+2,Y0-3),K6
OC 870      FOR J = 1 TO 8
AC 880        READ X,Y
LK 890        LINE -STEP(X,Y),K6
JL 900      NEXT J
CI 910      PAINT (X0+4,Y0-5),K6
FF 920      ' -- HIND LEG
FL 930      PSET (X0-7,Y0+5),K7
KP 940      LINE -STEP(3,0),K7: LIN
          E -STEP(1,1),K7
MB 950      IF I = 0 THEN GET (175,
          100)-(197,120),CURSOR.SPX
CL 960      IF I = 1 THEN GET (205,
          100)-(227,120),SPHINX1
CO 970      IF I = 2 THEN GET (235,
          100)-(257,120),SPHINX2
CH 980    NEXT I
NF 990  RETURN
HE 1000 REM KEY VALUES
MD 1010   BELL$ = "O3 G8"
OP 1020   BUZZ$ = "T255 O3 C8 < C
          8"
EJ 1030   GURGLE$ = "T255 O3 L16
          CGCG"
DB 1040   RANDOMIZE TIMER
EM 1050   DEF FNEVEN.ODD(I,J) = -
          ((I+J)/2 = INT((I+J)/2))
EK 1060   DEF FNX(V) = 24*V + 29
FG 1070   DEF FNY(V) = 22*V - 20
BG 1080   DEF FNROW(V) = INT(V/9)
          + 1
KI 1090   DEF FNCOL(V) = V - (R-1
          )*9
GI 1100   ' --  OFF-BOARD SQUARES
MB 1110   FOR I = 1 TO 81: B(I) =
          -9: NEXT
OM 1120   FOR I = 11 TO 65 STEP 9
OK 1130     FOR J = I TO I + 6
AB 1140       B(J) = 0
BO 1150     NEXT J,I
MO 1160   ' -- DIRECTION DELTAS
ME 1170   DATA 1,8,9,10
NM 1180   FOR I = 1 TO 4
MC 1190     READ DR(I)
PP 1200   NEXT
EO 1210   ' -- CONTINUE
CE 1220   FOR PAUSE = 1 TO 1000:
          NEXT PAUSE
JI 1230 RETURN
GO 1240 REM RULES
HE 1250   CLS
KA 1260   LOCATE 2,1
EC 1270   PRINT "  Near the ancie
          nt pyramids of Giza,"
DJ 1280   PRINT "not far from the
          river Nile, sits"
EF 1290   PRINT "the inscrutable
          Egyptian Sphinx."
EA 1300   PRINT
LD 1310   PRINT "  Part man and p
          art lion, the mighty"
AC 1320   PRINT "Sphinx is your p
          iece to play."
FJ 1330   PRINT
KB 1340   PRINT "  Try to line up
           four Sphinxes in a"
KA 1350   PRINT "row, in any dire
          ction, before I line"
PM 1360   PRINT "up four of my py
          ramids."
FF 1370   PRINT
IO 1380   PRINT "  Use the arrow
          keys to move a Sphinx"
FH 1390   PRINT "along the top ed
          ge of the board."
EC 1400   PRINT
EB 1410   PRINT "  -- Then press
          ENTER."
CN 1420   PRINT "  -- The Sphinx
          will fall to the bottom"
FA 1430   PRINT "     of the colu
          mn."
FO 1440   PRINT
IJ 1450   PRINT "  I'll move my p
          ieces similarly."
FB 1460   ' -- CONTINUE
NF 1470   LOCATE 24,14: PRINT "Pr
          ess any key";
NI 1480   WHILE INKEY$ = "": WEND
KO 1490 RETURN
NH 1500 REM PLAY
CD 1510     GOSUB 1640: ' SELECT O
          PPONENT
DI 1520     IF GAME = 1 THEN GOSUB
           1780: ' FIRST TO GO
CN 1530     IF GAME = 2 THEN GOSUB
           1920: ' ENTER NAMES
FG 1540     GOSUB 2050: ' SET THE
          RECORD
BJ 1550     GOSUB 2270: ' DRAW THE
           BOARD
FB 1560   WHILE GAME$ = "ON" AND
          N <> 49
GD 1570     GOSUB 2460: ' ENTER MO
          VE
BJ 1580     GOSUB 3120: ' MAKE MOV
          E
NP 1590     GOSUB 3320: ' CHECK FO
          R THE END
EB 1600     PLAYER = 3 - PLAYER
EP 1610   WEND
AE 1620     GOSUB 3450: ' GAME'S O
          VER
JA 1630 RETURN
QN 1640 REM SELECT OPPONENT
IM 1650   CLS
CM 1660   LOCATE 10, 8: PRINT "Pl
          ease choose your opponen
          t."
FN 1670   LOCATE 12,14: PRINT "<1
          > Me"
IE 1680   LOCATE 13,14: PRINT "<2
          > Another human."
BB 1690   LOCATE 15,14: PRINT "==
          > ?"
HD 1700   ' -- SELECT
DO 1710   GAME = 0
BA 1720   WHILE GAME <> 1 AND GAM
          E <> 2
QJ 1730     PLAY BELL$
EM 1740     S$ = INKEY$: IF S$ =
            "" THEN 1740
EI 1750     GAME = ASC(S$) - 48
FA 1760   WEND
KO 1770 RETURN
JE 1780 REM FIRST TO GO
JK 1790   CLS
CF 1800   LOCATE 11,4: PRINT "Wou
          ld you like to go first
          (Y/N) ?"
QO 1810   GOSUB 1840: ' YES OR NO
QE 1820   IF A = 78 THEN FIRST.TO
          .GO = 1 ELSE FIRST.TO.GO
           = 2
JE 1830 RETURN
MF 1840 REM YES OR NO
KM 1850   A = 0
BM 1860   WHILE A <> 78 AND A <>
          89
OC 1870     S$ = INKEY$: IF S$ =
            "" THEN 1870
AE 1880     A = ASC(S$): IF A > 90
           THEN A = A - 32
JK 1890     IF A <> 78 AND A <> 89
           THEN PLAY BELL$
EC 1900   WEND
JA 1910 RETURN
QP 1920 REM ENTER NAMES
IM 1930   CLS
CI 1940   LOCATE 2,8
PO 1950   PRINT "Please enter you
          r names."
LO 1960   FOR I = 1 TO 2
EI 1970     NME$(I) = ""
LP 1980     WHILE NME$(I) = ""
JP 1990       LOCATE I*2 + 3,3: PRI
          NT USING "Player #";I;
OI 2000       INPUT " = ";NME$(I)
EC 2010     WEND
CP 2020     NME$(I) = LEFT$(NME$(I
          ),12)
PF 2030   NEXT
JI 2040 RETURN
LC 2050 REM RECORD
HE 2060   CLS
LD 2070   ' -- VACANT = 0; COMPUT
          ER = 1; HUMAN = 2
GH 2080   FOR I = 11 TO 71
MM 2090     IF B(I) <> -9 THEN B(I
          ) = 0
PO 2100   NEXT
GI 2110   ' -- LAST EMPTY SQUARE
          IN EACH COLUMN
CK 2120   FOR I = 2 TO 8
BK 2130     LAST(I) = I + 63
QK 2140   NEXT
KK 2150   ' -- TURNS
CO 2160   IF GAME = 1 THEN TURN$(
          1) = "My turn ..."
KD 2170   IF GAME = 1 THEN TURN$(
          2) = "Your turn ..."
CL 2180   IF GAME = 2 THEN TURN$(
          1) = "Your turn, " + NME
          $(1) + "."
HE 2190   IF GAME = 2 THEN TURN$(
          2) = "Your turn, " + NME
          $(2) + "."
AG 2200   ' -- FIRST PLAYER TO GO
GL 2210   IF GAME = 1 THEN PLAYER
          = FIRST.TO.GO ELSE PLAY
          ER = 1
HC 2220   ' -- OTHER VALUES
BE 2230   GAME$ = "ON"
OJ 2240   N = 0: ' NUMBER OF MOVE
          S
LN 2250   VICTOR = 0
JC 2260 RETURN
EG 2270 REM DRAW BOARD
IL 2280   LINE (76,23)-(244,177),
          K8,BF
JE 2290   FOR R = 2 TO 8
NK 2300     FOR C = 2 TO 8
KK 2310       SHAPE = 0: GOSUB 2340
DE 2320     NEXT C,R
JL 2330 RETURN
MN 2340 REM DRAW SHAPE
PO 2350   X = FN X(C): Y = FN Y(R
          )
```

```
KK 2360  E.D = FN EVEN.ODD(R,C)
PJ 2370  ' -- BLANK
KK 2380  IF SHAPE = 0 AND E.D =
         1 THEN PUT(X,Y),SQEVEN,P
         SET
NJ 2390  IF SHAPE = 0 AND E.D =
         0 THEN PUT(X,Y),SQODD,PS
         ET
KO 2400  ' -- MARKER
FI 2410  IF SHAPE = 1 AND E.D =
         1 THEN PUT(X,Y),PYRAMID1
         ,PSET
GC 2420  IF SHAPE = 1 AND E.D =
         0 THEN PUT(X,Y),PYRAMID2
         ,PSET
LB 2430  IF SHAPE = 2 AND E.D =
         1 THEN PUT(X,Y),SPHINX1,
         PSET
NK 2440  IF SHAPE = 2 AND E.D =
         0 THEN PUT(X,Y),SPHINX2,
         PSET
JD 2450 RETURN
AG 2460 REM ENTER MOVE
KG 2470  S$ = TURN$(PLAYER)
BN 2480  LOCATE 24,21-LEN(S$)/2:
         PRINT S$;
MI 2490  IF GAME = 1 AND PLAYER
         = 1 THEN GOSUB 2510 ELSE
         GOSUB 2910
IG 2500 RETURN
DA 2510 REM COMPUTER'S TURN
QO 2520  HPTS = -999
FO 2530  FOR SQ.CSR = 2 TO 8
FO 2540   SQ.END = LAST(SQ.CSR)
EJ 2550   IF SQ.END = SQ.CSR THE
         N 2680
DG 2560   ' -- DRAW THE CURSOR
BC 2570   GOSUB 2710
IA 2580   ' -- RANK THE SQUARE
KB 2590   J = 1: GOSUB 2760
HP 2600   PTS = SCORE
JH 2610   J = 2: GOSUB 2760
DE 2620   IF SCORE > PTS THEN PT
         S = SCORE
JO 2630   ' -- COMPARE TO PREVIO
         US BEST SCORE
PO 2640   IF PTS = HPTS AND RND(
         1) > .5 THEN MOVE = SQ.C
         SR
JJ 2650   IF PTS > HPTS THEN HPT
         S = PTS: MOVE = SQ.CSR
KJ 2660   ' -- ERASE THE CURSOR
BE 2670   GOSUB 2710
IE 2680  NEXT SQ.CSR
PL 2690  SQ.CSR = MOVE
JK 2700 RETURN
CJ 2710 REM DRAW CURSOR
MM 2720  X = FN X(SQ.CSR): Y = F
         N Y(1) - 1
MM 2730  IF PLAYER = 1 THEN PUT(
         X,Y),CURSOR.PYD,XOR
EN 2740  IF PLAYER = 2 THEN PUT(
         X,Y),CURSOR.SPX,XOR
KJ 2750 RETURN
NN 2760 REM RANK SQUARE
FA 2770  SCORE = -J
KC 2780  FOR D = 1 TO 4
PP 2790   T = 0: DLT = DR(D)
BP 2800   ' -- FIRST PART
KC 2810   SQ = SQ.END
EC 2820   SQ = SQ + DLT: IF B(SQ
         ) = J THEN T = T + 1: GO
         TO 2820
AD 2830   F1 = -(B(SQ) = 0)
CE 2840   ' -- SECOND PART
LO 2850   SQ = SQ.END
GK 2860   SQ = SQ - DLT: IF B(SQ
         ) = J THEN T = T + 1: GO
         TO 2860
HH 2870   S1 = -(B(SQ) = 0)
NJ 2880   SCORE = SCORE + F1*S1*
         3^T - 1000*(T > 2)
KH 2890  NEXT D
JO 2900 RETURN
DA 2910 REM HUMAN'S TURN
PC 2920  SQ.CSR = 5
KJ 2930  A = 0
NN 2940  WHILE A <> 13
HD 2950   GOSUB 2710: ' DRAW CUR
         SOR
LP 2960   ' -- MAKE ENTRY
HD 2970   A = 0
GP 2980   WHILE NOT ( A = 13 OR
         A = 75 OR A = 77 )
KA 2990    S$ = INKEY$: IF S$ =
         "" THEN 2990
CF 3000    IF LEN(S$) > 1 THEN A
         = ASC(MID$(S$,2,1)) ELS
         E A = ASC(S$)
ED 3010   WEND
BL 3020   GOSUB 2710: ' ERASE CU
         RSOR
DB 3030   ' -- FIND NEW LOCATION
NN 3040   SQ = SQ.CSR
MH 3050   IF A = 75 THEN SQ = SQ
         - 1: ' LEFT
ID 3060   IF A = 77 THEN SQ = SQ
         + 1: ' RIGHT
IF 3070   IF SQ > 1 AND SQ < 9 T
         HEN SQ.CSR = SQ ELSE PLA
         Y BUZZ$
FH 3080   ' -- CHECK FOR FULL CO
         LUMN
HJ 3090   IF A = 13 AND B(SQ.CSR
         +9) <> 0 THEN A = 0: PLA
         Y BUZZ$
DE 3100  WEND
IC 3110 RETURN
HH 3120 REM MAKE MOVE
QP 3130  SQ.END = LAST(SQ.CSR)
AC 3140  GOSUB 3210: ' MOVE DOWN
DO 3150  PLAY GURGLE$
NA 3160  B(SQ.END) = PLAYER
PJ 3170  LAST(SQ.CSR) = SQ.END -
         9
JM 3180  N = N + 1
JE 3190  LOCATE 24,9: PRINT SPAC
         E$(24);
IB 3200 RETURN
MA 3210 REM MOVE DOWN
IC 3220  FOR I = SQ.CSR + 9 TO S
         Q.END STEP 9
EC 3230   R = FNROW(I)
FL 3240   C = FNCOL(I)
PK 3250   ' -- DRAW PIECE
PN 3260   SHAPE = PLAYER: GOSUB
         2340
LM 3270   FOR PAUSE = 1 TO 100:
         NEXT PAUSE
OL 3280   ' -- ERASE PIECE
AC 3290   IF I <> SQ.END THEN SH
         APE = 0: GOSUB 2340
MP 3300  NEXT I
IG 3310 RETURN
KO 3320 REM CHECK FOR END
JM 3330  FOR D = 1 TO 4
OJ 3340   T = 0: DLT = DR(D)
BF 3350   ' -- FIRST PART
LI 3360   SQ = SQ.END
OD 3370   SQ = SQ + DLT: IF B(SQ
         ) = PLAYER THEN T = T +
         1: GOTO 3370
CH 3380   ' -- SECOND PART
LB 3390   SQ = SQ.END
HP 3400   SQ = SQ - DLT: IF B(SQ
         ) = PLAYER THEN T = T +
         1: GOTO 3400
EE 3410   ' -- CHECK
EM 3420   IF T >= 3 THEN GAME$ =
         "OVER": VICTOR = PLAYER
         : DIRECTION = D
JO 3430  NEXT D
JB 3440 RETURN
HA 3450 REM GAME'S OVER
HP 3460  IF JR$ = "Y" THEN GOSUB
         3500: ' SHOW MARKERS
OK 3470  GOSUB 3750: ' SHOW WINN
         ER
PE 3480  GOSUB 3840: ' PLAY MUSI
         C
KA 3490 RETURN
MK 3500 REM SHOW MARKERS
PD 3510  DLT = DR(DIRECTION)
LI 3520  ' -- INITIAL PIECE
QJ 3530  SQ = SQ.END: GOSUB 3680
JG 3540  ' -- FIRST PART
CH 3550  LOOK = 1
IP 3560  WHILE LOOK
GD 3570   SQ = SQ + DLT
CJ 3580   IF B(SQ) = VICTOR THEN
         GOSUB 3680 ELSE LOOK =
         0
FH 3590  WEND
GB 3600  ' -- SECOND PART
CN 3610  LOOK = 1
QI 3620  SQ = SQ.END
II 3630  WHILE LOOK
IM 3640   SQ = SQ - DLT
BC 3650   IF B(SQ) = VICTOR THEN
         GOSUB 3680 ELSE LOOK =
         0
FA 3660  WEND
KO 3670 RETURN
II 3680 REM HIGHLIGHT MARKER
KJ 3690  R = FN ROW(SQ)
JF 3700  C = FN COL(SQ)
PL 3710  X = FN X(C): Y = FN Y(R
         )
DI 3720  IF VICTOR = 1 THEN PUT(
         X,Y),CURSOR.PYD,PSET
LJ 3730  IF VICTOR = 2 THEN PUT(
         X,Y),CURSOR.SPX,PSET
JH 3740 RETURN
AG 3750 REM SHOW WINNER
PD 3760  IF GAME = 1 AND VICTOR
         = 0 THEN S$ = "We tie ..
         . sigh."
JO 3770  IF GAME = 1 AND VICTOR
         = 1 THEN S$ = "I win !"
JA 3780  IF GAME = 1 AND VICTOR
         = 2 THEN S$ = "You win !
         "
NF 3790  IF GAME = 2 AND VICTOR
         = 0 THEN S$ = "You tie .
         .. sigh."
PK 3800  IF GAME = 2 AND VICTOR
         = 1 THEN S$ = "You win,
         " + NME$(1) + " !"
FM 3810  IF GAME = 2 AND VICTOR
         = 2 THEN S$ = "You win,
         " + NME$(2) + " !"
IL 3820  LOCATE 2,21-LEN(S$)/2:
         PRINT S$;
JG 3830 RETURN
DK 3840 REM PLAY ANTON DVORAK'S
         "HUMORESQUE"
DI 3850  PLAY "O2 T96 L16"
LM 3860  S1$ = "G P12 AG P12 AB
         P12 > DE P12 D"
FE 3870  S2$ = "G P12 F+A P12 GF
         + P12 AG P12 E"
QN 3880  PLAY "XS1$; XS2$; D P12
          DE P12 DG P12 ED P12 <
         BA2 P12"
EP 3890  PLAY "XS1$; XS2$; D P12
          DG P12 < GA8 > D6 < G4.
         "
JP 3900 RETURN
JC 3910 REM ASK TO PLAY AGAIN
JK 3920  LOCATE 25,12: PRINT "Pl
         ay again (Y/N) ?";
PD 3930  GOSUB 1840
KL 3940 RETURN
CF 3950 REM EXIT
DJ 3960  SCREEN 0: WIDTH 40: LOC
         ATE ,,0: COLOR 15,0,0: C
         LS
DK 3970  PRINT "BYE-BYE"
KH 3980 RETURN
```

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Atari Screen Display Toggle

Frank Murphy

A press of a key speeds up your Atari by 30 percent when you use this short utility. It's compatible with most languages, including Atari BASIC and many assemblers and compilers. A disk drive is required.

When you run a BASIC program, or when you assemble or compile programs in other languages, your computer is fighting against itself. In one corner is the 6502 microprocessor, doing its best to run your program at 1.78 megahertz. In the other corner is the Antic video chip which has the job of constantly updating your screen. Antic turns off the 6502 repeatedly to look at screen memory and character definitions. "Atari Screen Display Toggle" lets you turn the Antic chip off or on with a single keypress—speeding your computer up by as much as 30 percent. Of course, the price to pay for turning off Antic is a blank screen.

Typing It In

Type in Program 1 and save a copy to disk. Since the program requires accurate entry, be sure to use "The Automatic Proofreader" program located elsewhere in this issue when you type it in.

Load Program 1 and type RUN. You are asked to choose whether you want to save the program as a binary file or POKE it directly in memory. If you're going to be using the program in BASIC, choose P, for Put into memory. Choose C, for Create disk file, to be able to use Screen Display Toggle from within any language. If you choose this option, you must create a filename for the program. I suggest a name like SDT.OBJ.

If you choose to create a binary file, go to the DOS menu and select L, Binary Load. When you are asked for a filename, respond with the name you used to create the file. If you are using an alternative DOS like OS/A+ or DOS XL, simply type the name of the file at the DOS prompt.

Screen Display Toggle (SDT) is ready. Press SHIFT-CTRL-S to blank the screen and speed up the computer. Repeat the keystroke to return the screen to normal. Whenever you need an extra burst of speed, SDT is the answer.

Program 2 is the source code for SDT. You do not need to enter this program to use Atari Screen Display Toggle—it is included for those interested in machine language programming. The program, as written, is assembled into the cassette buffer. Those who wish to use the program with a cassette drive can assemble the program at another location (two possibilities are $100 and $600).

Program 1: Atari Screen Display Toggle

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
NO 1  REM COPYRIGHT 1987 COMP
      UTE! PUBLICATIONS, INC.
      {3 SPACES}ALL RIGHTS RE
      SERVED.
IA 2  PRINT "{CLEAR}"
BG 5  DIM X$(40):OPEN #2,4,0,
      "K:":POKE 752,1
BB 10 PRINT "{10 SPACES}COPYR
      IGHT 1987":PRINT "
      {5 SPACES}COMPUTE! PUB
      LICATIONS, INC.":PRINT
       "{8 SPACES}ALL RIGHTS
       RESERVED."
AO 20 ? :? :? "Put into memo
      ry, or Create Disk Fil
      e?"
JI 25 GET #2,X:X$=CHR$(X):IF
       (X$<>"P") AND (X$<>"C
      ") THEN 25
MG 30 IF X$="C" THEN 50
KC 40 RESTORE 130:FOR X=1026
       TO 1072:READ Y:POKE X
      ,Y:NEXT X:POKE 1024,PE
      EK(520):POKE 1025,PEEK
      (521)
GC 45 POKE 520,2:POKE 521,4:
      POKE 752,0:END
EA 50 POKE 752,0:? :? "  Ent
      er Dn:Filename:";:INPU
      T #16,X$
DD 60 IF (X$(2,2)<>":") AND
      (X$(3,3)<>":") THEN GO
      SUB 95
EL 70 OPEN #1,8,0,X$:FOR X=1
       TO 53:READ Y:PUT #1,Y
      :NEXT X:CLOSE #1:POKE
      752,0:END
MB 95 X=LEN(X$):X$(20)=X$:X$
      (1,2)="D:":X$(3)=X$(20
      ):X$(1,X+3)="":RETURN
AP 100 DATA 255,255
DD 110 DATA 2,4
HD 120 DATA 42,4
PD 130 DATA 173,9,210,201,254
PP 140 DATA 208,8,173,47,2,73
CD 150 DATA 254,141,47,2,108
      ,0
IM 160 DATA 4,173,8,2,141,0
IP 170 DATA 4,173,9,2,141,1
JF 180 DATA 4,169,2,141,8,2
NE 190 DATA 169,4,141,9,2,96
LH 200 DATA 226,2,227,2,20,4
```

Program 2: SDT Source Code

```
0100 ;-------------------------------;
0110 ;Source Code: Screen Toggle     ;
0120 ;-------------------------------;
0130 ;Copyright 1987 COMPUTE! PUBL.,;
0140 ;INC.  ALL RIGHTS RESERVED      ;
0150 ;-------------------------------;
1000 KBCODE = $D209
1010 SDMCTL = $022F
1020 OLDVEC = $0400
1030 VKEYBD = $0208
1990 START = $0402
1995      *=  START
2000 ; This is where the new interrupt
2010 ; routine is handled.
2020 ;
2030      LDA KBCODE
2040      CMP #$FE     ; Check for SH-CT-S
2050      BNE NEXT1
2060      LDA SDMCTL   ;
2070      EOR #$FE     ; Toggle Display
2080      STA SDMCTL   ;
2090 NEXT1
2100 ; New funtions follow....
2990      JMP (OLDVEC)
3000 ;
3005 ; Initialize our new routine
3010 ;
3015 INIT
3020      LDA VKEYBD   ; You can write
3030      STA OLDVEC   ; your own prgs.
3040      LDA VKEYBD+1 ; that make use
3050      STA OLDVEC+1 ; of VKEYBD's
3060      LDA #START&255 ; vector by using
3070      STA VKEYBD   ; code similar to
3080      LDA #START/256 ; this with your
3090      STA VKEYBD+1 ; own routine's
3100      RTS          ; address.
9000 ;
```

©

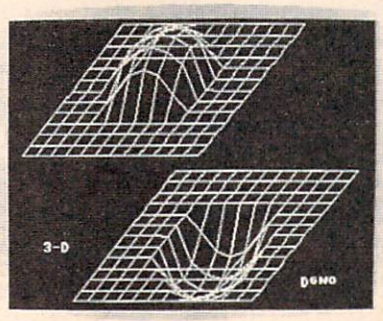
Dynamic Graphics For The 64

Ronald Carnell

You don't have to program in machine language to get lightning-fast graphics. This impressive, full-featured program lets you easily and quickly generate high-resolution graphics from BASIC. A disk drive is recommended.

The Commodore 64's hardware support of high-resolution (hi-res) graphics is among the best found in an eight-bit computer. Unfortunately, that hardware is very difficult to access from BASIC. Like many graphics enhancements, "Dynamic Graphics" solves this problem by adding commands that allow you to draw on the hi-res screen in BASIC. It does this, however, in an unusually ingenious—and fast—way.

The graphics commands added by most programs are interpreted, just like any other BASIC statement. This technique, however, leads to slow execution time. For example, to plot 500 points using a FOR-NEXT loop, BASIC has to interpret the plot command 500 different times—and that can take quite a while. Dynamic Graphics operates under the philosophy that graphics commands should be executed only once, without the burden of BASIC's interpreter.



Complex high-resolution graphics can be drawn instantaneously from BASIC.

When Dynamic Graphics encounters one of its graphics commands, it does not execute it, so to speak. Instead, the points plotted by each graphics command are assembled into a specialized *shape table*. Later, when it's time to display the graphics, a dedicated machine language routine plots each point, quickly and efficiently to the hi-res screen. Shape tables can be quite complex, and may be saved to disk for later use.

Typing It In

Dynamic Graphics is listed below as Program 1. This program is written in machine language, so you'll need to use the "MLX" machine language entry program to type it in. MLX is found elsewhere in this issue. When you run MLX, you will be asked for a starting address and an ending address for the data you'll be entering. For Dynamic Graphics, use the following values:

Starting Address: C000
Ending Address: CA7F

After typing in Dynamic Graphics, save it to disk or tape. Because Dynamic Graphics is written in machine language, it must be loaded with a ,1 extension (LOAD *"filename"*,8,1). To activate Dynamic Graphics after it has been loaded into memory, enter SYS 49152. Dynamic Art can be disabled with the command SYS 49155.

Using The Program

Dynamic Graphics' commands fall into three different categories: Build, Execute, and Immediate. Build commands, such as Point and Line, are used to build the graphics shape table. An Execute command displays the hi-res screen, plotting each point specified in the shape table. Remember: Until an Execute command is used, no graphics are output to the screen. Immediate commands are commands that execute immediately and do not affect the shape table.

All of Dynamic Graphics' commands begin with an exclamation point (!). Parameters are placed on the line following the graphics command. Parameters must be preceded by a colon. If there is more than one parameter (which there usually is), they too must be separated by colons. Do *not* use commas for separating data. For example, the syntax for the Line command might appear as

```
100 !DO (LINE)
110 :X1:Y1:X2:Y2
120 !END LINE
```

Parameters may be constants, variables, or even expressions such as X*SIN(3.14159265). If a parameter contains a syntax error, the line number in which the command is located (line 100 in the example above) is listed as the offending line. Some parameters are enclosed in parentheses directly following the command.

Parameters for hi-res screen coordinates are entered in :X:Y (:horizontal:vertical) format. The X coordinate can vary between 0 and 319. The Y coordinate can vary between 0 and 199.

Below is a description of each of Dynamic Graphics' commands.

Build Commands

!DO (POINT). This command plots points on the hi-res screen. Following this command can be any number of point coordinates. The following example plots points in the center and four corners of the screen:

```
100 !DO (POINT)
110 :0:0:319:199
120 :0:199:319:0
130 :160:100
140 !END POINT
```

You must end the Point command with an !END POINT statement.

!DO (LINE). This command allows you to draw one, or several connected lines. Like the Point command, Line can contain any number of point coordinates. Here's an example:

```
100 !DO (LINE)
110 :10:10:132:10
120 :132:100:10:100
130 :10:10
140 !END LINE
```

This routine draws four connecting lines in the shape of a square. When one set of coordinates is specified, only a single point is plotted. When two coordinates are specified, a line is drawn.

The !DO (LINE) command is exited by !END LINE. An alternative exit is !STOP LINE. Normally, lines drawn by different !DO (LINE) commands are kept separate. If, however, a Line command ends with !STOP LINE, succeeding !DO (LINE) commands start plotting from the endpoint of the previously drawn line. Executing a !FINLINE returns things back to normal by keeping lines created by different !DO (LINE) commands separate.

!DO (SPRITE). This command allows you to define up to 96 sprite shapes. Although Dynamic Graphics does not provide commands for displaying or moving sprites—this still must be done with POKEs—it does allow you to define sprite shapes.

Exactly 64 numeric parameters must follow the !DO (SPRITE) command. For example, a solid-square sprite would be defined by the following:

```
100 !DO (SPRITE)
120 :255:255:255:255:255:255:255:255
130 :255:255:255:255:255:255:255:255
140 :255:255:255:255:255:255:255:255
150 :255:255:255:255:255:255:255:255
160 :255:255:255:255:255:255:255:255
170 :255:255:255:255:255:255:255:255
180 :255:255:255:255:255:255:255:255
190 :255:255:255:255:255:255:255:255
200 !END SPRITE
```

Every !DO (SPRITE) must terminate with an !END SPRITE statement. Later, sprite shapes are referenced by number. This number is determined by the order in which the sprites were defined. The first sprite defined is referred to as sprite 0, the second sprite is referred to as sprite 1, and so on.

!COLOR (*bg,fg,x,y,n*). The !COLOR command allows you to set the hi-res screen's colors. On the hi-res screen, you can have separate background and foreground colors for each 8 × 8–pixel area of the screen (often referred to as character boundaries). The parameters *bg* and *fg* specify the background and foreground colors of the character boundary defined by the *x* and *y* coordinates. The color parameters can range from 0 to 15. The *x* coordinate can range from 0 to 39, while *y* can range from 0 to 24.

The final parameter, *n*, specifies how many character boundaries the command affects (a maximum of 1000). As an example, !COLOR (0,5,0,0,1000) sets the background color to black and the foreground color to green for the entire screen. It is a good idea to execute a !COLOR command at the beginning of a program. Otherwise, you never know what strange colors you'll end up with.

!HUE (*bg,fg*). This command sets the colors of all pixels drawn after its use. As with the !COLOR command, *bg* and *fg* represent the background and foreground colors, respectively. If a line of a different color is drawn through a character boundary previously set by the !COLOR command, the new color supersedes the old.

!BRUSH (*n*). !BRUSH allows you to set the pixel width of your brush. The *n* parameter specifies the new width, and can range from 1 to 15. The actual size of lines drawn, however, depends on the angle of the lines. It is much like working with a chisel-point pencil. Experiment with different brush sizes to see a variety of effects.

!TEXTURE (*n*). Unlike any other Dynamic Graphics command, !TEXTURE can be used only once within a program. This command determines the texture of all lines drawn with a brush size greater than one. The *n* parameter specifies a brushes pattern. As an example, a line drawn with !BRUSH (2) and a !TEXTURE (2) results in a pixel/blank/pixel brush. Again, experiment with this command to get a feel for its capabilities.

!ERASE. This command tells Dynamic Graphics to erase points instead of draw them. This command

affects all of Dynamic Graphics' drawing commands. Erase mode is terminated with the statement !END ERASE.

!QUITPIC. This *very* important command informs Dynamic Graphics that you're finished defining a shape table. You *must* use this command prior to an Execute command. If you do not, the computer will try to plot points found beyond the shape table, possibly locking up your computer system.

Execute Commands

!VIEW. This command clears and displays the hi-res screen, drawing anything found in the shape table. Points and lines found in the shape table are drawn in the order in which they were defined. Because of this, it's possible to create an animation effect by drawing and redrawing various objects. !VIEW continues to display the hi-res screen until a key is pressed.

!MAP (ON/OFF). This command turns the hi-res screen on and off. When a !MAP (ON) is executed, the hi-res screen is displayed and the shape table is drawn. This command does not clear the hi-res screen, so it's possible to draw on top of previously drawn graphics. If you prefer, you may clear the hi-res screen prior to a !MAP (ON) with the !CLRMAP command described below. To return to the text screen, use the command !MAP (OFF). Unlike !VIEW, !MAP (ON) does not automatically return to the text screen after a key is pressed.

Immediate Commands

!SAVE *"filename"*. The !SAVE command saves the current shape table to disk. Dynamic Graphics normally saves shape tables to device 8. If you wish to save your shape table to the drive known as device 9, enter a **POKE 49159,9** prior to using the !SAVE command. To load a shape table, simply use BASIC's built-in load command. For example, LOAD "filename",8,1 loads the specified shape table into memory, ready to be displayed by an execute command.

!NEWPIC. Dynamic Graphics allows you to keep two separate shape tables in memory at once. This command switches between the two. When you execute a !NEWPIC, the current shape table is switched out and a new one is put in its place. To access the old shape table, simply execute another !NEWPIC.

Execute commands always display the current shape table. To see which shape table is currently active, PEEK location 49158. If this location contains a 0, the default shape table—the one active when you first run your program—is in use. If this location returns a 1, then you're using the alternate shape table. Note that once you have defined a shape table and executed the !QUITPIC command, you can not alter it. To redefine a shape table, you must either exit and rerun your program, or load in a new shape table from disk.

!DEFSPR(*s*,*n*). This command assigns a sprite shape defined by !DO (SPRITE) to one of the 64's sprites. The *s* represents the desired sprite shape (0–95), and *n* represents one of the 64's eight sprites (0–7). To assign the first sprite shape stored in the shape table to the 64's eighth sprite, for example, use the command !DEFSPR(0,7). Remember, in order to display a sprite, *you* must provide the proper POKEs.

!GETCHARS (*ct*). This command allows you to pick the type of characters produced by the !STRING statement (see below). The *ct* parameter determines the character type. Below is a list of *ct*'s possible values:

Value	Character Type
0	Normal uppercase/graphics
128	Reverse uppercase/graphics
256	Normal lowercase/uppercase
384	Reverse lowercase/uppercase

Notice that *ct* is simply an offset into the 64's built-in character set. You can use your own custom character sets by loading them into memory at 52000.

!STRING (*x*,*y*,*s$*). This command prints characters on the hi-res screen. The *x* and *y* parameters specify the horizontal and vertical position of your text. The *x* coordinate can range from 0 to 39 while *y* can range from 0 to 24. When !STRING is executed, *s$* is output to the hi-res screen. This parameter can be a string literal—like "Score"—or a string variable. Before using !STRING, you should use the !GETCHARS command to select the type of characters desired.

All of Dynamic Graphics' commands work from within a program only. And remember, before you can use any of these commands, you must first load Program 1 and execute a SYS 49152.

Sample Programs

Programs 2–4 offer examples on what you can do with Dynamic Graphics. Before any of these programs can be run, you must load Program 1 first.

Program 2 uses Dynamic Graphics to draw a potential game screen, complete with text. Program 3 displays a three-dimensional drawing in two different perspectives (see photo). Finally, Program 4 shows off Dynamic Graphics' ability to create animated art using a single shape table.

Dynamic Graphics

Please refer to the "MLX" article in this issue before entering the following program.

```
C000:4C 0D C0 4C 78 C0 00 08 96
C008:01 02 60 03 00 A2 14 A9 23
C010:00 9D 34 03 CA 10 FA A9 E5
C018:00 85 37 A9 5A 85 38 A9 7F
C020:4C 85 7C 8D 0C C0 A9 85 CD
C028:85 7D A9 C0 85 7E A9 00 86
C030:8D 36 03 A9 84 8D 37 03 CC
C038:A2 07 A0 6F 98 9D F8 5F 64
C040:9D F8 9F 9D F8 83 88 CA 4E
C048:10 F2 A9 00 85 05 85 FB 0B
C050:A9 A0 85 06 85 FC AD 0C 67
C058:C0 D0 1C A9 00 85 FD A9 48
C060:E0 85 FE A2 20 A0 00 A9 EA
C068:C2 91 FB 91 FD C8 D0 F9 F6
C070:E6 FC E6 FE CA D0 F2 60 51
C078:A9 C9 85 7C A9 3A 85 7D 78
C080:A9 B0 85 7E 60 48 C9 21 74
C088:D0 18 A5 7B C9 02 F0 12 2F
C090:A5 D4 D0 0E AD 41 03 C9 57
C098:A7 D0 04 A5 61 F0 03 68 3A
C0A0:D0 10 68 C9 20 F0 03 8D 90
C0A8:41 03 C9 3A 90 01 60 4C FD
C0B0:80 00 20 73 00 8D 42 03 6B
C0B8:20 73 00 F0 10 C9 2C F0 27
C0C0:0C C9 28 F0 08 C9 22 F0 6B
C0C8:04 C9 3A D0 EB A2 FF E8 E5
C0D0:E0 11 B0 2C BD 03 C1 CD 2B
C0D8:42 03 D0 F3 8A 0A AA BD 25
C0E0:14 C1 8D EC C0 BD 15 C1 46
C0E8:8D ED C0 20 FF FF 20 79 80
C0F0:00 F0 0D C9 3A F0 09 20 B4
C0F8:73 00 F0 04 C9 3A D0 F7 63
C100:4C 79 00 42 44 56 45 51 83
C108:46 53 4D 54 48 43 80 94 57
C110:A2 9C A1 96 D4 C1 EF C1 F8
C118:4B C3 E3 C1 15 C3 A6 C2 92
C120:2E CA 3E C3 CD C1 40 C1 29
C128:52 C1 E9 C1 FA C8 54 C5 08
C130:58 C8 30 C9 2F C4 20 73 F4
C138:00 20 9E AD 20 AA B1 60 E1
C140:20 36 C1 8C 0B C0 20 36 34
C148:C1 98 0A 0A 0A 0A 8D 0A 52
C150:C0 60 20 36 C1 8C 45 03 81
C158:8C 0B C0 20 36 C1 98 0A F2
C160:0A 0A 0A 8D 0A C0 0D 45 38
C168:03 8D 45 03 20 36 C1 84 8B
```

```
C170:FB 20 36 C1 84 FC 20 36 6B
C178:C1 8C 34 03 8D 35 03 A9 A7
C180:00 85 3B A9 9C 85 3C A6 81
C188:FB F0 0E 18 A5 3B 69 28 9E
C190:85 3B 90 02 E6 3C CA D0 66
C198:F2 18 A5 3B 65 FC 85 3B 69
C1A0:90 02 E6 3C AD 34 03 D0 A2
C1A8:05 AD 35 03 F0 1E A0 00 32
C1B0:AD 45 03 91 3B E6 3B D0 92
C1B8:02 E6 3C 38 AD 34 03 E9 30
C1C0:01 8D 34 03 B0 03 CE 35 43
C1C8:03 4C A4 C1 60 20 36 C1 43
C1D0:8C 08 C0 60 20 36 C1 C0 D8
C1D8:10 90 02 A0 0F 98 0A 8D 4F
C1E0:09 C0 60 A9 20 8D 44 03 82
C1E8:60 A9 00 8D 44 03 60 20 EE
C1F0:73 00 C9 4C F0 0C C9 53 CA
C1F8:D0 03 4C BD C3 A9 40 8D DD
C200:43 03 20 78 C0 20 73 00 E0
C208:D0 FB 18 A5 7A 69 05 85 5B
C210:7A 90 02 E6 7B 20 79 00 F4
C218:F0 13 C9 80 F0 07 C9 90 E3
C220:D0 06 4C C0 C2 4C A6 C2 7C
C228:20 73 00 D0 E8 20 36 C1 9D
C230:8C 39 03 8D 3A 03 20 36 D7
C238:C1 8C 3B 03 AD 3A 03 F0 A6
C240:15 C9 01 F0 05 A9 01 8D 50
C248:3A 03 AD 39 03 C9 41 90 47
C250:05 A9 40 8D 39 03 AD 3B 10
C258:03 C9 C9 90 05 A9 C8 8D 02
C260:3B 03 A0 00 AD 39 03 85 36
C268:F7 91 05 C8 AD 3A 03 85 5D
C270:F8 0D 09 C0 0D 44 03 0D 6F
C278:43 03 91 05 C8 AD 3B 03 59
C280:85 F9 91 05 20 3B C5 A5 E8
C288:06 C9 C0 90 06 20 48 C5 AB
C290:EE 21 D0 20 D2 C2 20 0A DD
C298:C3 20 79 00 C9 3A F0 03 53
C2A0:4C 0A C2 4C 15 C2 20 48 28
C2A8:C5 78 A9 36 85 01 58 A0 49
C2B0:01 B1 05 09 40 91 05 78 1F
C2B8:A9 37 85 01 58 20 3B C5 21
C2C0:A9 00 8D 43 03 A9 4C 85 DD
C2C8:7C A9 85 85 7D A9 C0 85 99
C2D0:7E 60 46 F9 46 F9 46 F9 B6
C2D8:46 F8 66 F7 46 F8 66 F7 E6
C2E0:46 F8 66 F7 A9 00 85 3B A7
C2E8:A9 9C 85 3C A6 F9 F0 0E EB
C2F0:18 A5 3B 69 28 85 3B 90 48
C2F8:02 E6 3C CA D0 F2 18 A5 95
C300:3B 65 F7 85 3B 90 02 E6 DC
C308:3C 60 AD 0B C0 0D 0A C0 3B
C310:A0 00 91 3B 60 A9 00 8D 05
C318:40 03 20 48 C5 78 A9 36 A2
C320:85 01 58 A0 01 B1 05 48 E0
C328:78 A9 37 85 01 58 68 30 FF
C330:08 09 80 91 05 20 3B C5 0C
C338:60 EE 40 03 D0 F7 20 73 FD
C340:00 C9 91 F0 03 4C AA C3 DD
C348:4C 7F C3 20 15 C3 20 58 A0
C350:C8 20 7F C3 20 E4 FF F0 F5
C358:FB 20 AA C3 78 A9 36 85 D3
C360:01 58 20 93 C8 AD 40 03 3C
C368:D0 0E 20 48 C5 A0 01 B1 C8
C370:05 49 80 91 05 20 3B C5 DA
C378:78 A9 37 85 01 58 60 20 30
C380:6A CA 20 70 C8 A9 C6 8D 03
C388:00 DD A9 78 8D 18 D0 AD 60
C390:11 D0 09 20 8D 11 D0 78 C2
C398:A9 36 85 01 58 20 77 C4 3A
C3A0:78 A9 37 85 01 58 20 75 2D
C3A8:CA 60 A9 C7 8D 00 DD A9 31
C3B0:15 8D 18 D0 AD 11 D0 29 B2
C3B8:DF 8D 11 D0 60 20 78 C0 F7
C3C0:A9 00 8D 38 03 A5 05 85 90
C3C8:42 A5 06 85 44 AD 36 03 3C
C3D0:85 05 AD 37 03 85 06 20 DF
C3D8:79 00 F0 05 20 73 00 D0 2B
C3E0:F6 20 79 00 C9 3A F0 0B 3F
C3E8:18 A5 7A 69 05 85 7A 90 8F
C3F0:02 E6 7B 20 36 C1 98 AC 3B
C3F8:38 03 91 05 EE 38 03 C8 07
C400:C0 40 90 D3 18 A5 05 69 14
C408:40 8D 36 03 A5 06 69 00 24
C410:8D 37 03 A5 42 85 05 A5 C0
C418:44 85 06 20 73 00 C9 80 97
C420:D0 F9 A9 4C 85 7C A9 85 81
C428:85 7D A9 C0 85 7E 60 A9 A5
C430:00 85 FB A9 84 85 FC A9 13
C438:00 85 FD A9 5A 85 FE 20 84
C440:36 C1 84 42 20 36 C1 84 EB
C448:44 A6 42 F0 0E 18 A5 FD 0F
C450:69 40 85 FD 90 02 E6 FE 88
C458:CA D0 F2 A6 44 F0 0E 18 5E
C460:A5 FB 69 40 85 FB 90 02 2C
C468:E6 FC CA D0 F2 A0 3F B1 55
C470:FB 91 FD 88 10 F9 60 A9 77
C478:00 85 05 A9 A0 85 06 A0 66
C480:00 B1 05 85 39 85 F7 C8 08
C488:B1 05 85 3A C8 B1 05 85 1D
C490:3D 85 F9 20 3B C5 A5 3A D1
C498:29 80 85 47 A5 3A 29 40 A4
C4A0:85 48 A5 3A 29 20 85 45 71
C4A8:A5 3A 29 1E 4A 85 41 A5 2B
C4B0:3A 29 01 85 3A 85 F8 20 14
C4B8:D2 C2 A0 00 B1 3B 8D 46 4C
C4C0:03 A5 48 D0 32 A0 00 B1 11
C4C8:05 85 3E C8 B1 05 85 3F 76
C4D0:C8 B1 05 85 40 20 3B C5 E2
C4D8:A5 3F 29 80 85 47 A5 3F 06
C4E0:29 40 85 46 A5 3F 29 20 C0
C4E8:85 45 A5 3F 29 1E 4A 85 0B
C4F0:41 A5 3F 29 01 85 3F A5 41
C4F8:06 C9 C0 B0 3D A5 39 85 93
C500:F7 A5 3A 85 F8 A5 3D 85 EE
C508:F9 A5 48 F0 0A 20 1B C7 E0
C510:A5 47 D0 26 4C 7F C4 A5 4C
C518:3E 85 FB 85 39 A5 3F 85 60
C520:FC 85 3A A5 40 85 FD 85 C6
C528:3D 20 BB C5 A5 47 D0 0A 24
C530:A5 46 F0 03 4C 7F C4 4C A4
C538:C5 C4 60 18 A5 05 69 03 7C
C540:85 05 90 02 E6 06 60 60 72
C548:38 A5 05 E9 03 85 05 B0 81
C550:02 C6 06 60 AD 06 C0 49 A5
C558:01 8D 06 C0 A9 00 85 FB E8
C560:85 05 A9 A0 85 FC 85 06 60
C568:A9 00 85 FD A9 E0 85 FE 34
C570:A2 20 A0 00 78 A9 34 85 C1
C578:01 B1 FB 48 B1 FD 91 FB 99
C580:68 91 FD C8 D0 F3 E6 FC 12
C588:E6 FE CA D0 EC A9 37 85 AF
C590:01 58 A9 00 85 FB A9 9C F3
C598:85 FC A9 18 85 FD A9 80 D4
C5A0:85 FE A2 04 A0 00 B1 FB A7
C5A8:48 B1 FD 91 FB 68 91 FD 40
C5B0:C8 D0 F3 E6 FC E6 FE CA 0E
C5B8:D0 EC 60 A2 00 86 34 86 27
C5C0:30 86 32 86 2E 86 FA 86 BC
C5C8:FE 86 36 E8 86 35 86 37 18
C5D0:38 A5 FB E5 F7 85 2B A5 91
C5D8:FC E5 F8 85 2C 24 2C 10 2E
C5E0:17 A9 FF 85 35 85 36 A5 8C
C5E8:2B 49 FF 18 69 01 85 2B 63
C5F0:A5 2C 49 FF 69 00 85 2C 06
C5F8:38 A5 FD E5 F9 85 2D A5 0E
C600:FE E5 FA 85 2E 24 2E 10 AC
C608:15 A9 FF 85 37 A5 2D 49 D6
C610:FF 18 69 01 85 2D A5 2E 3B
C618:49 FF 69 00 85 2E A5 2B D2
C620:C5 2D A5 2C E5 2E B0 03 9F
C628:4C A9 C6 A5 2D 85 2F A5 FC
C630:2E 85 30 06 2F 26 30 A5 B4
C638:2B 85 31 A5 2C 85 32 06 1F
C640:31 26 32 38 A5 2F E5 31 A0
C648:85 31 A5 30 E5 32 85 32 D1
C650:38 A5 2F E5 2B 85 33 A5 23
C658:30 E5 2C 85 34 A6 2B F0 D8
C660:2B 20 1B C7 18 A5 F7 65 18
C668:35 85 F7 A5 F8 65 36 85 9A
C670:F8 24 34 30 1F 18 A5 F9 AB
C678:65 37 85 F9 18 A5 33 65 F9
C680:31 85 33 A5 34 65 32 85 E9
C688:34 CA D0 D5 C6 2C 10 D1 33
C690:20 1B C7 60 18 A5 33 65 17
C698:2F 85 33 A5 34 65 30 85 FC
C6A0:34 CA D0 BD C6 2C 10 B9 B1
C6A8:60 A5 2B 85 2F A5 2C 85 7B
C6B0:30 06 2F 26 30 A5 2D 85 18
C6B8:31 A5 2E 85 32 06 31 26 98
C6C0:32 38 A5 2F E5 31 85 31 4D
C6C8:A5 30 E5 32 85 32 38 A5 20
C6D0:2F E5 2D 85 33 B0 02 C6 94
C6D8:34 A6 2D 20 1B C7 18 A5 9F
C6E0:F9 65 37 85 F9 24 34 30 FC
C6E8:21 18 A5 F7 65 35 85 F7 44
C6F0:A5 F8 65 36 85 F8 18 A5 85
C6F8:33 65 31 85 33 A5 34 65 F5
C700:32 85 34 CA D0 D5 20 1B 76
C708:C7 60 18 A5 33 65 2F 85 04
C710:33 A5 34 65 30 85 34 CA 4A
C718:D0 C1 60 8A 48 A5 F7 85 83
C720:42 A5 F8 85 43 A5 F9 85 DB
C728:44 A5 41 85 49 20 74 C7 3F
C730:A5 45 D0 09 B1 03 05 FE 31
C738:91 03 4C 4A C7 38 A9 FF F1
C740:E5 FE 85 FE B1 03 25 FE 06
C748:91 03 C6 49 F0 17 18 A5 88
C750:F7 6D 08 C0 85 F7 90 02 73
C758:E6 F8 18 A5 F9 6D 08 C0 4D
C760:85 F9 4C 2D C7 68 AA A5 68
C768:44 85 F9 A5 42 85 F7 A5 D2
C770:43 85 F8 60 A9 00 85 03 83
C778:A9 60 85 04 A5 F9 4A 4A D9
C780:4A 85 FB A5 F7 85 FC A5 E5
C788:F8 85 FD 46 FD 66 FC 46 E3
C790:FD 66 FC 46 FD 66 FC A9 E9
C798:00 85 3B A9 5C 85 3C A6 A3
C7A0:FB F0 0E 18 A5 3B 69 28 C2
C7A8:85 3B 90 02 E6 3C CA D0 8A
C7B0:F2 18 A5 3B 65 FC 85 3B 8D
C7B8:90 02 E6 3C A0 00 AD 46 58
C7C0:03 91 3B A5 F7 29 07 85 EF
C7C8:FD 38 A9 07 E5 FD 85 FE 3C
C7D0:A5 F9 29 07 85 FD A5 FB B2
C7D8:0A AA 18 BD 24 C8 65 03 09
C7E0:85 03 BD 25 C8 65 04 85 67
C7E8:04 A9 00 85 FB 06 FC 26 55
C7F0:FB 06 FC 26 FB 06 FC 26 1A
C7F8:FB 18 A5 03 65 FC 85 03 9E
C800:A5 04 65 FB 85 04 18 A5 E3
C808:03 65 FD 85 03 90 02 E6 D1
C810:04 A5 FE AA BD 1C C8 85 0D
C818:FE A0 00 60 01 02 04 08 77
C820:10 20 40 80 00 00 40 01 53
C828:80 02 C0 03 00 05 40 06 5D
C830:80 07 C0 08 00 0A 40 0B 10
C838:80 0C C0 0D 00 0F 40 10 C2
C840:80 11 C0 12 00 14 40 15 75
C848:80 16 C0 17 00 19 40 1A 28
C850:80 1B C0 1C 00 1E 40 1F DA
C858:A9 00 85 03 A9 60 85 04 7D
C860:A2 20 A0 00 98 91 03 C8 39
C868:D0 FB E6 04 CA D0 F6 60 66
C870:A9 00 85 FB A9 9C 85 FC 0F
C878:A9 00 85 FD A9 5C 85 FE 38
C880:A2 04 A0 00 B1 FB 91 FD 17
C888:C8 D0 F9 E6 FC E6 FE CA AC
C890:D0 F2 60 A9 00 85 05 A9 B7
C898:A0 85 06 A0 01 B1 05 30 AF
C8A0:06 20 3B C5 4C 9B C8 20 83
C8A8:3B C5 60 A9 00 8D 3D 03 A3
C8B0:F0 03 20 73 00 20 79 00 2A
C8B8:F0 3B C9 22 D0 F7 E6 7A 9B
C8C0:D0 02 E6 7B A0 00 B1 7A B2
C8C8:F0 09 C9 22 F0 05 C8 C0 5E
C8D0:12 D0 F3 98 A6 7A A4 7B 8B
C8D8:20 BD FF A9 02 AE 07 C0 1E
C8E0:A8 20 BA FF 20 73 00 C9 BE
C8E8:22 F0 04 C9 00 D0 F5 20 34
C8F0:73 00 D0 FB 60 EE 3D 03 52
C8F8:D0 EA 20 AB C8 AD 3D 03 E6
C900:D0 2D 78 A9 36 85 01 58 13
C908:20 93 C8 A6 05 A4 06 A9 84
C910:00 85 05 A9 84 85 06 AD 34
C918:38 03 D0 08 A9 00 85 05 80
C920:A9 9C 85 06 A9 05 20 D8 3B
C928:FF 78 A9 37 85 01 58 60 C3
C930:A9 00 85 03 A9 D0 85 04 19
```

```
C938:20 36 C1 8C 3E 03 8D 3F C2
C940:03 A2 08 18 A5 03 6D 3E D2
C948:03 85 03 A5 04 6D 3F 03 D0
C950:85 04 CA D0 EE A9 20 85 F1
C958:3B A9 CB 85 3C 78 A9 33 10
C960:85 01 A2 04 A0 00 B1 03 F6
C968:91 3B C8 D0 F9 E6 04 E6 14
C970:3C CA D0 F2 A9 37 85 01 54
C978:58 AD 3E 03 10 05 49 80 43
C980:8D 3E 03 60 60 A9 00 85 FF
C988:03 A9 60 85 04 A6 FB F0 10
C990:10 18 A5 03 69 40 85 03 71
C998:A5 04 69 01 85 04 CA D0 DF
C9A0:F0 A6 FC F0 0E 18 A5 03 24
C9A8:69 08 85 03 90 02 E6 04 32
C9B0:CA D0 F2 60 48 29 80 4A 74
C9B8:85 FB 68 29 3F 05 FB 38 EB
C9C0:ED 3E 03 A2 20 86 FB A2 1B
C9C8:CB 86 FC AA F0 0E 18 A5 C3
C9D0:FB 69 08 85 FB 90 02 E6 23
C9D8:FC CA D0 F2 60 20 73 00 51
C9E0:C9 22 D0 35 E6 7A D0 02 14
C9E8:E6 7B A0 00 B1 7A F0 07 43
C9F0:C9 22 F0 03 C8 D0 F5 8C 42
C9F8:3C 03 A5 7A 85 FD A5 7B B2
CA00:85 FE 18 A5 7A 6D 3C 03 7A
CA08:85 7A 90 02 E6 7B 20 79 10
CA10:00 F0 05 20 73 00 D0 F6 B8
CA18:60 20 8B B0 A0 00 B1 47 12
CA20:8D 3C 03 C8 B1 47 85 FD 2C
CA28:C8 B1 47 85 FE 60 20 36 BF
CA30:C1 84 FB 20 36 C1 84 FC 08
CA38:20 DD C9 20 85 C9 A9 00 37
CA40:48 68 CD 3C 03 F0 22 A8 5A
CA48:C8 98 48 88 B1 FD 20 B4 74
CA50:C9 A0 00 B1 FB 91 03 C8 03
CA58:C0 08 D0 F7 18 A5 03 69 B0
CA60:08 85 03 90 DC E6 04 D0 20
CA68:D8 60 A2 20 B5 2B 9D 80 EE
CA70:CA CA 10 F8 60 A2 20 BD 3B
CA78:80 CA 95 2B CA 10 F8 60 4F
```

For instructions on entering these programs, please refer to "COMPUTE!'s Guide to Typing in Programs" elsewhere in this issue.

Dynamic Graphics—Demo 1

```
KC 10 REM COPYRIGHT 1987 COMPU
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       ALL RIGHTS RESERVED
XA 20 PRINT CHR$(147)"
      {3 SPACES}COPYRIGHT 1987
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EB 30 PRINT "{10 SPACES}ALL RI
      GHTS RESERVED"
EM 40 SYS 49152:POKE 53280,6
ER 50 !COLOR (6,1,22,0,120)
PM 60 !COLOR (14,0,0,0,880)
FC 70 !BRUSH (3):!TEXTURE(2)
QA 80 !HUE (14,6)
RF 90 FOR I=0 TO 252 STEP 4
QD 100 !DO (LINE)
FC 110 :32+I:20:32+I:120
EK 120 END LINE
ER 130 NEXT I
XH 140 !BRUSH (1):!HUE(14,0)
CS 150 !ERASE:FOR I=0 TO 1
EG 160 !DO (LINE)
EH 170 :32:122+I:289:122+I
QS 180 END LINE
BM 190 NEXT I:!END ERASE
HJ 200 !DO (LINE)
PR 210 :0:125:308:125:288:110
AB 220 END LINE
PM 230 !DO (LINE)
RB 240 :288:104:319:117
ED 250 END LINE
XQ 260 !DO (LINE)
EJ 270 :0:135:319:135
JF 280 END LINE
XD 290 !ERASE:X=50
QB 300 FOR I=0TO22
BB 310 !DO (LINE)
PM 320 :X:100+I:X+20:100+I
BG 330 END LINE
XP 340 NEXT I
QK 350 X=X+50:IF X<280 GOTO300
DK 360 !END ERASE
DG 370 FOR I=1 TO 24
RE 380 !DO (LINE)
DE 390 :32-I:22+I:32-I:122-I
CM 400 END LINE
EM 410 NEXT
QE 420 !QUITPIC:!CLRMAP:!MAP (
      ON)
FH 430 !GETCHA?RS (384)
XX 440 !STRING (23,1,"SCORE ")
AC 450 !STRING (23,34,"TIME ")
CG 460 !STRING (24,1,"000000"
FP 470 !STRING (24,34,"00:00"
CD 480 GETK$:IFK$="" GOTO480
JK 490 !MAP (OFF)
PE 500 SYS 49155
```

Dynamic Graphics—Demo 2

```
KC 10 REM COPYRIGHT 1987 COMPU
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XA 20 PRINT CHR$(147)"
      {3 SPACES}COPYRIGHT 1987
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EB 30 PRINT "{10 SPACES}ALL RI
      GHTS RESERVED"
ER 40 SYS 49152
XH 50 !COLOR (0,1,0,0,1000)
CE 60 T=30*↑/180:IX=136:IY=151
      :GOTO80
FP 70 T=210*↑/180:IX=182:IY=51
JK 80 Q1=1:S=15:DI=45:C=26*↑/1
      80
DG 90 FOR H=-90 TO 90 STEP S:Z
      =H
SM 100 FOR V=-90 TO 90 STEP S:
      X=V
BJ 110 Y=0:IF H<-DI OR H>DI GO
      TO140
PB 120 R=SQR(DI*DI-H*H):IFV<-R
      ORV>RGOTO140
DS 130 Y=SQR(R*R-V*V)
CM 140 GOSUB370
BP 150 NEXT:NEXT
KR 160 PRINT:PRINT"WORKING":!F
      INLINE
EB 170 Q1=2:Q=1
KA 180 FOR V=-90 TO 90 STEP S:
      X=V
BP 190 FOR H=-90 TO 90 STEP S:
      Z=H
BR 200 Y=0:IF V<-DI OR V>DI GO
      TO230
HX 210 R=SQR(DI*DI-V*V):IFH<-R
      ORH>RGOTO230
XF 220 Y=SQR(R*R-H*H)
MB 230 GOSUB370
JS 240 NEXT:NEXT
BJ 250 IF QQ=0 THEN QQ=1:GOTO7
      0
CC 260 !FINLINE:!QUITPIC
DG 270 PRINT:PRINT"PRESS ANY K
      EY..."
XD 280 GETK$:IFK$="" GOTO280
XX 290 !CLRMAP:!GETCHRS(256)
GM 300 !STRINGS (5,4,"3-D")
XA 310 !STRINGS (2,32,"DEMO")
JS 320 !MAP (ON)
XA 330 GETK$:IFK$=""GOTO330
JX 340 !MAP (OFF)
QR 350 SYS 49155
XQ 360 END
AC 370 IF Z=0 THEN Z=.001
AF 380 Z2=-TAN(T)*V:DZ=Z2-H:IF
      DZ<=0 GOTO460
AC 390 L1=DZ*SIN(T):X1=V+COS(T
      )*L1:Z1=Z2-SIN(T)*L1
DE 400 Y1=0:IF X1<-DI OR X1>DI
       GOTO430
GA 410 R=SQR(DI*DI-X1*X1):IF Z
      1*Z1>R*R GOTO430
XA 420 Y1=SQR(R*R-Z1*Z1)
RS 430 L=SQR(DZ*DZ-L1*L1):DY=Y
      1-Y:DA=ATN(DY/L)
BD 440 IF DA>C THEN Q2=1:GOTO5
      20
XK 450 Q2=0:IF F2=1 THEN Q2=2
SQ 460 A=-T:IF H<0 THEN A=T
PQ 470 L=SQR(Z*Z+Y*Y):Z=ABS(Z)
BS 480 A1=ATN(Y/Z):A2=A1+A
CM 490 Y2=SIN(A2)*L
DH 500 L=SQR(Z*Z+X*X):A1=ATN(X
      /Z):A2=A1+A
RR 510 X2=SIN(A2)*L
PS 520 IF YY=Y2+IY AND XX=X2+I
      X GOTO600
DC 530 IF Q2 THEN !FINLINE
XX 540 IF Q1=2 AND H=-90 THEN
      {SPACE}!FINLINE
BD 550 IF Q1=1 AND V=-90 THEN
      {SPACE}!FINLINE
CQ 560 XX=X2+IX:YY=Y2+IY
CA 570 !DO (LINE)
HM 580 :XX:YY
HG 590 !STOP LINE:PRINT".";
HP 600 RETURN
```

Dynamic Graphics—Demo 3

```
KC 10 REM COPYRIGHT 1987 COMPU
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XA 20 PRINT CHR$(147)"
      {3 SPACES}COPYRIGHT 1987
       COMPUTE! PUBL., INC."
EB 30 PRINT "{10 SPACES}ALL RI
      GHTS RESERVED"
ER 40 SYS 49152
DH 50 !COLOR (0,0,0,0,1000)
SG 60 !HUE (0,0)
KA 70 !BRUSH(1):!TEXTURE(2)
PM 80 RA=90:E=.8:AN=360:S=5
DC 90 FOR T=1 TO 11
DD 100 FOR TH=1 TO AN STEP S
KB 110 H=INT(RND(0)*15)+1:!HUE
      (0,H)
KA 120 X=(RA*COS(TH)+(160*E))/
      E
MG 130 Y=(RA*SIN(TH)+100)
QE 140 !DO (LINE)
EC 150 :X:Y
JM 160 !STOP LINE
HQ 170 IF INT(TH/2)=TH/2 THEN
      {SPACE}!FINLINE
HX 180 NEXT TH
RJ 190 !FINLINE
KQ 200 !ERASE:AN=300
QB 210 IF INT(T/2)=T/2 THEN !E
      ND ERASE:AN=360
SD 220 PRINT T,PEEK(5)+256*PEE
      K(6)
AK 230 NEXT T
PR 240 IF S=5 THEN S=3:!END ER
      ASE:GOTO90
GE 250 !QUITPIC:PRINT"{DOWN}PR
      ESS ANY KEY..."
PH 260 GETK$:IFK$=""GOTO260
HS 270 !CLRMAP
EB 280 !GETCHRS(0)
ER 290 !STRINGS (1,0,"COLOR")
EE 300 !STRINGS (1,34,"WHEEL")
QX 310 !MAP (ON)
KG 320 GETK$:IFK$="" GOTO320
QQ 330 !MAP (OFF)
AR 340 SYS 49155
```

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Masked Input For The Amiga

Steve Michel

Here's a versatile input routine for use in your Amiga Basic programs. Written as a subprogram, this input routine selectively masks out all unwanted characters. Whether you need numeric input or a simple Y/N response, "Masked Input" can do the job.

Probably the most vulnerable part of a program is its input routine. If a program is going to crash, it usually does so here. To avoid such occurrences, input routines must carefully screen illegal and unacceptable keypresses. For example, when the program is expecting a numeric response, the input routine should accept only numeric data. Editing keys must be monitored as well. You do not want someone who is using the program to accidentally clear the screen or backspace over your input prompt simply because they press the wrong key.

"Masked Input" is an Amiga Basic subprogram that provides a welcome alternative to the INPUT statement. Because it is a subprogram, Masked Input can be easily transported into your own programs. Besides being useful, Masked Input offers a good example of the use of subprograms and Amiga library routines.

Getting Started

Type in the demo program and save a copy before you run it. This program contains both the Masked Input subprogram, named INPUTSTRING, and some preliminary code that demonstrates its use.

Masked Input makes use of the Amiga library file graphics.bmap. This file is included in the BasicDemos drawer of the Amiga Extras disk. Before you run the program, make sure that a copy of the graphics.bmap file is on the same disk as the demo program. The location of this file is important. It must be either in the current directory, or in the directory named LIBS on the disk used when you booted the system. If you do not have this library file in the correct place, BASIC will stop with a *file not found* error when you run the program.

When run, the demo program asks you to enter a string length and edit mask (see below for details). Next, the program calls the INPUTSTRING subprogram using your previous two entries, prompting you for your final input. After you press RETURN, the computer echoes your entry to the screen, waits for the RETURN key to be pressed, and then reruns the program.

Using The Subprogram

The proper syntax for calling INPUTSTRING is

CALL INPUTSTRING(*entry$,strlen ,emask)*

Amiga Basic also provides an alternative call syntax that allows the subprogram to be used like a new BASIC command:

INPUTSTRING *entry$,strlen,emask*

INPUTSTRING requires three parameters: *entry$*, *strlen*, and *emask*. The string variable *entry$* returns the text entered by the user. The *strlen* parameter specifies the maximum length of input to be allowed. The *emask* parameter is an edit mask that determines the type of data that can be entered. Valid val-

ues for *emask* range from 0 to 127. Different mask values produce the following results:

Value	Function
0	All characters accepted
1	Numbers 0–9
2	Punctuation marks ., +, and −
4	Upper- and lowercase letters *A–Z*
8	Blanks (spaces) allowed
16	Uppercase letters *A–Z*
32	Characters *Y* and *N*
64	Null input not allowed

An important aspect of this method of masking is that the *emask* values may be added together to produce a cumulative effect. A value of 85 (1 + 4 + 16 + 64), for example, allows numbers, upper- and lowercase letters, and spaces, but not punctuation characters or a null input. This method of input masking puts the programmer in complete control.

INPUTSTRING uses less-than and greater-than symbols to frame the area of input. This lets the user see exactly how many characters can be entered. All responses are returned in the variable *entry$*. If a numeric value is required, *entry$* may be converted to a number with the VAL function as illustrated in the demo program.

This subprogram is fully documented with remark statements. All comments that follow the apostrophes found at the end of lines are instructional and may be omitted. The comments following the REMs, however, should be left in place to document the different parameters that are necessary for using the subprogram.

Editing Keys

In addition to the keys allowed by the edit mask, several other keys are available for editing input. The RETURN key terminates input. The cursor keys allow you to move through entered text. The current position of the cursor is denoted by an underline character. The BACK SPACE key deletes characters at the end of the input string. Pressing the DEL key erases the entire input field.

Subprograms

As explained above, the entire input routine is contained in the subprogram named INPUTSTRING. A subprogram is a section of code that is called by the main program and interacts with the main program by passing data back and forth through variables called parameters. Parameters are listed in parentheses after the subprogram name. Other variables may also be held in common between the main program and the subprogram through the use of the SHARED statement. Except for passed parameters and shared variables, the subprogram acts as though it were in a world by itself. All other variables used within the subprogram are referred to as *local variables*, which means they are known only to the subprogram. Thus, the variable LOOP.CNTR in the main program and the variable LOOP.CNTR in a subprogram are treated as two different variables and do not interfere with each other.

Why use a subprogram instead of a subroutine to perform this input function? The main reason is efficiency. Once a subprogram has been written, debugged, and polished up, it can be attached to any program that requires its services. With a variety of prewritten subprograms, you no longer have to rewrite vital routines for each new program. Ideally, one could build and maintain a whole library of subprograms, each one designed for a specific application (inputting, sorting, reading a disk directory, and so on). Writing a program would then simply consist of splicing the appropriate subprogram into the main program. And because each subprogram acts independently, you do not have to worry about conflicting variable names.

It's easy to create a version of the Masked Input subprogram that you can add to your own programs. First, load the demonstration program and delete all the lines that come before the SUB INPUTSTRING statement. Next, save the subprogram text to disk as an ASCII file. Use a statement of the form

```
SAVE "masked input",A
```

When you want to add the subprogram to one of your own programs, load or type in that program, then use a command of the form

```
MERGE "masked input"
```

to add the subprogram text from disk. Then add the statements for access to the graphics library routines, as explained below. All that's left is to add CALL statements for the INPUTSTRING subprogram and your program is set up for customized input.

Libraries

When the Amiga is first booted with Kickstart, approximately 192K of operating system is loaded into the upper part of the computer's memory. (Kickstart is found in ROM on the Amiga 500 and Amiga 2000.) This code contains, among many other things, a whole set of instructions that manage the Amiga's graphics. This set of instructions is organized into a neat collection of routines collectively known as the graphics library, which consists of such routines as ClearScreen( ), Draw( ), WritePixel( ), and SetSoftStyle( ).

Before any library routine can be used from BASIC, you must open the library with the LIBRARY command. In the case of our Masked Input routine, the command **LIBRARY "graphics.library"** is used. Executing this command instructs Amiga Basic to load the file graphics.bmap.

To create an underlined cursor, INPUTSTRING uses the graphics library routine named SetSoftStyle( ). This routine allows you to change a font's type style. The syntax for SetSoftStyle is

```
CALL SetSoftStyle&(WINDOW(8)
  ,font.style,font.mask)
```

where WINDOW(8) is a pointer to the RastPort for the current window, *font.style* is a value in the range 0–7, and *font.mask* is a value that specifies which type styles are valid for a particular font. Not all fonts have the capability of producing every type style.

To insure that Amiga BASIC interprets this as a function and not as an array reference, a **DECLARE FUNCTION AskSoftStyle& LIBRARY** command is placed near the beginning of the demo program.

At this point, we're ready to change a character's font style to produce an underlined cursor. Legal values for the *font.style* parameter are

0 = normal
1 = underlined
2 = boldface
4 = italics

These values may be added together to achieve multiple font

styles. For example, a value of 3 produces underlined boldface type. For our purposes, however, we need only use a 1 for underline.

Masked Input—Demo Program

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
' Copyright 1987 COMPUTE! Public
ations, Inc.
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demo.driver:
' the following declaration must
be made in the calling program
DECLARE FUNCTION AskSoftStyle& L
IBRARY
LIBRARY "graphics.library"      '
tell AmigaBASIC to read it
start:
CLS
PRINT"Copyright 1987 COMPUTE! Pu
blications, Inc."
PRINT"          All Rights Reserv
ed.":FOR tt=1 TO 3500:NEXT tt
CLS
strLen = 2: emask = 1
' set default values
LOCATE 2,2: PRINT "Enter string
length ";     ' set up prompt
CALL INPUTSTRING (entry$,strLen,
emask)        ' get input
size = VAL(entry$): strLen = 3
' convert to # & reset length
LOCATE 4,2: PRINT "Enter edit ma
sk (0 - 127) ";
CALL INPUTSTRING (entry$,strLen,
emask)
mask = VAL(entry$)
' convert to number
CLS: PRINT: PRINT "Enter input h
ere => ";
CALL INPUTSTRING (entry$,size,ma
sk)
PRINT: PRINT: PRINT "User input
was    =>  ";entry$
LOCATE 20,10: PRINT "PRESS ANY K
EY"
get.Loop:
g$ = INKEY$: IF g$ = "" THEN get
.Loop
GOTO start:

SUB INPUTSTRING (entry$,strLen,e
mask) STATIC:
REM entry$ = input string return
ed to calling program
REM strlen = maximum size of fie
ld to be input
REM emask  = number (0-127) that
determines input field traits
REM emask  = see table at end of
subprogram for values & traits

poss.styLe% =  AskSoftStyle&(WIN
DOW(8))     ' get possible styles

IF emask < 0 OR emask > 127 THEN
emask = 0

input.string:
g$ = INKEY$: IF g$ <> "" THEN in
put.string    ' clear out keyboar
d buffer
yLine = CSRLIN: xcoL = POS(0)
' get screen positions
PRINT "<";:LOCATE  yLine, xcoL +
strLen + 1: PRINT ">";:LOCATE yL
ine, xcoL
pos.cntr = 1: Len.cntr = 1
entry$ = "": backspace$ = CHR$(8
)
next.key:
IF Len.cntr = pos.cntr AND Len.c
ntr <> strLen + 1 THEN
LOCATE yLine,xcoL + pos.cntr: PR
INT "_";
END IF
get.key:
g$ = INKEY$: IF g$ = "" THEN get
.key
ascii = ASC(g$)
IF ascii =  13 THEN quit.sub
' return
IF ascii =   8 THEN back.up
' backspace
IF ascii =  30 THEN move.right
' cursor right
IF ascii =  31 THEN move.left
' cursor left
IF ascii = 127 THEN wipe.out
' del(ete)
IF Len.cntr = strLen + 1 AND Len
.cntr = pos.cntr THEN get.key
IF emask = 0 OR emask = 64 THEN
print.char

' AND each bit of emask to deter
mine edit functions

check.nums:
IF (emask AND 1) = 0 THEN check.
punct
IF ascii >= 48 AND ascii <= 57 T
HEN print.char
check.punct:
IF (emask AND 2) = 0 THEN check.
upLow
IF ascii = 46 OR ascii = 43 OR a
scii = 45 THEN print.char
check.upLow:
IF (emask AND 12) = 0 THEN check
.spaces
IF ascii < 65 OR (ascii > 90 AND
ascii < 97) OR ascii > 122 THEN
check.spaces
IF (emask AND 8) THEN g$ = UCASE
$(g$)
GOTO print.char
check.spaces:
IF (emask AND 16) = 0 THEN check
.yorn
IF g$ = " " THEN print.char
check.yorn:
IF (emask AND 32) = 0 THEN bad.c
har
g$ = UCASE$(g$): IF g$ = "Y" OR
g$ = "N" THEN print.char
bad.char:       ' invalid charac
ter based on edit mask
GOTO get.key
print.char:     ' valid characte
r so print it
IF Len.cntr = pos.cntr THEN
' at end of entered text ?
PRINT backspace$;g$;
entry$ = entry$ + g$
Len.cntr = Len.cntr + 1
pos.cntr = pos.cntr + 1
ELSE
' no, in middle of entered text
MID$(entry$,pos.cntr,1) = g$
GOTO move.right
END IF
GOTO next.key
back.up:        ' delete key act
ion
IF entry$ = "" THEN get.key
IF pos.cntr <> Len.cntr THEN get
.key
PRINT backspace$;" ";backspace$;
Len.cntr = Len.cntr - 1: pos.cnt
r = pos.cntr - 1
IF LEN(entry$) < 2 THEN entry$ =
"": GOTO next.key
entry$ = LEFT$(entry$,LEN(entry$
)-1): GOTO next.key
move.right:     'cursor right ac
tion
IF pos.cntr = Len.cntr THEN next
.key
char$ = MID$(entry$,pos.cntr,1)
CALL SetSoftStyLe&(WINDOW(8),0,p
oss.styLe%)   ' for underlined c
haracters
LOCATE yLine, xcoL + pos.cntr
PRINT char$;
pos.cntr = pos.cntr + 1
char$ = MID$(entry$,pos.cntr,1)
CALL SetSoftStyLe&(WINDOW(8),1,p
oss.styLe%)
LOCATE yLine, xcoL + pos.cntr
PRINT char$;
CALL SetSoftStyLe&(WINDOW(8),0,p
oss.styLe%)
GOTO next.key
move.left:      ' cursor left ac
tion
IF pos.cntr = 1 THEN get.key
IF (pos.cntr = Len.cntr) AND (Le
n.cntr <> strLen + 1) THEN
LOCATE yLine, xcoL + pos.cntr
PRINT " ";
END IF
IF pos.cntr < Len.cntr THEN
char$ = MID$(entry$,pos.cntr,1)
CALL SetSoftStyLe&(WINDOW(8),0,p
oss.styLe%)
LOCATE yLine, xcoL + pos.cntr
PRINT char$;
END IF
pos.cntr = pos.cntr - 1
char$ = MID$(entry$,pos.cntr,1)
CALL SetSoftStyLe&(WINDOW(8),1,p
oss.styLe%)
LOCATE yLine,xcoL + pos.cntr
PRINT char$;
CALL SetSoftStyLe&(WINDOW(8),0,p
oss.styLe%)
GOTO get.key
wipe.out:       ' erase WHOLE in
put field & position at start of
field
LOCATE yLine,xcoL+1: FOR wo = 1
TO strLen: PRINT " ";: NEXT wo
entry$ = "": pos.cntr = 1: Len.c
ntr = 1: LOCATE yLine, xcoL+1
GOTO next.key
quit.sub:       ' return to call
ing program
IF (emask AND 64) AND entry$ = "
" THEN next.key
END SUB

REM ===  EMASK values  ===

REM   0 = all characters
REM   1 = numbers only
REM   2 = .  +   -  punctuation
REM   4 = A-Z , a-z  upper and l
ower
REM   8 = A-Z force upper case
REM  16 = blank spaces allowed i
n input
REM  32 = Y or N only (forced up
per case)
REM  64 = null input not allowed

REM  all mask values may be adde
d together for a cumulative effe
ct
REM  i.e.  an emask of 67 = forc
ed entry of numbers and punctuat
ion
```

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Chrome II

More Double Hi-Res Graphics Commands For Applesoft

Zachary T. Smith

Last month we presented "Chrome," a powerful double hi-res extension for Applesoft BASIC. "Chrome II" adds several new features to its predecessor, including FILL, enhanced HPLOT and ELLIPSE modes, box draw, windowing support, and more. For the Apple IIe (Revision B), IIc, and IIGS computers. DOS 3.3 is required.

"Chrome," presented in the October issue of COMPUTE!, was an extension of Applesoft's graphics capabilities, providing a new ELLIPSE command and a revised HPLOT command with horizontal resolutions of 560 pixels in monochrome or 140 pixels in 16 colors.

"Chrome II" complements Chrome with new and extended commands to produce a graphics toolbox. Chrome II was designed to help you write your own drawing program or personal typesetter.

Setting Up The Disk

First, note that you must have a working copy of the original Chrome program to be able to use Chrome II.

Type in a copy of Chrome II using the Apple version of the "MLX" machine language entry program found elsewhere in this issue. When you run MLX, you'll be asked for a starting and an ending address for the data you'll be entering. For Chrome II, use the following values:

```
STARTING ADDRESS?    0C00
ENDING ADDRESS?      1347
```

After you have entered all the data, be sure to save a copy to disk before leaving MLX.

To use Chrome II, copy it onto a disk that contains a copy of Chrome. Then edit the setup program given in the October issue to read as follows:

```
10 PRINT CHR$ (4)"PR#3"
15 PRINT "DOUBLE HI-RES EXTENDE
   D APPLESOFT BEING LOADED"
20 PRINT CHR$ (4)"BLOAD CHROME"
25 PRINT CHR$ (4)"BRUN CHROME I
   I"
30 NEW
```

Lines 20 and 25 assume that the Chrome and Chrome II programs are saved with the filenames CHROME and CHROME II, respectively. You may need to change those lines to reflect the names you actually used. Remember to resave this as the disk's HELLO program so that it will run automatically when the disk is booted. When you boot your computer with this disk, Chrome II should be installed.

Program 2 is a demonstration program which shows off the capabilities of Chrome II. Type it in and save a copy before trying it out. Perhaps the best way to learn how to use Chrome II is by studying and altering the demo. It uses all of the new features except the auxiliary RAM data-mover command.

The New Commands

Chrome II offers six new commands, all of which are designed for the 560-point monochrome mode. This mode is selected with the DOUBLE command provided in the original Chrome. For quick reference, the tables located near the end of the article show the syntax of the new commands. Of course, all of the old commands from the original Chrome are still functional.

LINE is similar to HPLOT, except that it can draw only horizontal lines. The syntax is

LINE *x1,x2,y*

where *x1* and *x2* are, respectively, the left and right endpoints of the line (0–559), and *y* is the line's vertical position (0–191). As with HPLOT, the type of line drawn is determined by the setting of the HCOLOR= command. When the HCOLOR mode is 0, 1, or 2, LINE simply draws a horizontal line as HPLOT would with the same HCOLOR= setting. In these modes, LINE *x1,x2,y* is the same as HPLOT *x1,y* TO *x2,y*. HCOLOR

mode 0 sets bits, turning on pixels to draw white lines. Mode 1 clears bits, turning pixels off. You can think of this either as erasing lines or as drawing black lines. Mode 2 inverts (toggles) the state of the pixels in the line.

The real power of LINE becomes obvious when the HCOLOR mode is set to 3 (HCOLOR=3). In this case, LINE draws a patterned line. The default pattern looks like bricks, but you can change the pattern with the SETPTN (set pattern) command, described below.

Actually, you won't see the brick pattern if you draw just a single line. The complete pattern is eight lines tall, so you must use the LINE command on eight successive lines to see the full pattern. Each screen line has a fixed relationship to the pattern. For example, when you use the LINE command on screen lines 0, 8, 16, 24, and so forth, the line drawn will take its pattern from line 0 (the top line) of the pattern definition. Lines drawn on screen lines 2, 10, 18, 26, and so forth, will have the pattern of line 2 (the third line) of the pattern definition. Note that nothing will be drawn if you use the LINE command on a screen line for which the corresponding pattern definition line is blank.

LINE can also be used to read data from the screen into RAM. To do this, set the HCOLOR mode to 4 (HCOLOR=4). The syntax for this is

LINE *x1,x2,y* [AT *address*]

The optional *address* value specifies the starting location of the area of memory to which the data will be transferred. If this parameter is omitted, the address value in memory locations 96 and 97 (in low byte/high byte order) determines the starting address for the operation. The address in these locations is automatically updated as each byte is stored. Thus, when reading a series of lines from the screen, you do not need to manually update the address for each line—only for the first line to be read. The number of bytes required to store the data read from a single screen line can be calculated with the expression INT((*x2* − *x1* + 7) / 7).

LINE can also move data from memory to the screen, reversing the process described above. This is achieved by setting the HCOLOR mode to 5 (HCOLOR=5). The syntax of the LINE command in this case is identical to that used for reading from the screen in HCOLOR mode 4. Remember that the *address* value is automatically incremented during each reading or writing operation. If you use HCOLOR mode 4 to read a line from the screen, you must reset the address before using HCOLOR mode 5 to write that line back to the screen.

When restoring data to the screen with HCOLOR mode 5, you must maintain the horizontal bit-position alignment with which the data was saved. If you restore the data at the same horizontal position from which it was saved, you'll have no problem. However, data restored at a different horizontal position will be distorted unless the new pixel position has the same bit position within its screen memory byte. The bit position for pixel position *x* can be determined by the expression ((*x* / 7) − INT(*x* / 7)) * 7.

AREA performs the same function as a series of executions of the LINE command. Therefore, it uses HCOLOR modes in the same way that LINE does (see the explanation above). Its syntax is

AREA *x1,y1,x2,y2* [AT *address*]

The first coordinate pair—*x1,y1*—specifies the upper left corner of the area to be affected, and the second pair—*x2,y2*—specifies the lower right corner. By selecting the proper HCOLOR modes, AREA can whiten, blacken, invert, pattern fill, save, or restore any rectangular portion of the screen. When saving screen data, the number of bytes of memory required can be calculated using the expression INT((*x2* − *x1* + 7) / 7) * (*y2* − *y1* +1).

FILL is perhaps the most exciting of the new commands. It can flood fill any enclosed screen area with the current pattern. Its syntax is

FILL *x,y,buffer address,autofill*

The *x* and *y* values specify the horizontal and vertical coordinates, respectively, at which the fill operation is to begin. These can be anywhere within the enclosed figure to be filled. Be careful that the figure being filled is completely enclosed by set (white) pixels. If there are any gaps in the figure boundaries, the fill operation will spill out through the gaps into adjacent areas of the screen.

The algorithm used for the FILL routine first generates a list of the starting and ending addresses in memory of each screen line to be filled and then proceeds to fill in the lines. The *buffer address* parameter in the command allows you to specify the starting address for the area of memory to be used to hold this list. You can choose any address you want for the buffer area, but it's best to place the buffer at the top of memory.

Fill operations stop when FILL is finished or when the buffer pointer goes above 38143 ($94FF hex), which is considered an overflow. Thus, you should set the buffer address sufficiently far below that address to provide space for the list. The larger and more irregular the area you are filling, the more room will be required for the list. (The entry for each screen line to be filled requires four bytes.) For example, a *buffer address* value of 37376 provides 768 bytes of line-list buffer space.

To prevent the FILL command from corrupting BASIC variables as the list is generated, you should include a HIMEM command at the beginning of your program to restrict variables to the area below the list. The syntax for the command is

HIMEM: *address*

where *address* is one location above the highest address used for variables. In this case, specify the value of the lowest *buffer address* used in any FILL statement in your program. For instance, if you were using the *buffer address* value in the example above, your program should begin with the statement HIMEM: 37376.

The *autofill* parameter specifies whether the area is to be filled solidly or with the current pattern. An *autofill* value of 0 specifies a solid-white fill (all pixels set in filled area), while a value of 1 specifies a pattern fill.

REFILL takes advantage of the two-phase structure of FILL to provide a quick way to change the pattern of the most recently filled area. It uses the list created by the most recent FILL operation to fill the same area with the current pattern. For example, you could use a FILL com-

mand with an *autofill* value of 0 to solidly fill an area and then use a series of SETPTN and REFILL commands to paint a variety of different patterns in the area.

SETPTN allows you to define the fill pattern used by LINE, AREA, FILL, REFILL, and ELLIPSE. Its syntax is

SETPTN *address*

where *address* is the starting location of a 32-byte area of RAM containing the definition of a 28 × 8–pixel pattern.

Pattern definitions are stored in memory just as they are on the screen, with the highest bit (bit 7) unused. Thus, one simple way to create pattern definitions is to design the pattern in a 28 × 8 area of the screen using HPLOT, LINE, and the other drawing commands and then use an AREA command in HCOLOR mode 4 to copy the contents of that screen area into the memory to be used for the pattern.

You can place pattern definitions anywhere in memory that you want, but the 1K of unused RAM at 2048–3071 ($0800–$0BFF hex) is a good choice. If you've used HIMEM to reserve space for the FILL list, there will also be 256 bytes available at 38144–38399 ($9500–$95FF), just below the start of DOS 3.3 at 38400 ($9600). The FILL operation doesn't use any locations above 38143.

One special case of the command is SETPTN −1, which restores the default pattern.

AUXMOVE, the last of the new commands, isn't a drawing command like the others. Instead, it provides a handy way of moving data to and from the 64K RAM in the auxiliary bank of a 128K system. The command calls the ROM subroutine of the same name to transfer any length of data from one bank to the other. One practical use for this command is to store the original contents of screen windows for later replacement. Its syntax is

AUXMOVE *direction,source start,source end,destination*

The *direction* parameter specifies the direction of the transfer. Use a value of 1 to transfer data from main memory to auxiliary memory, and use a value of 0 to transfer from auxiliary memory to main memory. The *source start* and *source end* parameters specify, respectively, the starting and ending addresses of the area of memory to be copied to the other bank. The *destination* parameter specifies the starting address of the area in main or auxiliary memory to which the data is to be copied. Because of the limitations of the ROM routine used, AUXMOVE cannot be used for moves to or from screen RAM, control RAM (the first 512 addresses, hex $0000–$01FF), and high RAM (the 16K RAM cards for each bank). Thus the allowable areas are $0200–$03FF and $4000–$95FF in the main bank, and $0200–$1FFF and $4000–$BFFF in the auxiliary bank.

Quick Reference—Chrome II Commands

LINE *x1,x2,y* **[AT** *address***]**
Draws, saves, or restores horizontal lines according to the current HCOLOR mode setting.

AREA *x1,y1,x2,y2* **[AT** *address***]**
Draws, saves, or restores rectangular areas of the screen according to the current HCOLOR mode setting.

FILL *x,y,buffer address,autofill*
Fills enclosed areas of the screen. An *autofill* value of 1 means fill with the current pattern, a 0 means solid fill.

REFILL
Uses the last line-fill list to refill an area with the current pattern.

SETPTN *address*
Specifies the location of a 32-byte area of memory to be used as the current pattern definition.

SETPTN −1
Selects the default (brick) pattern.

AUXMOVE *direction,source start,source end,destination*
Employs the AUXMOVE subroutine in ROM to move data to and from auxiliary memory. A *direction* value of 1 means transfer from main to auxiliary RAM, and a 0 means transfer from auxiliary to main RAM.

HPLOT
A new HCOLOR mode 4 draws dotted lines.

ELLIPSE *xr,yr,mode* **[AT** *xc,yc***] [AT** *address***]**
New *mode* values allow filled ellipses. Add 16 to the *mode* value to fill the lower half, and add 32 to fill the upper half. The current HCOLOR setting determines how the outline of the ellipse will be drawn, and the current COLOR setting determines how filled portions of the ellipse will be drawn.

Quick Reference—Drawing Modes

Drawing modes for LINE, AREA, and ELLIPSE are as follows:

Mode	Effect
0	Set pixels (white line)
1	Clear pixels (black line)
2	Invert (toggle) pixels
3	Set or clear pixels according to pattern
4	Read line to RAM
5	Write RAM to screen line

For LINE and AREA, the modes are set with the HCOLOR= command. For filled areas drawn with ELLIPSE, the modes are set with the COLOR= command.

New Modes For Old Commands

HPLOT, which previously could draw only solid lines, now has the capability to draw dotted lines as well. For dotted lines, specify HCOLOR mode 4 (HCOLOR=4). The 16-bit definition of the dots and dashes is preset, and there is no equivalent to the SETPTN command for changing the dotted-line pattern. However, the widths of the dots or dashes can be manually changed with POKEs to locations 3075 and 3076.

ELLIPSE can now fill in the ellipse as it goes. Chrome's original ELLIPSE command could draw only an outline. The extended syntax is

ELLIPSE *x radius,y radius,mode* [AT *x center,y center*] [AT *address*]

The *x radius* and *y radius* values specify the horizontal and vertical radii of the figure, and the optional *x center* and *y center* values specify the center point of the figure, just as in the original version of the command. The third parameter, called *quadrant* in the original command, now uses two additional bits to allow a filled ellipse. Previously, four bits were used to specify which quadrants of the figure's outline were to be drawn. In Chrome II, bit 4 of the *mode* value specifies whether or not to draw the lower half of the interior of the figure, and bit 5 does the same for the upper half. The effect of various *mode* values is as follows:

lower right outline	1
lower left outline	2
upper right outline	4
upper left outline	8
lower half filled	16
upper half filled	32

As before, the values are cumulative. For example, to draw a figure with the lower half filled and the upper half outlined, use a *mode* value of 28 (16 + 8 + 4). The new drawing modes work only in the monochrome (DOUBLE) mode. If Chrome's multicolor (COLOR) mode is selected, the two extra bits are ignored, and only outlines are drawn.

Drawing modes for the enhanced ELLIPSE command are selected differently from the other drawing commands. The HCOLOR= command is used to select the drawing mode for outlines, while the COLOR= command selects the mode for interior areas. For outlines, HCOLOR can take the following values:

HCOLOR=	Effect
0	Set pixels (white outline)
1	Clear pixels (black outline)
2	Invert (toggle) pixels
3	Draw pattern outline
4	Draw dotted outline

The HCOLOR setting has no effect on the interior area of the ellipse, if that is filled. The interior fill is controlled by the current COLOR= mode. For filled ellipses, COLOR can take the following values:

COLOR=	Effect
0	Set pixels (fill with white)
1	Clear pixels (fill with black)
2	Invert (toggle) pixels
3	Fill with pattern
4	Copy data from screen to memory
5	Copy data from memory to screen

With COLOR modes 4 and 5, you can now use the ELLIPSE command to transfer data between memory and an elliptical (or circular) area of the screen. The *mode* setting determines whether the command reads or writes data for the shape's outline or for its interior area. The optional AT *address* parameter allows you to specify the starting address of the area of memory to or from which the data is to be transferred. Note that, if you give the AT *address* parameter, you must also specify the AT *x center, y center* parameter.

Having the border and interior drawn by two different methods is a powerful feature. You could, for instance, save a portion of the screen (in the shape of an ellipse) and then draw a black outline of an elliptical window as well as fill the inside with white. Later, COLOR mode 5 could be used to restore the background, thus closing the window.

Chrome II And Memory

RAM usage by Chrome II is minimal. It creates no new tables and occupies only RAM from the area just before the original Chrome—3072–5119 ($0C00–$13FF). There is still 1K of unused RAM available at 2048–3071 ($0800–$0BFF), page 3 is still free for machine language programs, and 21.5K of RAM is still available for BASIC programs, excluding the FILL buffer at the top of memory.

Program 1: Chrome II

For instructions on entering this program, please refer to the "Apple MLX" article elsewhere in this issue.

```
0C00: 4C 8A 0D 00 FF 7F 7E 7C F9
0C08: 78 70 60 40 01 03 07 0F B9
0C10: 1F 3F 7F 7F 7F 7F 7F 60 C8
0C18: 00 60 00 60 00 60 00 60 30
0C20: 00 60 00 7F 7F 7F 7F 00 41
0C28: 60 00 60 00 60 00 60 00 40
0C30: 60 00 60 60 A6 E2 E0 C0 CD
0C38: B0 F9 8D 80 C0 BD 00 D8 B6
0C40: 85 26 BD 00 D9 09 20 85 15
0C48: 27 8A 29 07 0A 0A A8 B9 AF
0C50: A1 13 8D 8F 13 B9 A2 13 80
0C58: 8D 90 13 B9 A3 13 8D 91 6F
0C60: 13 B9 A4 13 8D 92 13 A4 B7
0C68: E0 A5 E1 09 D0 8D 77 0C DE
0C70: 09 04 8D 7A 0C B9 00 D0 7F
0C78: BE 00 D4 8D 93 13 8E 94 FD
0C80: 13 A4 E6 A5 E7 09 D0 8D 15
0C88: 91 0C 09 04 8D 94 0C B9 5E
0C90: 00 D0 BE 00 D4 8D 95 13 CF
0C98: 8E 96 13 8D 88 C0 18 ED 3E
0CA0: 93 13 8D 97 13 4E 93 13 7E
0CA8: A2 01 90 01 CA 9D 54 C0 AA
0CB0: AC 93 13 AE 94 13 BD 05 C2
0CB8: 0C AE 97 13 10 09 AE 96 3F
0CC0: 13 3D 0C 0C 4C DD 0C 20 06
0CC8: E4 0C CE 97 13 30 08 A9 BC
0CD0: FF 20 E4 0C 4C CA 0C AE A2
0CD8: 96 13 BD 0C 0C 20 E4 0C 30
0CE0: 8D 54 C0 60 AE 99 19 F0 F1
0CE8: 0E E0 02 90 1B F0 1F E0 45
0CF0: 04 90 1F F0 3D B0 49 11 72
0CF8: 26 91 26 A2 00 2C 1C C0 21
0D00: 30 02 C8 E8 9D 54 C0 60 7A
0D08: 49 FF 31 26 90 EB 51 26 4C
0D10: B0 E7 85 E8 98 29 01 0A 31
0D18: AA 2C 1C C0 30 01 E8 BD 37
0D20: 8F 13 25 E8 48 A5 E8 49 ED
0D28: 7F 31 26 85 E8 68 05 E8 47
0D30: 90 C7 31 26 A2 00 81 60 85
0D38: E6 60 D0 BF E6 61 D0 BB 0E
0D40: A2 00 48 21 60 85 E8 68 1A
0D48: 49 FF 31 26 05 E8 E6 60 89
0D50: D0 A7 E6 61 D0 A3 C7 19 6D
0D58: CD 19 0F 1D 3E 1F 31 0E 32
0D60: 94 0E 54 0E DE 12 73 11 EA
0D68: 19 13 4C 49 4E C5 41 52 50
0D70: 45 C1 46 49 4C CC 41 55 68
0D78: 58 4D 4F 56 C5 52 45 46 A9
0D80: 49 4C CC 53 45 54 50 54 91
0D88: CE 00 20 00 18 A9 B0 8D 64
0D90: 80 1A A9 07 8D 70 1A A9 23
0D98: 2F 8D 6F 1F A9 13 8D 70 B2
0DA0: 1F A9 D4 8D B2 1D A9 11 96
0DA8: 8D B3 1D A9 DF 8D 54 1E B0
0DB0: A9 11 8D 55 1E A0 FF C8 27
0DB8: B9 6A 0D 99 A6 17 D0 F7 B0
0DC0: A2 56 8E 57 19 E8 8E 53 E5
0DC8: 19 A9 0D 8D 58 19 8D 54 EA
0DD0: 19 A9 4C 8D B1 1D 8D D7 39
0DD8: 1A A9 7B 8D D8 1A A9 0E 43
0DE0: 8D D9 1A 8D 89 C0 2C 89 85
0DE8: C0 2C 89 C0 A9 CA 8D 24 63
0DF0: D0 A9 0E 8D 25 D0 8D 88 88
0DF8: C0 A9 49 A0 07 99 6C 1A A2
0E00: 8C 99 19 88 10 F7 8D 80 70
0E08: C0 2C 83 C0 2C 83 C0 A0 9D
0E10: BF B9 00 D9 09 20 99 00 14
0E18: D9 88 C0 FF D0 F3 8D 88 55
0E20: C0 A0 1F B9 13 0C 49 7F 1F
0E28: 99 A1 13 88 10 F5 60 4C C9
0E30: 06 F2 20 D4 12 C9 02 90 A9
0E38: 06 D0 F4 E0 30 B0 F0 86 E4
0E40: E0 85 E1 20 15 13 20 A1 43
0E48: 19 86 E2 84 E6 85 E7 20 74
0E50: B9 0E 4C 34 0C 20 A1 19 D6
0E58: 86 E2 84 E0 85 E1 20 15 18
0E60: 13 20 D4 12 48 8A 48 20 E6
0E68: 15 13 20 F8 E6 8E 75 0E D1
0E70: 68 AA 68 A8 A9 00 29 01 A3
0E78: 4C 1A 0F E0 04 F0 07 A2 C5
0E80: 01 31 26 4C DB 1A 0E 03 59
0E88: 0C 2E 04 0C 90 06 EE 03 F4
0E90: 0C 4C ED 1A 60 20 A1 19 05
0E98: 86 E2 84 E0 85 E1 20 15 58
0EA0: 13 20 A1 19 86 E3 84 E6 C7
0EA8: 85 E7 20 B9 0E 20 34 0C 86
0EB0: E6 E2 A5 E3 C5 E2 B0 F5 FC
0EB8: 60 20 B7 00 C9 C5 D0 F8 04
0EC0: 20 B1 00 20 D4 12 85 61 B6
0EC8: 86 60 60 2C 92 19 30 03 6B
0ED0: 4C E9 F6 20 F8 E6 29 07 2B
0ED8: 8E 99 19 60 A9 00 8D 93 C7
0EE0: 19 20 7C 1A A5 E1 09 D0 5A
0EE8: 8D F7 0E 09 D4 8D FD 0E 03
0EF0: A6 E0 8D 80 C0 BD 00 D0 20
```

```
0EF8: 8D 83 13 BD 00 D4 8D 88 F1
0F00: C0 8D 82 13 AA BD 9A 19 FD
0F08: 8D 8E 13 A5 06 F0 02 A9 EE
0F10: FF 60 A9 00 8D 93 19 4C B4
0F18: 7C 1A 8D 61 1D 86 D0 84 EB
0F20: D1 8E 75 11 8C 79 11 86 7D
0F28: D2 84 D3 A0 00 A5 E0 91 3F
0F30: D2 A5 E1 C8 91 D2 A5 E2 EF
0F38: A0 03 91 D2 A9 03 8D 99 D4
0F40: 19 20 DC 0E 8D 8C 13 49 7D
0F48: FF 8D 8D 13 4C 62 0F A0 57
0F50: 00 B1 D2 85 E0 C8 B1 D2 ED
0F58: 29 03 85 E1 A0 03 B1 D2 E1
0F60: 85 E2 A2 FF 8E 84 13 8E 89
0F68: 87 13 8E 86 13 8E 89 13 42
0F70: A5 E0 8D 8A 13 A5 E1 8D 74
0F78: 8B 13 A9 03 8D 99 19 20 AB
0F80: DC 0E 4D 8C 13 F0 03 4C B1
0F88: 34 10 A6 E2 8D 80 C0 BD 75
0F90: FF D7 85 1B BD FF D8 85 2C
0F98: 1C BD 01 D8 85 D4 BD 01 DD
0FA0: D9 85 D5 8D 88 C0 AD 8E D1
0FA8: 13 51 26 91 26 A6 E2 F0 05
0FB0: 20 B1 1B 4D 8C 13 2D 8E 1D
0FB8: 13 8D 85 13 AD 84 13 F0 3C
0FC0: 0A AD 85 13 D0 05 A9 FF 1F
0FC8: 20 47 11 AD 85 13 8D 84 DD
0FD0: 13 E0 BF B0 20 B1 D4 4D 72
0FD8: 8C 13 2D 8E 13 8D 88 13 83
0FE0: AD 87 13 F0 0A AD 88 13 54
0FE8: D0 05 A9 01 20 47 11 AD E3
0FF0: 88 13 8D 87 13 CE 82 13 2E
0FF8: 4E 8E 13 90 1C A9 40 8D E2
1000: 8E 13 A9 06 8D 82 13 CE 2D
1008: 83 13 30 22 AD 83 13 4A C2
1010: A8 A2 01 90 01 CA 9D 54 19
1018: C0 A5 E0 D0 02 C6 E1 C6 E0
1020: E0 B1 26 4D 8C 13 2D 8E 50
1028: 13 D0 09 4C A6 0F A0 00 9E
1030: 84 E0 84 E1 A0 00 A5 E0 AA
1038: 91 D2 A5 E1 C8 91 D2 AD 88
1040: 8A 13 85 E0 AD 8B 13 85 70
1048: E1 AD 86 13 8D 84 13 AD 19
1050: 89 13 8D 87 13 E6 E0 D0 EA
1058: 02 E6 E1 A5 E0 C9 30 A5 FD
1060: E1 E9 02 90 03 4C 05 11 99
1068: A9 03 8D 99 19 20 DC 0E 7A
1070: 4D 8C 13 F0 03 4C 0D 11 40
1078: AD 8E 13 51 26 91 26 A6 F4
1080: E2 F0 20 B1 1B 4D 8C 13 A7
1088: 2D 8E 13 8D 85 13 AD 84 76
1090: 13 F0 0A AD 85 13 D0 05 B1
1098: A9 FF 20 47 11 AD 85 13 63
10A0: 8D 84 13 E0 BF B0 20 B1 CB
10A8: D4 4D 8C 13 2D 8E 13 8D A0
10B0: 88 13 AD 87 13 F0 0A AD 26
10B8: 88 13 D0 05 A9 01 20 47 25
10C0: 11 AD 88 13 8D 87 13 EE B6
10C8: 82 13 0E 8E 13 AD 82 13 01
10D0: C9 07 D0 1E A9 01 8D 8E 8E
10D8: 13 A9 00 8D 82 13 EE 83 87
10E0: 13 AD 83 13 C9 50 B0 1D A5
10E8: 4A A8 A2 01 90 01 CA 9D 78
10F0: 54 C0 E6 E0 D0 02 E6 E1 94
10F8: B1 26 4D 8C 13 2D 8E 13 6B
1100: D0 0B 4C 78 10 A0 02 84 E9
1108: E1 A0 2F 84 E0 A0 02 A5 A4
1110: E0 91 D2 A5 E1 88 0A 0A 0B
1118: 11 D2 91 D2 A5 D2 18 69 E8
1120: 04 85 D2 90 02 E6 D3 A5 02
1128: D0 C5 D2 A5 D1 E5 D3 B0 57
1130: 13 A5 D2 8D 9F 13 A5 D3 E0
1138: 8D A0 13 8D 54 C0 AD 61 E6
1140: 1D D0 31 60 4C 4F 0F 8D 9C
1148: 6E 11 A5 D0 18 69 04 85 9B
1150: D0 90 02 E6 D1 A5 D1 C9 40
1158: 95 B0 E0 98 48 A0 00 A5 81
1160: E0 91 D0 C8 A5 E1 91 D0 A6
1168: A0 03 A5 E2 18 69 00 91 76
1170: D0 68 A8 60 A9 00 85 D0 59
1178: A9 00 85 D1 05 D0 F0 F3 7E
1180: AD 9F 13 85 D2 AD A0 13 BD
1188: 85 D3 A9 03 8D 99 19 A5 72
1190: D2 45 D0 D0 06 A5 D3 45 48
1198: D1 F0 D8 A0 00 B1 D0 18 85
11A0: 69 01 85 E0 C8 B1 D0 29 4E
11A8: 03 69 00 85 E1 B1 D0 4A C0
11B0: 4A 85 E7 C8 B1 D0 38 E9 0E
11B8: 01 85 E6 B0 02 C6 E7 C8 68
11C0: B1 D0 85 E2 20 34 0C A5 5E
11C8: D0 18 69 04 85 D0 90 BF 17
11D0: E6 D1 B0 BB 8D 5D 1D A2 6B
11D8: 80 8E 81 13 4C B4 1D AD 5D
11E0: 81 13 8D 9E 13 8D 09 C0 C5
11E8: A5 0E 8D 08 C0 8D 81 13 E5
11F0: 2C 98 19 10 03 4C D0 1E 7C
11F8: AD 99 19 48 A5 30 29 0F 4F
1200: 8D 99 19 A5 E0 48 A5 E1 24
1208: 48 A5 E2 48 A5 E0 18 6D E8
1210: 5B 1D 85 E6 8D 9A 13 A5 EA
1218: E1 6D 5C 1D 85 E7 8D 9B 68
1220: 13 A5 E0 38 ED 5B 1D 85 73
1228: E0 8D 98 13 A5 E1 ED 5C 51
1230: 1D 85 E1 8D 99 13 A5 E2 A0
1238: 18 6D 5D 1D 85 E2 8D 9D B1
1240: 13 AD 5D 1D F0 0F 2C 9E 91
1248: 13 10 0A AD 61 1D 29 10 F7
1250: F0 03 20 34 0C 68 48 38 BF
1258: ED 5D 1D 85 E2 8D 9C 13 60
1260: 2C 9E 13 10 0A AD 61 1D 8C
1268: 29 20 F0 03 20 34 0C 68 C9
1270: 85 E3 68 85 E7 68 85 E6 88
1278: 68 8D 99 19 AD 9A 13 85 7C
1280: E0 AD 9B 13 85 E1 AD 9D D1
1288: 13 85 E2 AD 61 1D 29 01 A1
1290: F0 03 20 12 0F AD 9C 13 8E
1298: 85 E2 AD 61 1D 29 04 F0 8A
12A0: 03 20 12 0F AD 98 13 85 FC
12A8: E0 AD 99 13 85 E1 AD 61 7D
12B0: 1D 29 08 F0 03 20 12 0F 89
12B8: AD 61 1D 29 02 F0 08 AD D3
12C0: 9D 13 85 E2 20 12 0F A5 64
12C8: E6 85 E0 A5 E7 85 E1 A5 F6
12D0: E3 85 E2 60 20 67 DD 20 25
12D8: 52 E7 A5 51 A6 50 60 20 41
12E0: F8 E6 8A 48 20 15 13 20 AC
12E8: D4 12 48 8A 48 20 15 13 AD
12F0: 20 D4 12 86 3E 85 3F 20 AB
12F8: 15 13 20 D4 12 86 42 85 72
1300: 43 68 85 3C 68 85 3D 68 92
1308: 6A BA 8E 80 13 20 11 C3 EA
1310: AE 80 13 9A 60 A9 2C 4C 08
1318: C0 DE 20 D4 12 C9 FF D0 30
1320: 03 4C 21 0E A0 1F B1 50 15
1328: 99 A1 13 88 10 F8 60 20 B3
1330: A1 19 86 E2 84 E0 85 E1 01
1338: 20 B9 0E 68 68 4C 77 1F A7
1340: 60 AA 20 52 20 52 45 50 8F
```

Program 2: Chrome II Demo

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
73 5 REM COPYRIGHT 1987 COMPUTE!
     PUBLICATIONS, INC. ALL RIG
     HTS RESERVED.
C4 6 HOME : PRINT "COPYRIGHT 198
     7": PRINT "COMPUTE! PUBLICA
     TIONS, INC.": PRINT "ALL RI
     GHTS RESERVED.": FOR TT = 1
      TO 1500: NEXT TT: HIMEM: 2
     4320
23 7 PRINT CHR$ (4)"PR#3": PRINT
      : HGR 3: HCOLOR= 3: DOUBLE
      : SETPTN - 1: HOME : VTAB
     21
0E 8 INVERSE : PRINT "EXTENDED '
     CHROME' DEMO": NORMAL
C1 9 PRINT "DEMONSTRATES /FILL/,
     /AREA/,HCOLOR=4 USED WITH /
     HPLOT/,EXTENDED /ELLIPSE/
BB 10 PRINT "/LINE/, AND FINALLY
       THE SCREEN R/W AND SHIFT
      FUNCTIONS...
33 15 FOR Y = 1 TO 100
14 20 LINE Y,Y + Y,Y: NEXT
76 25 HCOLOR= 2
B2 30 AREA 75,40,450,150
90 35 HCOLOR= 1: HPLOT 0,159 TO
     559,0
7E 40 COLOR= 2: HCOLOR= 2
1A 45 ELLIPSE 250,60,35 AT 280,9
     0
7E 49 HCOLOR= 1
03 50 COLOR= 3: ELLIPSE 90,40,63
      AT 390,100
9D 65 INPUT "PRESS <RETURN>";A$
44 100 HOME
E2 105 VTAB 22
9F 110 PRINT "THE SCREEN READ/WR
     ITE MODES OF /LINE/ AND /
     AREA/ CAN BE USED TO OPEN
      AND CLOSE WINDOWS EASILY
     ..."
B6 120 REM
94 130 HCOLOR= 4
58 140 AREA 100,30,300,130 AT 24
     576
AJ 150 REM CLEAR WINDOW AND DRAW
      OUTLINE
8E 160 HCOLOR= 1
E2 170 AREA 100,30,300,130
8E 180 HCOLOR= 0
56 190 HPLOT 100,30 TO 300,30 TO
      300,130 TO 100,130 TO 10
     0,30
4B 200 REM PRINT O-K USING WITHO
     UT SHAPES
56 210 ELLIPSE 20,20,15 AT 175,8
     0
D0 215 ELLIPSE 19,19,15 AT 175,8
     0
C2 220 HPLOT 205,60 TO 205,100
CE 225 HPLOT 204,60 TO 204,100
11 230 HPLOT 205,80 TO 245,60
1D 235 HPLOT 204,80 TO 244,60
EE 240 HPLOT 205,80 TO 245,100
FA 245 HPLOT 204,80 TO 244,100
FC 250 INPUT "HIT ANY KEY";A$
51 255 PRINT "AND WITH /FILL/ YO
     U CAN DO MONOCHROME AND P
     ATTERNED FILL-INS
1F 260 FILL 150,70,32000,1
92 280 INPUT "HIT ANY KEY";A$: F
     OR X = 2100 TO 2131: READ
      A: POKE X,A: NEXT
E4 285 PRINT "AND EVEN /REFILL/
     WHAT WAS FILLED WITH THE
     CURRENT PATTERN
8B 290 SETPTN 2100: REFILL
04 300 REM RESTORE BACKGROUND
96 310 HCOLOR= 5
56 320 AREA 100,30,300,130 AT 24
     576
55 400 DATA 64,64,64,64
CF 410 DATA 32,32,32,32
B3 420 DATA 16,16,16,16
01 430 DATA 8,8,8,8
58 440 DATA 4,4,4,4
05 450 DATA 2,2,2,2
5C 460 DATA 1,1,1,1
5E 470 DATA 1,1,1,1
A4 500 HOME : VTAB 21
32 510 PRINT "AND FINALLY /ELLIP
     SE/ CAN BE USED TO MAKE U
     NUSUAL WINDOWS
17 520 COLOR= 4
72 560 ELLIPSE 200,50,48 AT 280,
     76 AT 24576
90 570 HCOLOR= 0
1D 580 COLOR= 1
5A 590 ELLIPSE 200,50,63
98 591 HCOLOR= 0
18 592 REM  DRAW AN "X"
34 593 HPLOT 0,50 TO 559,109
37 594 HPLOT 0,109 TO 559,50
F6 600 INPUT "HIT ANY KEY";A$
1A 620 COLOR= 5
6D 630 ELLIPSE 200,50,48 AT 280,
     76 AT 24576
```

©

Atari Multiple File Deleter

Craig Stadler

Free up valuable disk space by quickly discarding old files with this handy disk utility. For all Atari eight-bit computers.

Once your disk library has grown to a dozen or more disks, discarding old files can become quite a chore. "Atari Multiple File Deleter" simplifies the housekeeping, allowing you to scratch files with the press of a key.

Getting Started

Type in and save a copy of Multiple File Deleter. To use the program, load it and type RUN.

First, choose the drive from which you would like to delete files. If you are using DOS 2.5 with the RAMDISK.COM file on a 130XE, you may choose drive 8—the ramdisk. Insert the correct disk into the selected drive, then press any key to continue. Each file on the disk is displayed, one at a time. Press D if you wish to delete the file. Press RETURN if you want to keep the file. Press X to escape and start over. To exit the program without deleting any files, press the BREAK key.

The files aren't deleted when you press D—in fact, no files are deleted until you have decided whether or not to delete every file on the disk. Before the files tagged for deletion are actually deleted, you are given one final chance to change your mind and start over.

For the safety of your files, this utility does not attempt to delete locked files. Files can be locked and unlocked from the DOS menu. If you wish to unlock all the files on a disk at once, enter *.* as the filename after choosing unlock.

Atari Multiple File Deleter

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
AO 10  REM COPYRIGHT 1987  CO
       MPUTE! PUBLICATIONS, I
       NC.  ALL RIGHTS RESERV
       ED.
GG 20  ? "{CLEAR}":POSITION 1
       3,6:PRINT "Copyright 1
       987":POSITION 6,7:PRIN
       T "COMPUTE! Publicatio
       ns, Inc."
KD 30  POSITION 10,8:PRINT "A
       ll Rights Reserved.":F
       OR I=1 TO 1500:NEXT I
NB 100 CLR :POP :GRAPHICS 0:
       GOSUB 1000
MF 110 ? "{CLEAR}____Atari M
       ultiple file deleter_
       ____":?
AG 120 TRAP 110:? "Use drive
        1-8:";:INPUT DR:IF D
       R<1 OR DR>8 THEN 120
FL 130 DR$(1,1)="D":DR$(2,2)
       =STR$(INT(DR)):DR$(3,
       6)=":*.*"
OD 140 ? "{UP}Insert disk an
       d hit any key.";:GET
       #A2,A
ML 150 CLOSE #A1:OPEN #A1,A6
       ,A0,DR$:TRAP 110
JC 160 ? :? "{UP}{6 SPACES}R
       ETURN for next file
       {3 SPACES}":? "{TAB}
       D to delete file":? "
       {TAB} X to end select
       ions"
DE 170 ? "_________________
       _________________":?
       "{TAB}{7 SPACES}Drive
        #";DR:? :?
MP 180 FOR A=A0 TO 65:TRAP 3
       20:INPUT #A1,A$:IF A$
       (14,15)="OR" THEN 320
GJ 190 ? ;A+1;"{TAB}";A$(1,1
       );
NC 200 A$(1,11)=A$(3,13):FOR
        X=A1 TO 8:IF A$(X,X)
       =CHR$(32) THEN 220
HA 210 ? A$(X,X);:NEXT X
NK 220 ? ".";A$(9,11);"
       {TAB}";A$(15,17);":";
HK 230 GET #A2,C
GD 240 IF C=155 OR C=68 OR C
       =88 THEN ? CHR$(C)
AB 250 IF C=155 THEN ? "
       {3 UP}":NEXT A
DH 260 IF C=88 THEN 10000
BK 270 IF C=68 THEN GOSUB 29
       0:NEXT A
GI 280 GOTO 230
HJ 290 DIR$(LEN(DIR$)+1)=DR$
       (1,3):DIR$(LEN(DIR$)+
       1)=A$(1,X-1)
EG 300 DIR$(LEN(DIR$)+1)=CHR
       $(46):DIR$(LEN(DIR$)+
       1)=A$(9,11)
LL 310 DIR$(LEN(DIR$)+1)=CHR
       $(155):RETURN
NB 320 ? :? :? "PRESS X TO E
       XIT":? "PRESS ANY KEY
        TO BEGIN":GET #A2,CC
BI 330 IF CC=88 THEN 100
EI 340 ? :CLOSE #A1:IF LEN(D
       IR$)<5 THEN 100
FA 350 FOR A=A1 TO LEN(DIR$)
       :XD=XD+1
BJ 360 IF DIR$(A,A)=CHR$(155
       ) THEN 420
EI 370 DR$(XD,XD)=DIR$(A,A)
OC 380 NEXT A:? :? "END OR R
       ESTART PROGRAM?";:GET
        #A2,CC
KI 390 IF CC=69 OR CC<>82 TH
       EN ? "{CLEAR}":END
EJ 400 IF CC=82 THEN GOTO 10
       0
MA 410 REM DELETE FILENAMES
FB 420 ? "DELETING-";DR$:TRA
       P 430:XIO 33,#A1,A0,A
       0,DR$:XD=0:GOTO 380
KG 430 ? "FILE-";DR$:? "LOCK
       ED/DISK ERROR":? "NEX
       T FILE...":XD=0:GOTO
       380
GM 1000 DIM A$(17),DIR$(600)
        ,DR$(15)
OB 1010 A0=0:A1=1:A2=2:A4=4:
        A6=6:A33=33:XD=0
AF 1030 CLOSE #A2:OPEN #A2,A
        4,A0,"K:"
KF 1040 RETURN
```

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Twin Pack
For The Commodore 64

Steve Feinstein

This handy pair of utilities gives BASIC programmers the ability to delete multiple program lines and, with a single-character command, to list selected lines.

"Twin Pack" adds two useful programming utilities to your 64: Erase, and a LIST command with a memory. The Erase command deletes several program lines at once. Twin Pack's List command lists program lines and *remembers* these lines for later use.

Both commands are called by entering a period (.) followed by the appropriate single character: Erase and List are called by typing .E and .L, respectively.

Using The Program

Because Twin Pack is written in machine language, it must be typed in with "MLX," the machine language entry program found elsewhere in this issue. When you run MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. For Twin Pack, respond with the following values:

Starting address: C000
Ending address: C127

After you've entered all the data, be sure to save a copy before leaving MLX.

To use Twin Pack, load it with a statement of the form

```
LOAD "TWINPACK",8,1
```

(Tape users should replace the ,8,1 with ,1,1.) After the loading is completed, activate the program with the command SYS 49152. When the READY prompt returns, Twin Pack is ready for use.

The Erase command is called by entering

```
.E starting line-ending line
```

where *starting line* is the number of the first line to be erased and *ending line* is the number of the last line. So, the command

```
.E10-100
```

erases lines 10 through 100, inclusively. Lines deleted with the Erase command cannot be recovered. If you accidently erase any important program lines, you will have to retype them.

Twin Pack's List command is called by entering

```
.L starting line-ending line
```

where, again, *starting line* and *ending line* specify the range of line numbers to list. To list a single line, you must supply the same number for both *starting line* and *ending line*.

What makes this command different than BASIC's list command is that Twin Pack remembers which lines were last listed. So, to see the program lines that were previously listed, all you have to do is enter a period (.) and press RETURN. This single-character List command can come in handy when you are working on a particular section of your program.

Twin Pack

Please refer to the "MLX" article in this issue before entering the following program.

```
C000:A9 4C 85 7C A9 00 85 7D EB
C008:A9 C0 85 7E 60 C9 2E D0 7E
C010:08 48 A5 7A C9 00 F0 09 3D
C018:68 C9 3A 90 01 60 4C 80 33
C020:00 68 20 73 00 D0 03 4C 8C
C028:AB C0 C9 4C D0 03 4C AB 84
C030:C0 C9 45 D0 E6 20 73 00 D8
C038:20 6B A9 20 13 A6 A5 5F B9
C040:85 FB A5 60 85 FC 20 73 12
C048:00 20 6B A9 20 13 A6 A0 15
C050:00 38 B1 5F 85 FD E5 FB F7
C058:8D A7 02 C8 B1 5F 85 FE 6C
C060:E5 FC 8D A8 02 A2 00 A0 8B
C068:00 84 02 B1 FD F0 04 86 A8
C070:02 D0 09 E6 02 A5 02 C9 2B
C078:03 F0 0C 8A 91 FB C8 D0 C0
C080:EA E6 FC E6 FE D0 E4 A9 ED
C088:00 91 FB 38 A5 2D ED A7 D6
C090:02 85 2D 85 2F 85 31 A5 0A
C098:2E ED A8 02 85 2E 85 30 02
C0A0:85 32 20 D7 AA 20 33 A5 D4
C0A8:4C 74 A4 C9 4C F0 10 AD 92
C0B0:1F C1 D0 08 AD 20 C1 D0 0F
C0B8:03 4C A2 C0 4C DF C0 20 B2
C0C0:73 00 20 6B A9 A5 14 8D 50
C0C8:1F C1 A5 15 8D 20 C1 20 E0
C0D0:73 00 20 6B A9 A5 14 8D 60
C0D8:21 C1 A5 15 8D 22 C1 AD 87
C0E0:00 03 8D 23 C1 AD 01 03 D0
C0E8:8D 24 C1 A9 0F 8D 00 03 BE
C0F0:A9 C1 8D 01 03 AD 1F C1 48
C0F8:85 14 AD 20 C1 85 15 20 68
C100:13 A6 AD 21 C1 85 14 AD 78
C108:22 C1 85 15 20 BD A6 AD 02
C110:23 C1 8D 00 03 AD 24 C1 20
C118:8D 01 03 6C 00 03 00 00 D5
C120:00 00 00 00 00 00 00 00 A3
```

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Directory Menu For IBM

Paul W. Carlson

This handy utility displays a directory of all the BASIC programs on your disk and allows you to load, run, rename, or delete them with just the touch of a key. A color/graphics adapter or equivalent hardware is required, along with BASICA for the PC, GW-BASIC for compatibles, or Cartridge BASIC for the PCjr.

Have you ever wished that managing your BASIC programs was easier? There are BASIC commands to load, run, rename, and delete files, but they can be time-consuming and cumbersome to use. "Directory Menu for IBM" makes performing these BASIC file operations simple and fast.

To get started, type in and save the program below. Save it with a short name that's easy to remember (for example, DM for DISK MENU) so that you can run it quickly—it's a program you're likely to use often. In fact, you'll probably want a copy of the program on any disk with which you'll be doing BASIC programming. The program is only 1667 bytes long, so it won't use much disk space.

Now run the program. You'll see the current directory displayed at the top of the screen followed by a list of all the BASIC programs (.BAS files) in the directory. After the list of files, the total number of free bytes on the disk is shown. The menu selections appear at the bottom of the screen. An arrow will be pointing to the name of the first file in the list. Use the cursor keys to move the arrow. Don't be concerned about moving the arrow too far—the program won't let you move it off of the list.

With the arrow pointing at the file you want to load, run, rename, or delete, simply press the key corresponding to the highlighted letter of the menu selection. If you press N to rename a file, you'll be prompted for the new name. (The program will allow you to enter a name with an extension other than .BAS, but the new name won't appear in the updated directory listing.) After you enter the new name, the directory of BASIC programs will be redisplayed and you can continue with the menu program. The file that you renamed will probably not be in the same location in the list as it was previously.

If you press D, the file the arrow is pointing to will be deleted immediately, so be sure you really want to delete it—you won't get a second chance. After a file is deleted, the directory of BASIC programs is redisplayed and you can continue with the menu program.

If you load or run a program, it will replace the menu program if it is in memory. This means you won't be able to continue with the menu program unless you reload it from disk and run it again.

The program will trap any errors and, after printing an error message, will allow you either to continue or to quit the menu program. There is one exception: If a syntax error is found, the program will stop and display the line containing the syntax error.

How It Works

Directory Menu for IBM uses the PC's *memory-mapped video*. (Memory-mapped simply means that anything displayed on the screen is also stored at known locations in memory.) Since you may want to use video memory in programs of your own, here's a brief explanation of how it works (for more details, see page 173 of *Mapping the IBM PC and PCjr* from COMPUTE! Books). Some of the variables involved are NF, the number of files displayed; F, the number of the file that the arrow moves from; T, the number of the file that the arrow moves to; and F$, the name of the file.

The program sets the default segment to &HB800 (line 10). This is the beginning of video memory for the IBM color/graphics adapter. All PEEK and POKE values will now be the number of bytes counting from the beginning of video memory. The program uses the FILES statement to display all the .BAS files on the screen and place the names in video memory (line 40). Then it counts the number of files displayed by PEEKing in video memory and checking for the presence of the period (.) that separates the filename from its BAS extension (line 50). The program POKEs the number 112 into the proper attribute bytes in video memory to highlight the first character for each of the menu selections (lines 70 through 110).

The program reads the names of the files directly from video memory by starting at the memory location corresponding to the beginning of a filename and PEEKing every other memory location (skipping the attribute bytes) until either a space or a period is found (lines 450 through 470). This eliminates the extra spaces, if any, after the filename. The .BAS extension is

added to the filename before a file is renamed or deleted.

Directory Menu For IBM

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
AB 1 REM COPYRIGHT 1987  COMPUTE
     ! PUBLICATIONS, INC.  ALL R
     IGHTS RESERVED.
JB 2 CLS:LOCATE 10,30:PRINT "Cop
     yright 1987":LOCATE 11,24:P
     RINT "COMPUTE! Publications
     , Inc."
EC 3 LOCATE 12,27:PRINT "All Rig
     hts Reserved.":FOR I = 1 TO
      1500:NEXT I
NC 10 T=0:F=0:DEF SEG=&HB800:SCR
     EEN 0,0,0,0:WIDTH 80:KEY O
     FF
FC 20 P$=CHR$(17)+CHR$(205)+CHR$
     (205)+CHR$(60)
DI 30 ON ERROR GOTO 270
KL 40 CLS:LOCATE,,0:A$="F":FILES
     "*.BAS":NF=0:PRINT:PRINT
CN 50 K=176+160*(NF\4)+36*(NF MO
     D 4):J=PEEK(K):IF J=46 THE
     N NF=NF+1:GOTO 50
MC 60 GOSUB 480
NL 70 LOCATE 25,10,0:PRINT"Load"
     ;:POKE 3859,112
FI 80 LOCATE 25,20,0:PRINT"Run";
     :POKE 3879,112
LL 90 LOCATE 25,30,0:PRINT"Name"
     ;:POKE 3899,112
HH 100 LOCATE 25,40,0:PRINT"Dele
     te";:POKE 3919,112
HO 110 LOCATE 25,50,0:PRINT"Quit
     ";:POKE 3939,112
CE 120 ON KEY (11) GOSUB 500
GE 130 ON KEY (12) GOSUB 520
KE 140 ON KEY (13) GOSUB 540
OE 150 ON KEY (14) GOSUB 560
DL 160 KEY (11) ON:KEY (12) ON:K
     EY (13) ON:KEY (14) ON
GA 170 A$=INKEY$:IF A$="" THEN 1
     70
PD 180 KEY (11) OFF:KEY (12) OFF
     :KEY (13) OFF:KEY (14) OF
     F
FG 190 A$=CHR$(ASC(A$) AND 223):
     IF A$<>"L" AND A$<>"R" TH
     EN 210
DA 200 GOSUB 450:CLS:PRINT"Searc
     hing for ";F$;".BAS"
EL 210 IF A$="L" THEN LOAD F$
CB 220 IF A$="R" THEN LOAD F$,R
OF 230 IF A$="D" THEN GOSUB 450:
     KILL F$+".BAS":T=0:F=0:GO
     TO 40
HC 240 IF A$="N" THEN GOSUB 450:
     GOTO 330
IB 250 IF A$<>"Q" THEN 160
BL 260 CLS:ON ERROR GOTO 0:END
IP 270 IF ERR<51 THEN 260
IL 280 RESUME 290
EN 290 IF A$="N" THEN 350
GN 300 IF A$="L" OR A$="R" THEN
     390
BC 310 IF A$="D" THEN CLS:GOTO 3
     90
IL 320 IF A$="F" THEN 400
OE 330 CLS:PRINT"RENAME ";F$;".B
     AS TO ";:LINE INPUT;N$
EC 340 NAME F$+".BAS" AS N$:GOTO
      40
BK 350 PRINT CHR$(7):PRINT"ERROR
     - possible causes:"
BH 360 PRINT"   New file name wa
     s illegal"
IP 370 PRINT"   New file name al
     ready exists"
ON 380 PRINT"   Disk access erro
     r":PRINT:GOTO 410
DB 390 PRINT CHR$(7):PRINT F$;".
     BAS not found.":PRINT:GOT
     O 410
ID 400 PRINT CHR$(7):PRINT"No .B
     AS files in this director
     y":PRINT
ND 410 PRINT"Press C to continue
      or Q to quit...";
AH 420 R$=INKEY$:IF R$="C" OR R$
     ="c" THEN 40
JJ 430 IF R$="Q" OR R$="q" THEN
     260
EL 440 GOTO 420
IJ 450 F$="":E=160+160*(T\4)+36*
     (T MOD 4)
IP 460 U=PEEK(E):IF U<>46 AND U<
     >32 THEN F$=F$+CHR$(U):E=
     E+2:GOTO 460
NM 470 RETURN
PK 480 RW=F\4+2:CL=18*(F MOD 4+1
     )-5:LOCATE RW,CL,0:PRINT"
        ";
OL 490 RW=T\4+2:CL=18*(T MOD 4+1
     )-5:LOCATE RW,CL,0:PRINT
     P$;:F=T:RETURN
AA 500 V=F-4:IF V>=0 THEN T=V:GO
     SUB 480
MB 510 RETURN
PJ 520 V=F-1:IF V>=0 THEN T=V:GO
     SUB 480
MF 530 RETURN
EF 540 V=F+1:IF V<NF THEN T=V:GO
     SUB 480
NJ 550 RETURN
GE 560 V=F+4:IF V<NF THEN T=V:GO
     SUB 480
NN 570 RETURN
```

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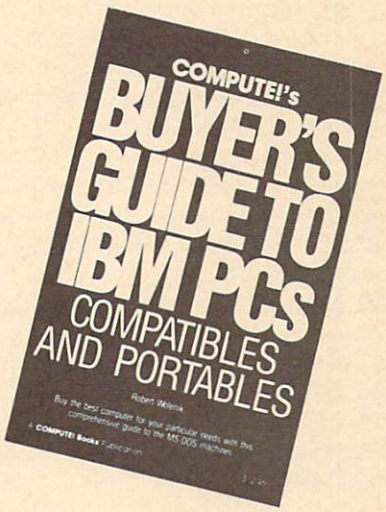

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IFF To Icon Translator For The Amiga

Charles L. Baker

Design your own Workbench icons using programs such as Deluxe Paint, Aegis Images, *and* Graphicraft.

"IFF to Icon" lets you customize your Workbench icons by translating IFF image files into Workbench info files. IFF (Interchange File Format) is a standard file structure developed jointly by Electronic Arts and Commodore-Amiga. Most commercial drawing programs for the Amiga store images according to the IFF standards.

In order for a file's icon to appear on the Workbench screen, there must be a corresponding info file. The Preferences program, for example, has the Preferences.info file associated with it. Drawers, the Trashcan (a special type of drawer), and even disks use info files to describe what their icons look like. By modifying info files, we can redefine Workbench icons.

Creating An Image

Before you can use this program, you must create an image file with *Deluxe Paint* or any other IFF-compatible program. This article will describe what you must do when using *Deluxe Paint;* other programs use a similar process. Once you have created the image file, you can run IFF to Icon to convert your image into a Workbench icon.

Before you create the image, set the drawing program to the type of screen which your Workbench uses—either medium-resolution or high-resolution (interlace). The icon's colors are ultimately determined by the Workbench and not the drawing program used to design the icon. You may use the Preferences program to change the Workbench colors. Remember that the Workbench only uses four colors.

After you have drawn the desired image, it must be saved as a brush. To select an image as a brush within *Deluxe Paint,* click the left mouse button on the brush-selection tool and drag a selection box around the image. To save a brush file, select Save or Save As from the Brush menu.

Exit the drawing program. At this point, the image has been saved as a brush file on disk. To minimize disk swapping, you should copy the brush file to your BASIC work disk.

Getting Started

Type in and save IFF to Icon. The program uses the system library file named icon.bmap. In order for Amiga Basic to use this library, it must have a file description of the library in a form which it understands. This form is called a *bmap file.* The bmap file is essentially a list of pointers that allow Amiga Basic to access library routines.

The file icon.bmap must be created before you can run IFF to Icon. If you have version 1.2 of the Amiga operating system (available as an inexpensive upgrade from any Amiga dealer), you can create icon.bmap quite easily. The BASIC-Demos disk for 1.2 contains a BASIC program named ConvertFd, as well as a directory named FD1.2. Run the ConvertFd program and enter the following information when prompted:

```
Enter name of .fd file to read > Amiga
  Extras:fd1.2/icon-lib.fd
Enter name of .bmap file to produce >
  icon.bmap
```

When the ConvertFd program is finished, the disk contains the icon.bmap file. Copy this file onto the same disk as the IFF to Icon program. When IFF to Icon is run, the icon.bmap file must be either in the current directory or in the directory named LIBS (LIBrarieS) on the disk used when you booted the system. The LIBS directory is a good place for bmap files, since their purpose is to give you access to libraries. If you don't have the bmap files

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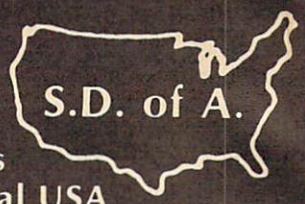

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in the correct place, BASIC will stop with a *file not found* error when you run IFF to Icon.

Using The Program

Run IFF to Icon. The program asks you to enter the name of the IFF file to translate and the name of the info file to modify. You must specify the disk and folder in which the programs are located. Do not include the .info extension when entering the second filename. The program does this for you. If you wish to change the trashcan's icon, for example, simply enter the filename TRASHCAN. The IFF to Icon program does not create new info files; it modifies existing ones. So, the info file must already exist on disk.

After both filenames have been entered, IFF to Icon translates the IFF image, creates a temporary image file of its own, and finally modifies the specified info file. To convert IFF image files, this program uses code from the "IFF Translator" program published in the April 1987 issue.

Even after modification, a file's original icon will stay on the Workbench screen until the file, drawer, or disk is closed and redrawn. For files and drawers, this means closing and reopening the window that the icon is located in. If you modified a disk's icon, you must close all drawers and windows from the disk, remove the disk from the drive, and reinsert the disk after the original icon has disappeared. In some cases, you may have to reboot in order to remove the original disk icon from the Workbench screen.

IFF To Icon

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
'  Copyright 1987 COMPUTE! Publi
cations, Inc.
'  All Rights Reserved
'
'  IFF to Icon
'
DECLARE FUNCTION GetDiskObject&
LIBRARY
DECLARE FUNCTION PutDiskObject&
LIBRARY
DECLARE FUNCTION FreeDiskObject&
LIBRARY
'
LIBRARY "icon.library"
'
MainLine:
GOSUB InitiaLize
OPEN FiLeIFF$ FOR INPUT AS 1
PRINT "Reading from file     : ";
FiLeIFF$
GOSUB TransLateChunks
CLOSE 1
OPEN FiLeIFF$+"_Image" FOR OUTPU
T AS 1
PRINT "Writing to file       : ";
FiLeIFF$+"_Image"
GOSUB CreateImageFiLe
CLOSE 1
OPEN FiLeIFF$+"_Image" FOR INPUT
AS 1
PRINT "Translating file      : ";
FiLeIFF$+"_Image"
GOSUB TransLateImage
CLOSE 1
KILL FiLeIFF$+"_Image"
PRINT "Modifying file        : ";
FiLeInfo$+".info"
GOSUB CreateInfoFiLe
LIBRARY CLOSE
END
'
InitiaLize:
WINDOW 1,"Brush To Icon",(0,120)
-(450,186),15
PRINT "Copyright 1987 COMPUTE! P
ublications, Inc."
PRINT "           All Rights Rese
rved.":PRINT
DEFINT a-z
DIM R1(31), G1(31), B1(31)
true = -1
faLse = 0
INPUT "IFF file to translate: ",
FiLeIFF$
INPUT ".info file to modify : ",
FiLeInfo$
RETURN
'
TransLateChunks:
ckID$=INPUT$(4,1)
SkipData$=INPUT$(4,1)
ckType$=INPUT$(4,1)
IF ckID$ <> "FORM" OR ckType$ <>
"ILBM" THEN
PRINT "File is not a FORM ILBM c
hunk."
STOP
END IF
FoundBMHD = faLse
FoundCMAP = faLse
WHILE true
ckID$=INPUT$(4,1)
ckLength&=CVL(INPUT$(4,1))
IF ckID$="BMHD" THEN
GOSUB TransLateBMHD
FoundBMHD = true
ELSEIF ckID$="CMAP" THEN
GOSUB TranslateCMAP
FoundCMAP = true
ELSEIF ckID$="BODY" THEN
IF FoundBMHD AND FoundCMAP THEN
GOSUB TransLateBODY
RETURN
ELSE
PRINT "Context chunks are missin
g."
STOP
END IF
ELSE
SkipData$=INPUT$(ckLength&,1)
SkipData$=""
END IF
IF ckLength& MOD 2 THEN
SkipData$=INPUT$(1,1)
END IF
WEND
'
TransLateBMHD:
Wide&=CVI(INPUT$(2,1))
Height&=CVI(INPUT$(2,1))
SkipData$=INPUT$(4,1)
depth&=ASC(INPUT$(1,1))
Masking=ASC(INPUT$(1,1))
Compression=ASC(INPUT$(1,1))
SkipData$=INPUT$(1,1)
TransCoLor=CVI(INPUT$(2,1))
SkipData$=INPUT$(2,1)
PageWidth=CVI(INPUT$(2,1))
PageHeight=CVI(INPUT$(2,1))
ScnMode=PageWidth/320+2*(PageHei
ght/200-1)
pLanepick=2^depth&-1
IF Masking<>2 THEN
PRINT "Unknown masking technique
used."
STOP
END IF
IF Compression = 0 THEN
FiLeCompressed = faLse
ELSEIF Compression = 1 THEN
FiLeCompressed = true
ELSE
PRINT "Unknown compression techn
ique used."
STOP
END IF
IF TransCoLor <>0 THEN
PRINT "Register zero is not the
transparent color."
STOP
END IF
Header$=MKL$(0)+MKL$(0)+MKL$(dep
th&)+MKL$(Wide&)+MKL$(Height&)
Header$=Header$+MKI$(24)+MKI$(pL
anepick)+MKI$(0)
RETURN
'
TranslateCMAP:
CoLorCount=ckLength&/3-1
FOR register=0 TO CoLorCount
R1(register)=INT(ASC(INPUT$(1,1)
)/12)/20
G1(register)=INT(ASC(INPUT$(1,1)
)/12)/20
B1(register)=INT(ASC(INPUT$(1,1)
)/12)/20
NEXT register
RETURN
'
TransLateBODY:
BytesPerRow = 2*INT((Wide&+15)/1
6)
BytesPerPLane = BytesPerRow*Heig
ht&
ReqBytes = BytesPerPLane*depth&
BitMap$=STRING$(ReqBytes,CHR$(0)
)
FOR RowNo=1 TO Height&
pointer=1+BytesPerRow*(RowNo-1)
FOR PLaneNo=1 TO depth&
Offset=BytesPerPLane*(PLaneNo-1)
IF FiLeCompressed THEN
Row$=""
WHILE LEN(Row$)<BytesPerRow
UByte=ASC(INPUT$(1,1))
ControLByte=UByte-2*(UByte AND 1
28)
IF ControLByte<-127 THEN
' No operation
ELSEIF ControLByte<0 THEN
Row$=Row$+STRING$(-ControLByte+1
,INPUT$(1,1))
ELSEIF ControLByte<128 THEN
Row$=Row$+INPUT$(ControLByte+1,1
)
END IF
WEND
ELSE
Row$=INPUT$(BytesPerRow,1)
END IF
MID$(BitMap$,pointer+Offset,Byte
sPerRow)=Row$
NEXT PLaneNo
NEXT RowNo
RETURN
'
CreateImageFiLe:
PRINT#1, Header$+BitMap$;
```

```
RETURN
'
TransLateImage:
garbage$     = INPUT$(8,1)
' throw away colorset and datase
t
depth&       = CVL(INPUT$(4,1))
' depth of screen in bitmaps
bwidth&      = CVL(INPUT$(4,1))
' width of screen in pixels
bheight&     = CVL(INPUT$(4,1))
' height of screen in pixels
garbage$     = INPUT$(2,1)
' drop masking flags
pLanepick%   = CVI(INPUT$(2,1))
pLaneonoff%  = CVI(INPUT$(2,1))
bit$         = INPUT$(LOF(1)-26,1
)   ' bitplane data
RETURN
'
CreateInfoFiLe:
diskobj& = GetDiskObject&(SADD(F
iLeInfo$))
IF diskobj& = 0 THEN
PRINT "error opening ";FiLeInfo$
;".info"
GOTO ending
END IF
POKEL diskobj& + 8, 0     ' top c
orner at 0,0
POKEW diskobj& + 12, bwidth&
POKEW diskobj& + 14, bheight&
imageptr& = PEEKL(diskobj& + 22)
'
POKEW imageptr& + 4,   bwidth&
POKEW imageptr& + 6,   bheight&
POKEW imageptr& + 8,   depth&
POKEL imageptr& + 10, SADD(bit$)
'
POKE  imageptr& + 14, pLanepick%
'
POKE  imageptr& + 15, pLaneonoff
%
erro&=PutDiskObject&(SADD(FiLeIn
fo$), diskobj&)
IF erro& = 0 THEN
PRINT "error on file writing "
END IF
erro&=FreeDiskObject&(diskobj&)
IF erro& <> 0 THEN
PRINT "error on memory clearing
--> ";erro&
END IF
ending:
RETURN
'
```

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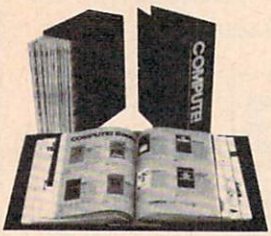

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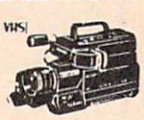

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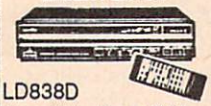

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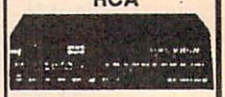

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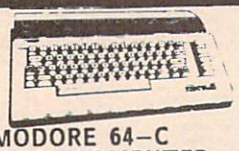

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Atari Marbles

A printing problem obliterated a character in line 1580 of the Atari version of this game from the October issue (Program 1, p. 40). The line should read as follows:

```
1580 ML=USR(ADR(MOVE$), 57344,
  CHSET, 1024)
```

Monte Carlo

All versions of this game program from the September issue (p. 30) are correct as listed, except for a minor problem in the Amiga version. The copyright message in the first line of Program 4 should begin with an apostrophe ('), which Amiga Basic accepts as a substitute for the REM statement.

Reader Joseph Meany has provided an enhancement to the Commodore version (Program 1) which allows the game to be played with a joystick in addition to the keyboard. If you are interested in this modification, add or change the following lines:

```
840 GET A$:J=PEEK(56320):IF(A$
   ="" ANDJ=127) THEN 840
842 J=-13*(J=111)-145*(J=126)-
   17*(J=125)-157*(J=123)-29*(
   J=119)
844 IF A$="" THEN A$=CHR$(J)
846 FOR DE=1 TO 100:NEXT DE
```

With these changes, you can use a joystick in port 2 to move the card cursor. Press the fire button to select a card. You must still use the keyboard to enter other commands.

BASIC Batch Files With Atari DOS

The article with this handy utility from the August issue (p. 81) suggested that batch files could be used to load and run BASIC programs. However, reader Justin E. Wilder discovered a problem with this technique. A BASIC program started from a batch file will crash with an ERROR 133 message if it contains any INPUT statements. This occurs because the the IOCB channel value in location 180 is left set to 7, the batch-file channel. The solution is to add a POKE 180,0 command to the batch file to reset the system for the default channel (the screen editor). To work properly, the POKE must appear on the same line as the LOAD or RUN command, and on the last line of the batch file (once the POKE is executed, no more lines will be read from the disk). For example, the proper batch-file line to automatically load and run a BASIC program named GAME.BAS would be

```
POKE 180,0:RUN "D:GAME.BAS"
```

IBM QuickChange

This memory-resident screen color selection program from the September issue (p. 82) will not work on the IBM PCjr. ©

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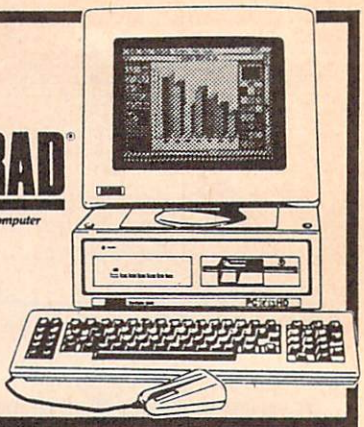

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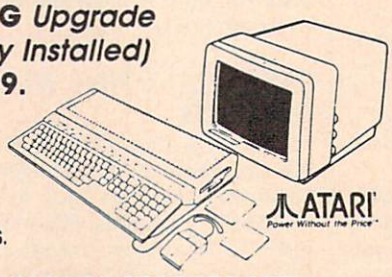

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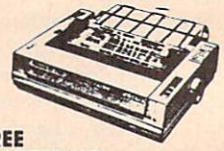

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COMPUTE!'s Guide To Typing In Programs

Computers are precise—type the program *exactly* as listed, including necessary punctuation and symbols, except for special characters noted below. We have provided a special listing convention as well as a program to check your typing—"The Automatic Proofreader."

Programs for the IBM, TI-99/4A, and Atari ST models should be typed exactly as listed; no special characters are used. Programs for Commodore, Apple, and Atari 400/800/XL/XE computers may contain some hard-to-read special characters, so we have a listing system that indicates these control characters. You will find these Commodore and Atari characters in curly braces; *do not type the braces.* For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A complete list of these symbols is shown in the tables below. For Commodore, Apple, and Atari, a single symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. This will produce a reverse video character on the Commodore (in quote mode), a graphics character on the Atari, and an invisible control character on the Apple.

Graphics characters entered with the Commodore logo key are enclosed in a special bracket: [<A>]. In this case, you would hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S. One exception is {SHIFT-SPACE}. When you see this, hold down SHIFT and press the space bar. If a number precedes a symbol, such as {5 RIGHT}, {6 S}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (white on black) should be entered with the inverse video

Atari 400/800/XL/XE

When you see	Type	See	
{CLEAR}	ESC SHIFT <		Clear Screen
{UP}	ESC CTRL -	↑	Cursor Up
{DOWN}	ESC CTRL =	↓	Cursor Down
{LEFT}	ESC CTRL +	←	Cursor Left
{RIGHT}	ESC CTRL *	→	Cursor Right
{BACK S}	ESC DELETE		Backspace
{DELETE}	ESC CTRL DELETE		Delete character
{INSERT}	ESC CTRL INSERT		Insert character
{DEL LINE}	ESC SHIFT DELETE		Delete line
{INS LINE}	ESC SHIFT INSERT		Insert line
{TAB}	ESC TAB		TAB key
{CLR TAB}	ESC CTRL TAB		Clear tab
{SET TAB}	ESC SHIFT TAB		Set tab stop
{BELL}	ESC CTRL 2		Ring buzzer
{ESC}	ESC ESC		ESCape key

Commodore PET/CBM/VIC/64/128/16/+4

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL 9	
{OFF}	CTRL 0	
{BLK}	CTRL 1	
{WHT}	CTRL 2	
{RED}	CTRL 3	
{CYN}	CTRL 4	
{PUR}	CTRL 5	
{GRN}	CTRL 6	
{BLU}	CTRL 7	
{YEL}	CTRL 8	

When You Read:	Press:	See:
[<1>]	COMMODORE 1	
[<2>]	COMMODORE 2	
[<3>]	COMMODORE 3	
[<4>]	COMMODORE 4	
[<5>]	COMMODORE 5	
[<6>]	COMMODORE 6	
[<7>]	COMMODORE 7	
[<8>]	COMMODORE 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	
←	←	

key (Atari logo key on 400/800 models).

Whenever more than two spaces appear in a row, they are listed in a special format. For example, {6 SPACES} means press the space bar six times. Our Commodore listings never leave a single space at the end of a line, instead moving it to the next printed line as {SPACE}.

Amiga program listings contain only one special character, the left arrow (←) symbol. This character marks the end of each program line. Wherever you see a left arrow, press RETURN or move the cursor off the line to enter that line into memory. Don't try to type in the left arrow symbol; it's there only as a marker to indicate where each program line ends.

The Automatic Proofreader

Type in the appropriate program listed below, then save it for future use. The Commodore Proofreader works on the Commodore 128, 64, Plus/4, 16, and VIC-20. Don't omit any lines, even if they contain unfamiliar commands or you think they don't apply to your computer. When you run the program, it installs a machine language program in memory and erases its BASIC portion automatically (so be sure to save several copies before running the program for the first time). If you're using a Commodore 128, Plus/4 or 16, do *not* use any GRAPHIC commands while the Proofreader is active. You should disable the Commodore Proofreader before running any other program. To do this, either turn the computer off and on or enter SYS 64738 (for the 64), SYS 65341 (128), SYS 64802 (VIC-20), or SYS 65526 (Plus/4 or 16). To reenable the Proofreader, reload the program and run it as usual. Unlike the original VIC/64 Proofreader, this version works the same with disk or tape.

On the Atari, run the Proofreader to activate it (the Proofreader remains active in memory as a machine language program); you must then enter NEW to erase the BASIC loader. Pressing SYSTEM RESET deactivates the Atari Proofreader; enter PRINT USR(1536) to reenable it.

The Apple Proofreader erases the BASIC portion of itself after you run it, leaving only the machine language portion in memory. It works with either DOS 3.3 or ProDOS. Disable the Apple Proofreader by pressing CTRL-RESET before running another BASIC program.

The IBM Proofreader is a BASIC program that simulates the IBM BASIC line editor, letting you enter, edit, list, save, and load programs that you type. Type RUN to activate. Be sure to leave Caps Lock on, except when typing lowercase characters.

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a hexadecimal number (on the Apple) or a pair of letters (on the Commodore, Atari, or IBM) appears. The number or pair of letters is called a *checksum*.

Compare the value displayed on the screen by the Proofreader with the checksum printed in the program listing in the magazine. The checksum is given to the left of each line number. Just type in the program a line at a time (without the printed checksum), press RETURN or Enter, and compare the checksums. If they match, go on to the next line. If not, check your typing; you've made a mistake. Because of the checksum method used, do not type abbreviations, such as ? for PRINT. On the Atari and Apple Proofreaders, spaces are not counted as part of the checksum, so be sure you type the right number of spaces between quote marks. The Atari Proofreader does not check to see that you've typed the characters in the right order, so if characters are transposed, the checksum still matches the listing. The Commodore Proofreader catches transposition errors and ignores spaces unless they're enclosed in quotation marks. The IBM Proofreader detects errors in spacing and transposition.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader prompts you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program as usual (this replaces the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert an existing BASIC program to Proofreader format, save it to disk with SAVE "*filename*",A.

Program 1: Atari Proofreader

By Charles Brannon

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:REA
    D A:POKE I,A:CK=CK+A:N
    EXT I
120 IF CK<>19072 THEN ? "E
    rror in DATA Statement
    s.  Check Typing.":END

130 A=USR(1536)
140 ? :? "Automatic Proofr
    eader Now Activated."
150 END
160 DATA 104,160,0,185,26,
    3,201,69,240,7
170 DATA 200,200,192,34,20
    8,243,96,200,169,74
180 DATA 153,26,3,200,169,
    6,153,26,3,162
190 DATA 0,189,0,228,157,7
    4,6,232,224,16
200 DATA 208,245,169,93,14
    1,78,6,169,6,141
210 DATA 79,6,24,173,4,228
    ,105,1,141,95
220 DATA 6,173,5,228,105,0
    ,141,96,6,169
230 DATA 0,133,203,96,247,
    238,125,241,93,6
240 DATA 244,241,115,241,1
    24,241,76,205,238
250 DATA 0,0,0,0,0,32,62,2
    46,8,201
260 DATA 155,240,13,201,32
    ,240,7,72,24,101
270 DATA 203,133,203,104,4
    0,96,72,152,72,138
280 DATA 72,160,0,169,128,
    145,88,200,192,40
290 DATA 208,249,165,203,7
    4,74,74,74,24,105
300 DATA 161,160,3,145,88,
    165,203,41,15,24
310 DATA 105,161,200,145,8
    8,169,0,133,203,104
320 DATA 170,104,168,104,4
    0,96
```

Program 2: IBM Proofreader

By Charles Brannon

```
10 'Automatic Proofreader Vers
   ion 3.0 (Lines 205,206 adde
   d/190 deleted/470,490 chang
   ed from V2.0)
100 DIM L$(500),LNUM(500):COLO
    R 0,7,7:KEY OFF:CLS:MAX=0:
    LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,C
    HR$(4)+CHR$(70):ON KEY(15)
     GOSUB 640:KEY (15) ON:GOT
    O 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PR
    INT"Proofreader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT
    (LEN(L$)/W)-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POK
    E 1052,34:POKE 1054,0:POKE
     1055,79:POKE 1056,13:POKE
     1057,28:LINE INPUT L$:DEF
     SEG:IF L$="" THEN 150
170 IF LEFT$(L$,1)=" " THEN L$
    =MID$(L$,2):GOTO 170
```

```
180 IF VAL(LEFT$(L$,2))=0 AND
    MID$(L$,3,1)=" " THEN L$=M
    ID$(L$,4)
200 IF ASC(L$)>57 THEN 260 'no
     line number, therefore co
    mmand
205 BL=INSTR(L$," "):IF BL=0 T
    HEN BL$=L$:GOTO 206 ELSE B
    L$=LEFT$(L$,BL-1)
206 LNUM=VAL(BL$):TEXT$=MID$(L
    $,LEN(STR$(LNUM))+1)
210 IF TEXT$="" THEN GOSUB 540
    :IF LNUM=LNUM(P) THEN GOSU
    B 560:GOTO 150 ELSE 150
220 CKSUM=0:FOR I=1 TO LEN(L$)
    :CKSUM=(CKSUM+ASC(MID$(L$,
    I))*I) AND 255:NEXT:LOCATE
     Y,1:PRINT CHR$(65+CKSUM/1
    6)+CHR$(65+(CKSUM AND 15))
    +" "+L$
230 GOSUB 540:IF LNUM(P)=LNUM
    THEN L$(P)=TEXT$:GOTO 150
    'replace line
240 GOSUB 580:GOTO 150 'insert
     the line
260 TEXT$="":FOR I=1 TO LEN(L$
    ):A=ASC(MID$(L$,I)):TEXT$=
    TEXT$+CHR$(A+32*(A>96 AND
    A<123)):NEXT
270 DELIMITER=INSTR(TEXT$," ")
    :COMMAND$=TEXT$:ARG$="":IF
     DELIMITER THEN COMMAND$=L
    EFT$(TEXT$,DELIMITER-1):AR
    G$=MID$(TEXT$,DELIMITER+1)
     ELSE DELIMITER=INSTR(TEXT
    $,CHR$(34)):IF DELIMITER T
    HEN COMMAND$=LEFT$(TEXT$,D
    ELIMITER-1):ARG$=MID$(TEXT
    $,DELIMITER)
280 IF COMMAND$<>"LIST" THEN 4
    10
290 OPEN "scrn:" FOR OUTPUT AS
     #1
300 IF ARG$="" THEN FIRST=0:P=
    MAX-1:GOTO 340
310 DELIMITER=INSTR(ARG$,"-"):
    IF DELIMITER=0 THEN LNUM=V
    AL(ARG$):GOSUB 540:FIRST=P
    :GOTO 340
320 FIRST=VAL(LEFT$(ARG$,DELIM
    ITER)):LAST=VAL(MID$(ARG$,
    DELIMITER+1))
330 LNUM=FIRST:GOSUB 540:FIRST
    =P:LNUM=LAST:GOSUB 540:IF
    P=0 THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(S
    TR$(LNUM(X)),2)+" "
350 IF CKFLAG=0 THEN A$="":GOT
    O 370
360 CKSUM=0:A$=N$+L$(X):FOR I=
    1 TO LEN(A$):CKSUM=(CKSUM+
    ASC(MID$(A$,I))*I) AND 255
    :NEXT:A$=CHR$(65+CKSUM/16)
    +CHR$(65+(CKSUM AND 15))+"
     "
370 PRINT #1,A$+N$+L$(X)
380 IF INKEY$<>"" THEN X=P
390 NEXT :CLOSE #1:CKFLAG=0
400 GOTO 130
410 IF COMMAND$="LLIST" THEN O
    PEN "lpt1:" FOR OUTPUT AS
    #1:GOTO 300
420 IF COMMAND$="CHECK" THEN C
    KFLAG=1:GOTO 290
430 IF COMMAND$<>"SAVE" THEN 4
    50
440 GOSUB 600:OPEN ARG$ FOR OU
    TPUT AS #1:ARG$="":GOTO 30
    0
450 IF COMMAND$<>"LOAD" THEN 4
    90
460 GOSUB 600:OPEN ARG$ FOR IN
    PUT AS #1:MAX=0:P=0
470 WHILE NOT EOF(1):LINE INPU
    T #1,L$:BL=INSTR(L$," "):B
    L$=LEFT$(L$,BL-1):LNUM(P)=
    VAL(BL$):L$(P)=MID$(L$,LEN
    (STR$(VAL(BL$)))+1):P=P+1:
    WEND
480 MAX=P:CLOSE #1:GOTO 130
490 IF COMMAND$="NEW" THEN INP
    UT "Erase program - Are yo
    u sure";L$:IF LEFT$(L$,1)=
    "y" OR LEFT$(L$,1)="Y" THE
    N MAX=0:LNUM(0)=65536!:GOT
    O 130:ELSE 130
500 IF COMMAND$="BASIC" THEN C
    OLOR 7,0,0:ON ERROR GOTO 0
    :CLS:END
510 IF COMMAND$<>"FILES" THEN
    520
515 IF ARG$="" THEN ARG$="A:"
    ELSE SEL=1:GOSUB 600
517 FILES ARG$:GOTO 130
520 PRINT"Syntax error":GOTO 1
    30
540 P=0:WHILE LNUM>LNUM(P) AND
     P<MAX:P=P+1:WEND:RETURN
560 MAX=MAX-1:FOR X=P TO MAX:L
    NUM(X)=LNUM(X+1):L$(X)=L$(
    X+1):NEXT:RETURN
580 MAX=MAX+1:FOR X=MAX TO P+1
     STEP -1:LNUM(X)=LNUM(X-1)
    :L$(X)=L$(X-1):NEXT:L$(P)=
    TEXT$:LNUM(P)=LNUM:RETURN
600 IF LEFT$(ARG$,1)<>CHR$(34)
     THEN 520 ELSE ARG$=MID$(A
    RG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34)
     THEN ARG$=LEFT$(ARG$,LEN(
    ARG$)-1)
620 IF SEL=0 AND INSTR(ARG$,".
    ")=0 THEN ARG$=ARG$+".BAS"
630 SEL=0:RETURN
640 CLOSE #1:CKFLAG=0:PRINT"St
    opped.":RETURN 150
650 PRINT "Error #";ERR:RESUME
     150
```

Program 3: Commodore Proofreader

By Philip Nelson, Assistant Editor

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
    ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```

Program 4: Apple Proofreader

By Tim Victor, Editorial Programmer

```
10 C = 0: FOR I = 768 TO 768 +
   68: READ A:C = C + A: POKE I
   ,A: NEXT
20 IF C < > 7258 THEN PRINT "ER
   ROR IN PROOFREADER DATA STAT
   EMENTS": END
30 IF PEEK (190 * 256) < > 76 T
   HEN POKE 56,0: POKE 57,3: CA
   LL 1002: GOTO 50
40 PRINT CHR$ (4);"IN#A$300"
50 POKE 34,0: HOME : POKE 34,1:
    VTAB 2: PRINT "PROOFREADER
   INSTALLED"
60 NEW
100 DATA 216,32,27,253,201,141
110 DATA 208,60,138,72,169,0
120 DATA 72,189,255,1,201,160
130 DATA 240,8,104,10,125,255
140 DATA 1,105,0,72,202,208
150 DATA 238,104,170,41,15,9
160 DATA 48,201,58,144,2,233
170 DATA 57,141,1,4,138,74
180 DATA 74,74,74,41,15,9
190 DATA 48,201,58,144,2,233
200 DATA 57,141,0,4,104,170
210 DATA 169,141,96
```

©

MLX Machine Language Entry Program For Commodore 64

Ottis Cowper, Technical Editor

"MLX" is a labor-saving utility that allows almost fail-safe entry of Commodore 64 machine language programs.

Type in and save some copies of MLX—you'll want to use it to enter future machine langauge (ML) programs from COMPUTE!. When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering A Listing

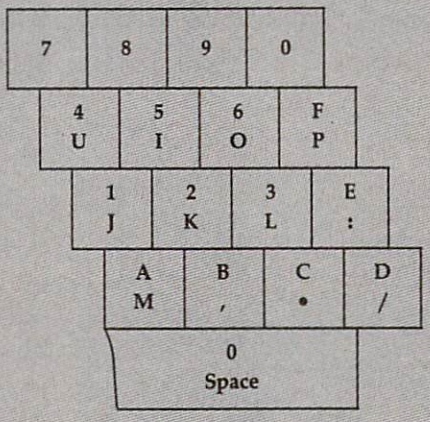
Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing.

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, a numeric keypad is now incorporated in the listing. The keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figure below shows the keypad configuration:



MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the checksum formula used, MLX won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to

restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save. Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750), so this should *not* be included when entering the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The QUIT menu option has the obvious effect—it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP-RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk or LOAD *"filename"* for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64. Other programs must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

MLX For Commodore 64

```
SS 10 REM VERSION 1.1: LINES 8
      30,950 MODIFIED, LINES 4
      85-487 ADDED
EK 100 POKE 56,50:CLR:DIM IN$,
      I,J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
      4=254:Z5=255:Z6=256:Z7=
      127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
      :BS=PEEK(55)+Z6*PEEK(56
      ):H$="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}"
      :S$=" ":D$=CHR$(20):Z$=
      CHR$(0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD
      +23:POKE I,0:NEXT:POKE
      {SPACE}SD+24,15:POKE 78
      8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
      R$(8):POKE 53280,15:POK
      E 53281,15
EJ 160 PRINT T$" {RED}{RVS}
      {2 SPACES}{8 @}
      {2 SPACES}"SPC(28)"
      {2 SPACES}{OFF}{BLU} ML
      X II {RED}{RVS}
      {2 SPACES}"SPC(28)"
      {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
      {3 SPACES}COMPUTE!'S MA
      CHINE LANGUAGE EDITOR
      {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
      RESS{4}";:GOSUB300:SA=A
      D:GOSUB1040:IF F THEN18
      0
GF 190 PRINT"{BLK}{2 SPACES}EN
      DING ADDRESS{4}";:GOSUB
      300:EA=AD:GOSUB1030:IF
      {SPACE}F THEN190
KR 200 INPUT"{3 DOWN}{BLK}CLEA
      R WORKSPACE [Y/N]{4}";A
      $:IF LEFT$(A$,1)<>"Y"TH
      EN220
PG 210 PRINT"{2 DOWN}{BLU}WORK
      ING...";:FORI=BS TO BS+
      EA-SA+7:POKE I,0:NEXT:P
      RINT"DONE"
DR 220 PRINTTAB(10)"{2 DOWN}
      {BLK}{RVS} MLX COMMAND
      {SPACE}MENU {DOWN}{4}":
      PRINT T$"{RVS}E{OFF}NTE
      R DATA"
BD 230 PRINT T$"{RVS}D{OFF}ISP
      LAY DATA":PRINT T$"
      {RVS}L{OFF}OAD FILE"
JS 240 PRINT T$"{RVS}S{OFF}AVE
       FILE":PRINT T$"{RVS}Q
      {OFF}UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=
      MID$("EDLSQ",I,1)THEN A
      =I:I=5
FD 270 NEXT:ON A GOTO420,610,6
      90,700,280:GOSUB1060:GO
      TO250
EJ 280 PRINT"{RVS} QUIT ":INPU
      T"{DOWN}{4}ARE YOU SURE
       [Y/N]";A$:IF LEFT$(A$,
      1)<>"Y"THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IF
      LEN(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$
      =MID$(IN$,3):GOSUB320:A
      D=AD*256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID
      $(B$,J,1):B=ASC(A$)-C4+
      (A$>"@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=
      0:A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(
      H$,B+1,1);:B=A-B*C6:PRI
      NT MID$(H$,B+1,1);:RETU
      RN
RR 360 A=INT(AD/Z6):GOSUB350:A
      =AD-A*Z6:GOSUB350:PRINT
      ":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*
      CK+Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT
      {4}";:GOSUB300:IF IN$<>
      N$ THEN GOSUB1030:IF F
      {SPACE}THEN400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA
      {SPACE}":GOSUB400:IF IN
      $=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F
```

```
      THEN PRINT IN$:PRINT"
      {UP}{5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$
      =S$:FOR J=1 TO 2:IF F T
      HEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<
      24THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A
      $>"@"ANDA$<"G")THEN540
GS 485 A=-(A$="M")-2*(A$=",")-
      3*(A$=".")-4*(A$="/")-5
      *(A$="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$=":
      ")-9*(A$="U")-10*(A$="I
      ")-11*(A$="O")-12*(A$="
      P")
CM 487 A=A-13*(A$=S$):IF A THE
      N A$=MID$("ABCD123E456F
      0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J
      =1)OR F)THEN PRINT B$;:
      J=2:NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRI
      NT B$:J=2:NEXT:I=24:NEX
      T:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF TH
      ENPRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR
      ((I=0)AND(J=1))THEN GOS
      UB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;
      :J=2-J:IF J THEN PRINT
      {SPACE}L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT
      {SPACE}S$;
PM 550 NEXT I:PRINT:PRINT"{UP}
      {5 RIGHT}";:INPUT#3,IN$
      :IF IN$=N$ THEN CLOSE3:
      GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=
      MID$(IN$,I):GOSUB320:IF
       I<25 THEN GOSUB380:A(I
      /3)=A
PK 570 NEXT:IF A<>CK THEN GOSU
      B1060:PRINT"{BLK}{RVS}
      {SPACE}ERROR: REENTER L
      INE {43}":F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FO
      R I=0 TO 7:POKE B+I,A(I
      ):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN C
      LOSE3:PRINT"{DOWN}{BLU}
      ** END OF ENTRY **{BLK}
      {2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"{CLR}{DOWN}{RVS}
      {SPACE}DISPLAY DATA ":G
      OSUB400:IF IN$=N$ THEN2
      20
RJ 620 PRINT"{DOWN}{BLU}PRESS:
       {RVS}SPACE{OFF} TO PAU
      SE, {RVS}RETURN{OFF} TO
       BREAK{43}{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FOR
      I=BTO B+7:A=PEEK(I):GOS
      UB350:GOSUB380:PRINT S$
      ;
CC 640 NEXT:PRINT"{RVS}";:A=CK
      :GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA TH
      ENPRINT"{DOWN}{BLU}** E
      ND OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GO
      SUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOS
      UB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD
      {SPACE}DATA ":OP=1:GOTO
      710
PC 700 PRINT"{DOWN}{RVS} SAVE
      {SPACE}FILE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILE
      NAME{43}";IN$:IF IN$=N$
      {SPACE}THEN220
PR 720 F=0:PRINT"{DOWN}{BLK}
      {RVS}T{OFF}APE OR {RVS}
      D{OFF}ISK: {43}";
FP 730 GET A$:IF A$="T"THEN PR
      INT"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8
      ,15,"I0:":B=EA-SA:IN$="
      0:"+IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":G
      OSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(A
      H*256):PRINT#1,CHR$(AL)
      ;CHR$(AH);
PE 780 FOR I=0 TO B:PRINT#1,CH
      R$(PEEK(BS+I));:IF ST T
      HEN800
FC 790 NEXT:CLOSE1:CLOSE15:GOT
      O940
GS 800 GOSUB1060:PRINT"{DOWN}
      {BLK}ERROR DURING SAVE:
      {43}":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":G
      OSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z
      $)+256*ASC(B$+Z$):IF AD
      <>SA THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:P
      OKE BS+I,ASC(A$+Z$):IF(
      I<>B)AND ST THEN F=2:AD
      =I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F
      >0)+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN
       CLOSE1:CLOSE15:GOSUB10
      60:PRINT"{RVS}ERROR: "A
      $
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE
      187,PEEK(FA+3):POKE188,
      PEEK(FA+4):IFOP=0THEN92
      0
HJ 890 SYS 63466:IF(PEEK(783)A
      ND1)THEN GOSUB1060:PRIN
      T"{DOWN}{RVS} FILE NOT
      {SPACE}FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(8
      30):IF AD<>SA THEN F=1:
      GOTO970
SC 910 A=PEEK(831)+256*PEEK(83
      2)-1:F=F-2*(A<EA)-3*(A>
      EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:P
      OKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOS
      UB1010:ON OP GOTO950:SY
      S 63591
AE 940 GOSUB1080:PRINT"{BLU}**
       SAVE COMPLETED **":GOT
      O220
XP 950 POKE147,0:SYS 63562:IF
      {SPACE}ST>0 THEN970
FR 960 GOSUB1080:PRINT"{BLU}**
       LOAD COMPLETED **":GOT
      O220
DP 970 GOSUB1060:PRINT"{BLK}
      {RVS}ERROR DURING LOAD:
      {DOWN}{43}":ON F GOSUB98
      0,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTIN
      G ADDRESS (";:GOSUB360:
      PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:
      AD=SA+AD:GOSUB360:PRINT
       D$:RETURN
FD 1000 PRINT"TRUNCATED AT END
       ING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH
      *256):POKE193,AL:POKE1
      94,AH
FF 1020 AH=INT(B/256):AL=B-(AH
      *256):POKE174,AL:POKE1
      75,AH:RETURN
FX 1030 IF AD<SA OR AD>EA THEN
      1050
HA 1040 IF(AD>511 AND AD<40960
      )OR(AD>49151 AND AD<53
      248)THEN GOSUB1080:F=0
      :RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
      {SPACE}INVALID ADDRESS
       {DOWN}{BLK}":F=1:RETU
      RN
AR 1060 POKE SD+5,31:POKE SD+6
      ,208:POKE SD,240:POKE
      {SPACE}SD+1,4:POKE SD+
      4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
      TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
      240:POKE SD,0:POKE SD+
      1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
      KE SD+4,0:POKE SD,0:PO
      KE SD+1,0:RETURN
```

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Attention Programmers

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MLX Machine Language Entry Program For Apple

Tim Victor, Editorial Programmer

To make it easier to enter machine language programs into your computer without typos, COMPUTE! is introducing its "MLX" entry program for the Apple II series. It's our best MLX yet. It runs on the II, II+, IIe, and IIc, and with either DOS 3.3 or ProDOS.

A machine language (ML) program is usually listed as a long series of numbers. It's hard to keep your place and even harder to avoid making mistakes as you type in the listing, since an incorrect line looks almost identical to a correct one. To make error-free entry easier, COMPUTE! generally lists ML programs for Commodore and Atari computers in a format designed to be typed in with a utility called "MLX." The MLX program uses a checksum system to catch typing errors almost as soon as they happen.

Apple MLX checks your typing on a line-by-line basis. It won't let you enter invalid characters or let you continue if there's a mistake in a line. It won't even let you enter a line or digit out of sequence. Best of all, you don't have to know anything about machine language to enter ML programs with MLX. Apple MLX makes typing ML programs almost foolproof.

Using Apple MLX

Type in and save some copies of Apple MLX on disk (you'll want to use MLX to enter future ML programs in COMPUTE!). It doesn't matter whether you type it in on a disk formatted for DOS 3.3 or ProDOS. Programs entered with Apple MLX, however, must be saved to a disk formatted with the same operating system as Apple MLX itself.

If you have an Apple IIe or IIc, make sure that the key marked CAPS LOCK is in the down position. Type RUN. You'll be asked for the starting and ending addresses of the ML program. These values vary for each program, so they're given at the beginning of the ML program listing and in the program's accompanying article. Find them and type them in.

The next thing you'll see is a menu asking you to select a function. The first is (E)NTER DATA. If you're just starting to type in a program, pick this. Press the E key, and the program asks for the address where you want to begin entering data. Type the first number in the first line of the program listing if you're just starting, or the line number where you left off if you've already typed in part of a program. Hit the RETURN key and begin entering the data.

Once you're in Enter mode, Apple MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight bytes and a checksum. When you enter a line and hit RETURN, Apple MLX recalculates the checksum from the eight bytes and the address. If you enter more or less than nine numbers, or the checksum doesn't exactly match, Apple MLX erases the line you just entered and prompts you again for the same line.

Invalid Characters Banned

Apple MLX is fairly flexible about how you type in the numbers. You can put extra spaces between numbers or leave the spaces out entirely, compressing a line into 18 keypresses. Be careful not to put a space between two digits in the middle of a number. Apple MLX will read two single-digit numbers instead of one two-digit number (F 6 means F and 6, not F6).

You can't enter an invalid character with Apple MLX. Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), nothing happens. This safeguards against entering extraneous characters. Even better, Apple MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, Apple MLX will catch your mistake.

Apple MLX also checks to make sure you're typing in the right line. The address (the number to the left of the colon) is part of the checksum recalculation. If you accidentally skip a line and try to enter incorrect values, Apple MLX won't let you continue. Just make sure you enter the correct starting address; if you don't, you won't be able to enter any of the following lines. Apple MLX will stop you.

Editing Features

Apple MLX also includes some editing features. The left- and right-arrow keys allow you to back up and go forward on the line that you are entering, so you can retype data. Pressing the CONTROL (CTRL) and D keys at the same time (*delete*) removes the character under the cursor, shortening the line by one character. Pressing CTRL-I (*insert*) puts a space under the cursor and shifts the rest of the line to the right, making the line one character longer. If the cursor is at the right end of the line, neither CTRL-D nor CTRL-I has any effect.

When you've entered the entire listing (up to the ending address that you specified earlier), Apple MLX automatically leaves Enter mode and redisplays the functions menu. If you want to leave Enter mode before then, press the RETURN key when Apple MLX prompts you with a new line address. (For instance, you may want to leave Enter mode to enter a program listing in more than one sitting; see below.)

Display Data

The second menu choice, (D)ISPLAY DATA, examines memory and shows the contents in the same format as the program listing. You can use it to check your work or to see how far you've gotten. When you press D, Apple MLX asks you for a starting address. Type in the address of the first line you want to see and hit RETURN. Apple MLX displays program lines until you press any key or until it reaches the end of the program.

Save And Load

Two more menu selections let you save programs on disk and load them back into the computer. These are (S)AVE FILE and (L)OAD FILE. When you press S or L, Apple MLX asks you for the filename. The first time you save an ML program, the name you assign will be the program's filename on the disk. If you press L and specify a filename that doesn't exist on the disk, you'll see a disk error message.

If you're not sure why a disk error has occurred, check the drive. Make sure there's a formatted disk in the drive and that it was formatted by the same operating system you're using for Apple MLX (ProDOS or DOS 3.3). If you're trying to save a file and see an error message, the disk might be full. Either save the file on another disk or quit Apple MLX (by pressing the Q key), delete an old file or two, then run Apple MLX again. Your typing should still be safe in memory.

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Apple MLX: Machine Language Entry Program

For instructions on entering this program, please refer to "COMPUTE!'s Guide to Typing In Programs" elsewhere in this issue.

```
8@ 100 N = 9: HOME : NORMAL : PR
       INT "APPLE MLX": POKE 34,
       2: ONERR GOTO 610
CC 110 VTAB 1: HTAB 20: PRINT "S
       TART ADDRESS";: GOSUB 530
       : IF A = @ THEN PRINT CHR
       $ (7): GOTO 110
8C 120 S = A
E3 130 VTAB 2: HTAB 20: PRINT "E
       ND ADDRESS ";: GOSUB 530
       : IF S > = A OR A = @ THE
       N PRINT CHR$ (7): GOTO 13
       @
20 140 E = A
B5 150 PRINT : PRINT "CHOOSE:(E)
       NTER DATA";: HTAB 22: PRI
       NT "(D)ISPLAY DATA": HTAB
        8: PRINT "(L)OAD FILE  (
       S)AVE FILE  (Q)UIT": PRIN
       T
AE 160 GET A$: FOR I = 1 TO 5: I
       F A$ < > MID$ ("EDLSQ",I,
       1) THEN NEXT : GOTO 160
93 170 ON I GOTO 270,220,180,200
       : POKE 34,@: END
AF 180 INPUT "FILENAME: ";A$: IF
        A$ < > "" THEN PRINT CHR
       $ (4);"BLOAD";A$;",A";S
A1 190 GOTO 150
38 200 INPUT "FILENAME: ";A$: IF
        A$ < > "" THEN PRINT CHR
       $ (4);"BSAVE";A$;",A";S;"
       ,L";(E - S) + 1
92 210 GOTO 150
C2 220 GOSUB 590: IF B = @ THEN
       150
9E 230 FOR B = B TO E STEP 8:L =
        4:A = B: GOSUB 580: PRIN
       T A$;": ";:L = 2
B5 240 FOR F = @ TO 7:V(F + 1) =
        PEEK (B + F): NEXT : GOS
       UB 560:V(9) = C
F2 250 FOR F = 1 TO N:A = V(F):
       GOSUB 580: PRINT A$" ";:
       NEXT : PRINT : IF PEEK (4
       9152) < 128 THEN NEXT
94 260 POKE 49168,@: GOTO 150
CC 270 GOSUB 590: IF B = @ THEN
       150
48 280 FOR B = B TO E STEP 8
A6 290 HTAB 1:A = B:L = 4: GOSUB
        580: PRINT A$;": ";: CAL
       L 64668:A$ = "":P = @: GO
       SUB 330: IF L = @ THEN 15
       @
F9 300 GOSUB 470: IF F < > N THE
       N PRINT CHR$ (7);: GOTO 2
       90
27 310 IF N = 9 THEN GOSUB 560:
       IF C < > V(9) THEN PRINT
       CHR$ (7);: GOTO 290
72 320 FOR F = 1 TO 8: POKE B +
       F - 1,V(F): NEXT : PRINT
       : NEXT : GOTO 150
8E 330 IF LEN (A$) = 33 THEN A$
       = O$:P = O: PRINT CHR$ (7
       );
22 340 L = LEN (A$):O$ = A$:O =
       P:L$ = "": IF P > @ THEN
       L$ = LEFT$ (A$,P)
E@ 350 R$ = "": IF P < L - 1 THE
       N R$ = RIGHT$ (A$,L - P -
        1)
55 360 HTAB 7: PRINT L$;: FLASH
       : IF P < L THEN PRINT MID
       $ (A$,P + 1,1);: NORMAL :
        PRINT R$;
7B 370 PRINT " ";: NORMAL
E6 380 K = PEEK (49152): IF K <
       128 THEN 380
C1 390 POKE 49168,@:K = K - 128
5B 400 IF K = 13 THEN HTAB 7: PR
       INT A$;" ";: RETURN
8A 410 IF K = 32 OR K > 47 AND K
        < 58 OR K > 64 AND K < 7
       1 THEN A$ = L$ + CHR$ (K)
        + R$:P = P + 1
C1 420 IF K = 4 THEN A$ = L$ + R
       $
5F 430 IF K = 9 THEN A$ = L$ + "
        " + MID$ (A$,P + 1,1) +
       R$
@A 440 IF K = 8 THEN P = P - (P
       > @)
93 450 IF K = 21 THEN P = P + (P
       < L)
9D 460 GOTO 330
37 470 F = 1:D = @: FOR P = 1 TO
        LEN (A$):C$ = MID$ (A$,P
       ,1): IF F > N AND C$ < >
       " " THEN RETURN
BB 480 IF C$ < > " " THEN GOSUB
       520:V(F) = J + 16 * (D =
       1) * V(F):D = D + 1
5F 490 IF D > @ AND C$ = " " OR
       D = 2 THEN D = @:F = F +
       1
@8 500 NEXT : IF D = @ THEN F =
       F - 1
17 510 RETURN
B5 520 J = ASC (C$):J = J - 48 -
        7 * (J > 64): RETURN
AB 530 A = @: INPUT A$:A$ = LEFT
       $ (A$,4): IF LEN (A$) = @
        THEN RETURN
6F 540 FOR P = 1 TO LEN (A$):C$
       = MID$ (A$,P,1): IF C$ <
       "@" OR C$ > "9" AND C$ <
       "A" OR C$ > "Z" THEN A =
       @: RETURN
2D 550 GOSUB 520:A = A * 16 + J:
        NEXT : RETURN
28 560 C = INT (B / 256):C = B -
        254 * C - 255 * (C > 127
       ):C = C - 255 * (C > 255)
2@ 570 FOR F = 1 TO 8:C = C * 2
       - 255 * (C > 127) + V(F):
       C = C - 255 * (C > 255):
       NEXT : RETURN
DA 580 I = FRE (@):A$ = "": FOR
       I = 1 TO L:T = INT (A / 1
       6):A$ = MID$ ("@123456789
       ABCDEF",A - 16 * T + 1,1)
        + A$:A = T: NEXT : RETUR
       N
1F 590 PRINT "FROM ADDRESS ";: G
       OSUB 530: IF S > A OR E <
        A OR A = @ THEN B = @: R
       ETURN
@D 600 B = S + 8 * INT ((A - S)
       / 8): RETURN
B6 610 PRINT "DISK ERROR": GOTO
       150
```

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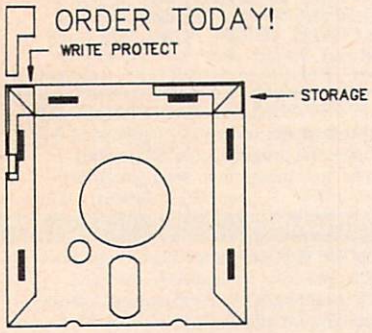

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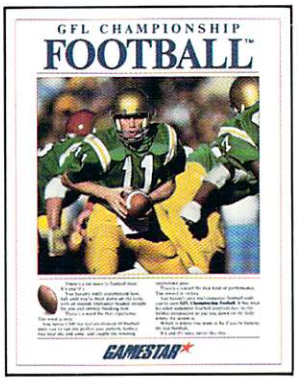

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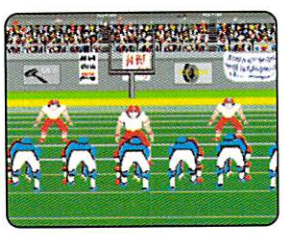

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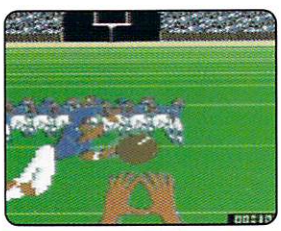

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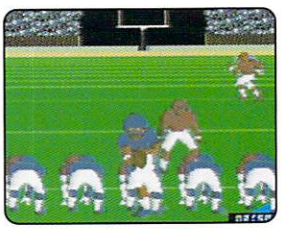

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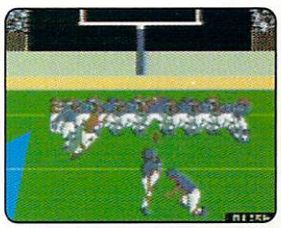

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