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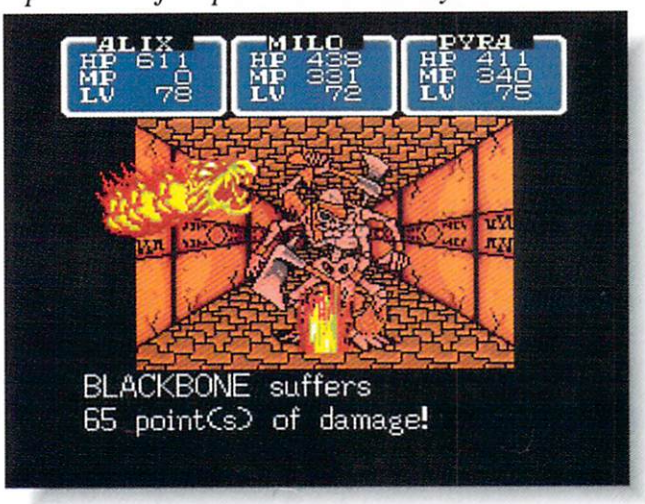

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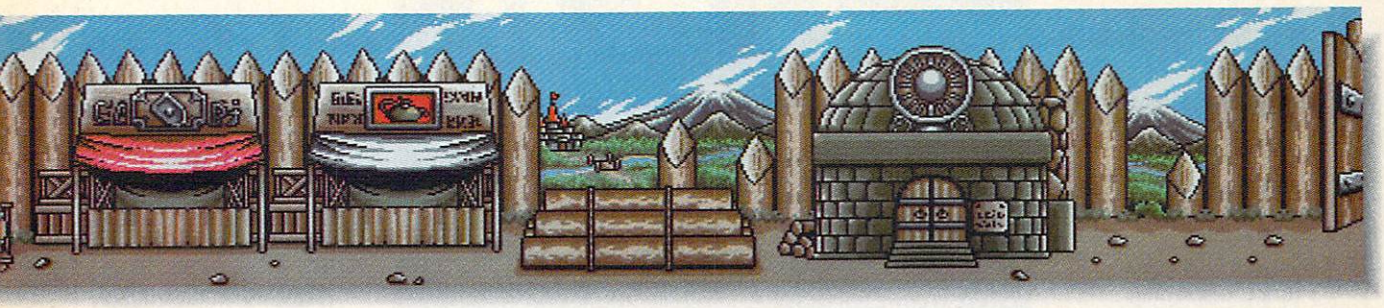

Master the perils of the Labyrinth to become a shining knight.

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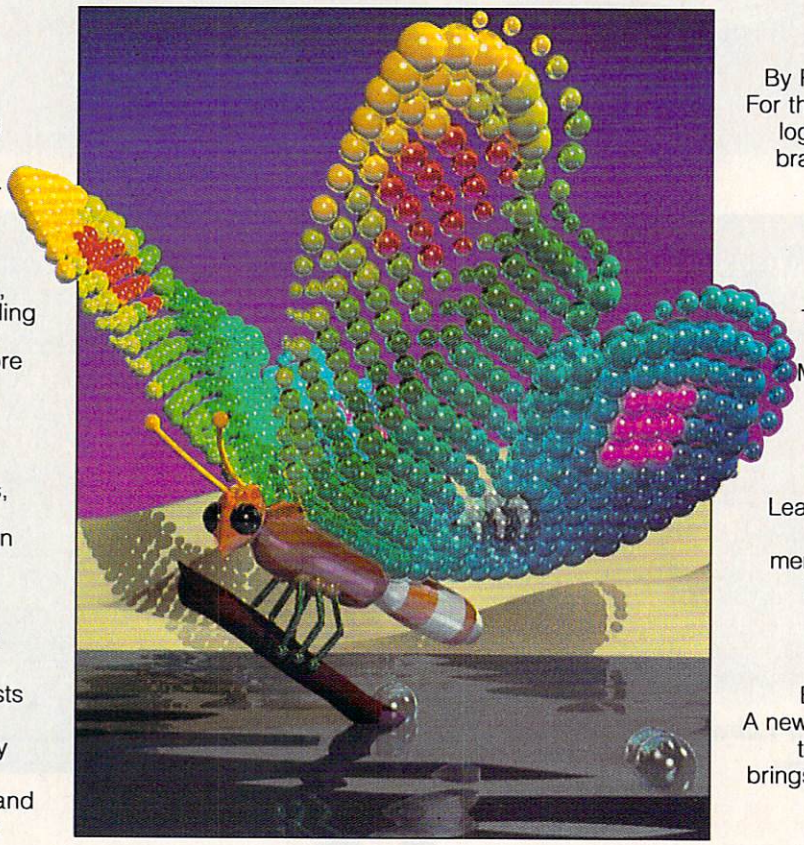

Melvin L. Prueitt of the Computer Graphics Group at the Los Alamos National Laboratory created the image on our November cover using a ray-tracing program called SCOPE *running on a Cray YMP mainframe computer. The entire image, which he calls* Contemplating Liftoff, *was composed through mathematical functions, from the shapes to the gradation of color.*

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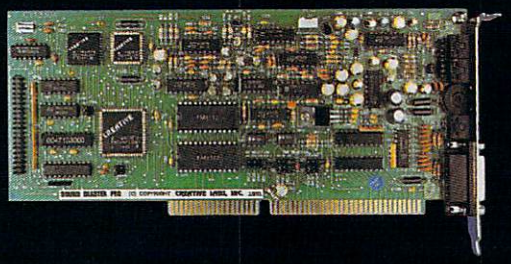

"With its associated software, it has quietly (no pun intended, but what the heck) become the standard sound system for advanced PCs."
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COMPUTE August 1991

" ...Creative Labs is now turning up the volume with the Sound Blaster Pro. It's basically two Sound Blasters on a single card with additional multimedia features thrown in. It has twin FM chips capable of creating 22 individual voices, two DACs for stereo voice and sound-effects playback, a stereo microphone jack, and a built-in stereo mixer that can adjust the volume of all your Sound Blaster audio sources (stereo DAC, stereo FM, microphone, stereo line-in, CD-Audio and PC internal speaker).

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The Sound Blaster Pro includes a CD-ROM interface for either an internal or external CD-ROM player. There's also an internal connector for CD-Audio. The MIDI interface is compatible with the original Sound Blaster's MIDI interface but adds the MIDI time-stamp that's part of Microsoft's new multimedia standard.

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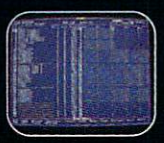

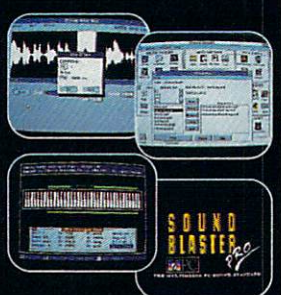

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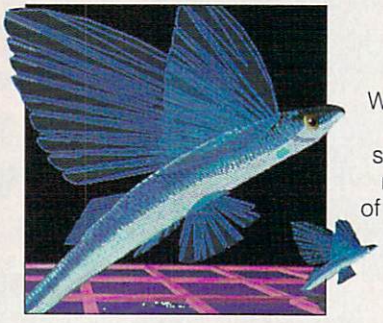

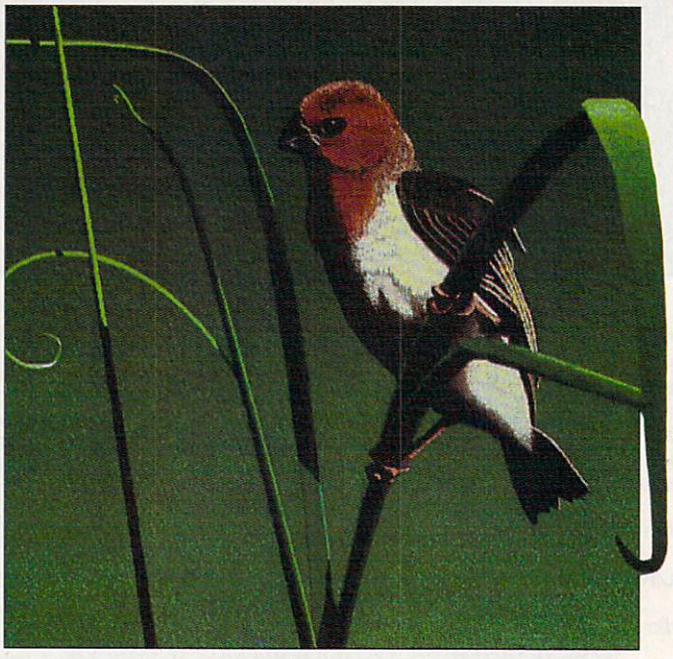

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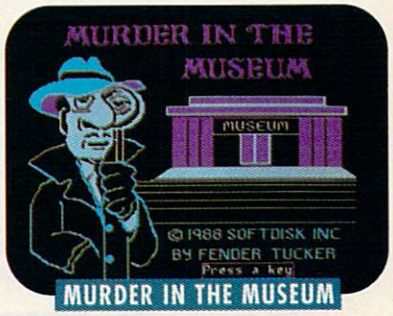

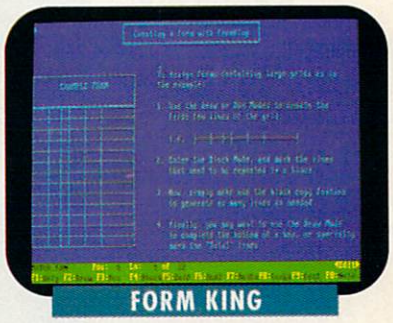

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EDITORIAL LICENSE

Peter Scisco

A few months back, magazines and newspapers all over the country ran stories about the tenth anniversary of the IBM personal computer, pausing to look at where PC technology has been and where it's going.

From the spreadsheet to multimedia, PCs have exploded onto the modern scene like few other phenomena. Yet for all of its whiz-bang promises and electronic pyrotechnics, many of us still wonder where PC technology will lead and whether it will sort itself out in the next decade—at least enough to allow more people to participate in the Information Age.

What do you need to participate in the Information Age now? Look to the future of computing.

The debate over where PCs are moving revolves around a larger debate over the shape of that technology. IBM PC clones claim the lion's share of the home market because of their relatively low cost and their compatibility with the largest share of business machines. And, too, software developers have produced tens of thousands of applications, games, and learning programs for PCs.

Amiga and Macintosh still command loyal followings, and even the Commodore 64 has a sizable audience. But it's the IBM PC that defines computing at home, even if some of its best ideas—like graphical interfaces and multitasking—are borrowed from other platforms.

What do *you* need to participate? What computer should you be running at home to take full advantage of your investment? One thing's for sure: With the price of technology falling rapidly, it pays to look forward. More and more big-name software companies are looking to support the most sophisticated machines, and the trend will continue in this decade.

Toward the end of the nineties, we expect new operating systems and new processors to take the stage from MS-DOS. If the IBM-Apple alliance works, we could see powerful machines with new interfaces that reach across a variety of hardware platforms. If that happens, the search for a computing standard will have taken a great leap forward.

Beyond that, we can expect major consumer electronics companies like Sony, Panasonic, and Philips to develop computerlike devices for the mass market. Certainly compact disc devices are in store, both as PC peripherals and as combination machines for playing videogames and audio CDs.

Be on the lookout for HDTV links by the year 2000 and for telephone companies to enter the arena—with home information services, banking, and shopping, for starters.

None of this will happen immediately, but if you want to take advantage of computing now and still be able to incorporate the advances, set your sights on a PC capable of performing those tasks.

If you're new to computing or getting ready to upgrade to a new machine, the minimum configuration you should look for is an IBM-compatible with an Intel 386SX chip running at 16 MHz, 2MB of memory, DOS 5.0, 16-bit VGA graphics, a sound card that uses an FM synthesizer and digital-to-analog conversion techniques (like the Sound Blaster or new Ad Lib Gold), a 40MB hard disk, and a mouse.

For added value, look for a system that's bundled with *GeoWorks Ensemble* or *Microsoft Windows*. If you buy through office superstores and mail order, such a fully configured system will run in the $1,200–$1,500 range. That's the machine you want. Anything less fails to capitalize on the possibilities.

You may disagree. Good XTs and ATs are available for hundreds of dollars less, but sooner or later, you'll want better graphics. Sooner or later, you'll want more speed. Sooner or later, you'll want applications that require extended memory. And sooner or later, the most innovative software won't run on anything less.

Remember that. When you take a look around the computer stores and electronics dealers this holiday season and you find yourself drawn to the shiny new PCs in the window, remember the future. ❐

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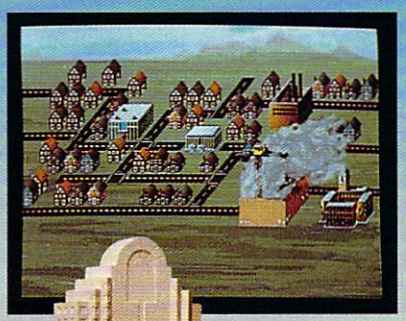

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NEWS & NOTES

Novell Absorbs DRI

By acquiring Digital Research (DRI), giant network system software marketer Novell signaled its frustration with Microsoft's failure to create *NetWare* network links in standard MS-DOS and *Windows*. DRI is the creator of DR DOS, an MS-DOS competitor. Novell intends to establish a desktop networking/operating system standard that's independent of Microsoft. Novell and DRI have been cooperating for a year on this venture.

DRI's first operating system, CP/M, was used almost universally by desktop computers in the late 1970s and early 1980s. DR DOS versions 5.0 and 6.0 have received very favorable reviews and are credited by some industry watchers with forcing Microsoft to make MS-DOS 5.0 friendlier and more frugal with memory.

Novell's impetus in purchasing DRI seems to have been Microsoft chairman Bill Gates's statement in a leaked memo that network capabilities built into MS-DOS would favor other network standards over Novell's *NetWare*. Integrating DR DOS with *NetWare* should help Novell remain competitive with other popular network software publishers, including Microsoft.

This news comes hard on the heels of an agreement between Novell and IBM that allows IBM to market Novell's products. Microsoft is beginning to look isolated in its conflict with one-time allies IBM, Apple, and Novell.

What does all of this mean for you? If you're on a network, it could mean that you won't have to go through the step of logging onto the network, that incompatibilities between your computer's operating system and your network will disappear, and that your computer's memory will be put to much better use. If you aren't on a network, you could still benefit from DRI's sudden access to the research and financial resources of a company ten times its size.

ROBERT BIXBY

The Flop's a Hit

Floptical technology promises to change the way you store data. The read-write optical disk will come in a familiar package—a square of plastic that's virtually indistinguishable from the shirt-pocket 3½-inch disk—but on that disk you can store a whopping 21MB of information. The disk format, now supported by Insite Peripherals, Iomega, Hitachi Maxell, and 3M, involves stamping concentric rings in a barium-ferrite disk. The rings assist the read-write heads in such perfect horizontal tracking that 1250 tracks can be laid down per inch. The actual data is stored magnetically between the stamped rings. The same drive can read and write 720K and 1.44MB 3½-inch disks.

Commodore International has selected the Insite Floptical drive for use in its Amiga 3000. There is some competition in the large-capacity, small-format area. The 2.88MB drive has been on the market for some time but has been impeded by high disk and equipment costs in return for only a twofold increase in capacity.

Panasonic recently introduced and then withdrew a 10MB drive from the market, intending to boost capacity to 20MB. NEC, Brier, and Springer Technology are all players in the field, but none have met with success yet. On the horizon is Sony's erasable CD in small format, which could arrive with a capacity of up to 128MB. Mass storage for little machines has never been such an exciting area for technical advances and marketing.

ROBERT BIXBY

Floptical technology disks have more than ten times the storage capacity of existing high density floppy disks.

An Empire Strikes

"The Force" may soon be with Lucasfilm Games and its use of CD-ROM technology as the company moves with new marketing and development strategies into the interactive entertainment industry. The newly consolidated organization plans to use its connections with the film industry to ensure the success of its games.

According to creative director Howard Phillips, the CD-ROM's ability to store massive amounts of data is like having a massive movie budget. Keeping that in mind, Lucasfilm Games plans to create cinematic games with strong stories, stunning visuals, and enthralling audio by utilizing the resources of other LucasArts divisions such as Skywalker Sound and Industrial Light & Magic.

Lucasfilm Games will introduce *Indiana Jones and the Last Crusade, The Secret of Monkey Island,* and a talking version of *Loom* for CDTV in 1992 along with several CD-ROM–based games over the next two years.

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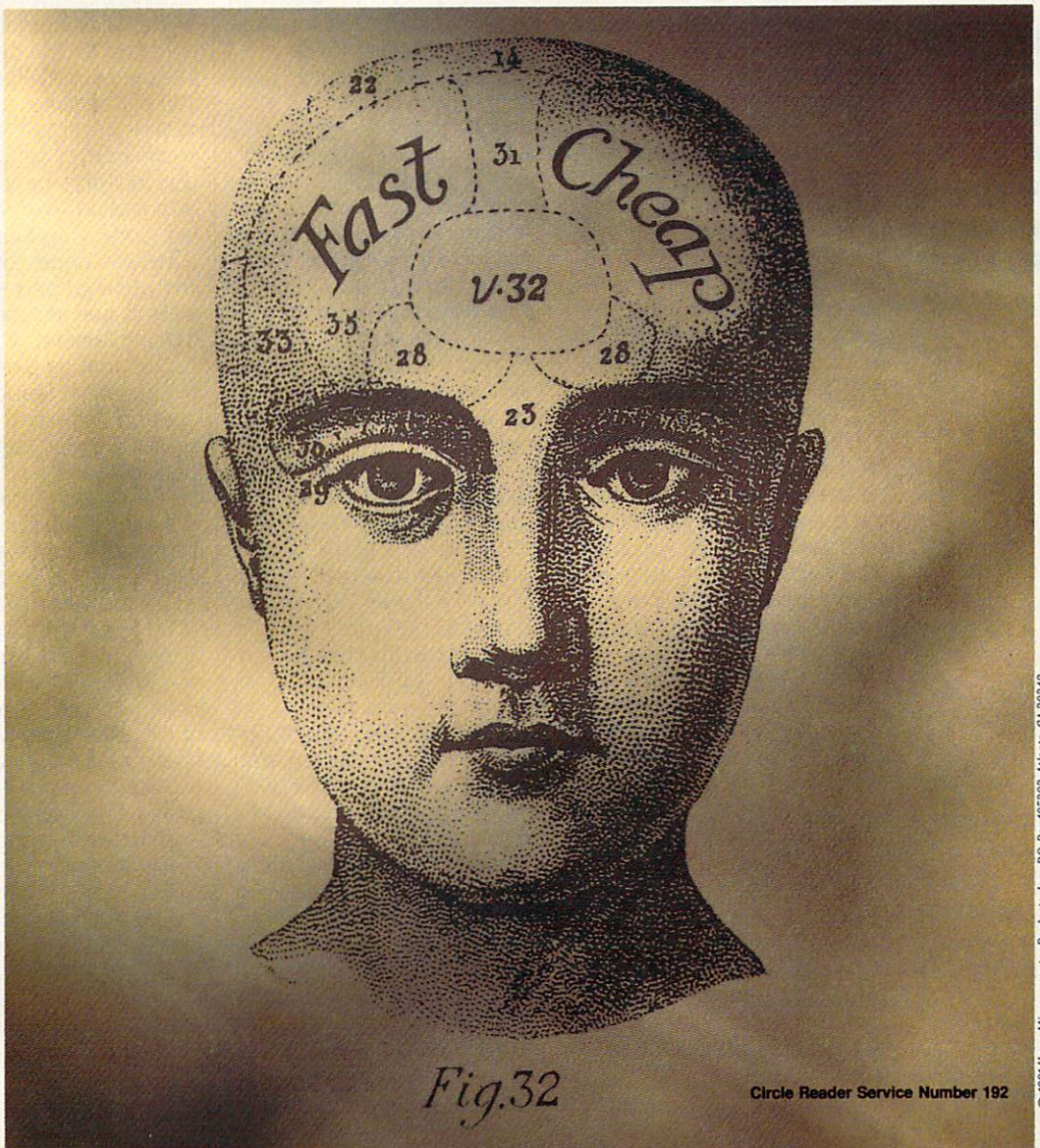

Fig.32

Circle Reader Service Number 192

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Three Lucasfilm Games—*Loom, Zak McKracken and the Alien Mindbenders,* and *Indiana Jones and the Last Crusade*—are now available for Fujitsu's FM Towns. The company is also introducing its first videogames this fall.
ERIN RICHTER

The Mother of All Soldiers

Foot soldiers may soon join the ranks of those using high-tech military machines with the introduction of a new pocket-sized computer destined to revolutionize ground military action. Texas Microsystems, a manufacturer of Mission-Critical microcomputers, will study the feasibility of a portable Soldier's Computer.

Perfect-bound textbooks may someday work their way out of the classroom and into the videodisc annals of history.

Deployment of the one-pound, high-speed portable computer could be as early as 1995 and is slated to have some of the same advanced communications and graphics capabilities found in fighter aircraft, tanks, and other sophisticated weapons systems. The Soldier's Computer, which will be about the size of a cigarette pack, will initially use Intel's 80386 architecture.

One possible configuration for the Soldier's Computer uses a radio to transmit both voice and data messages and a heads-up display mounted on a helmet or worn as glasses to project a virtual image. It could have a microphone for voice messaging and an integrated "Global Positioning System" to allow soldiers to pinpoint their exact locations at any time. Soldiers would also view a realtime map showing friendly and enemy troop positions, weapons sites, danger spots, and terrain features.

Although it could add new meaning to the concept of war games, Texas Microsystems also predicts widespread application of the portable PC in other areas. For example, it could just as easily be configured as the Automobile Mechanic's Computer, the Policeman's PC, or the Emergency Medical Technician's Computer.
ALAN BECHTOLD

Future Textbooks

Interactive multimedia computing has entered the public schools in a big way. *Windows on Science,* the nation's first videodisc-based science program approved as a textbook, has been adopted by 65 percent of the 3400 elementary schools in Texas. This is the first time in the U.S. that a videodisc-based program has competed head to head with traditional textbooks for state textbook-adoption funds.

Optical Data, producer, publisher, and distributor of *Windows on Science,* says the program will serve as the sole science curriculum in two large Texas school districts, replacing textbooks altogether. This year, more than 7000 Texas educators learned how to integrate *Windows on Science* into their curriculums. The program consists of 11 videodiscs as well as lesson guides, activities, and a language lab.
ALAN BECHTOLD

Personal PrintPartner

Fujitsu's DL3600 PrintPartner is a 24-wire dot-matrix printer and software bundle designed primarily for small businesses, corporate departments, and home offices that need a single printer to do the work of several office machines.

Combined with Fujitsu's *ZipType, Creative Faces,* and *DLMenu* software, the DL3600 emulates the font handling of a PostScript printer, the color capabilities of a thermal transfer printer, the functionality of a wide-carriage dot-matrix printer, and the most useful features of an office typewriter.

ZipType is a pop-up utility for creating templates that make filling out common office forms a snap. *ZipType* also has a typewriter mode in which the printer responds directly to keyboard instructions, so you can use the printer as a typewriter to complete other forms, labels, and documents not programmed as templates.

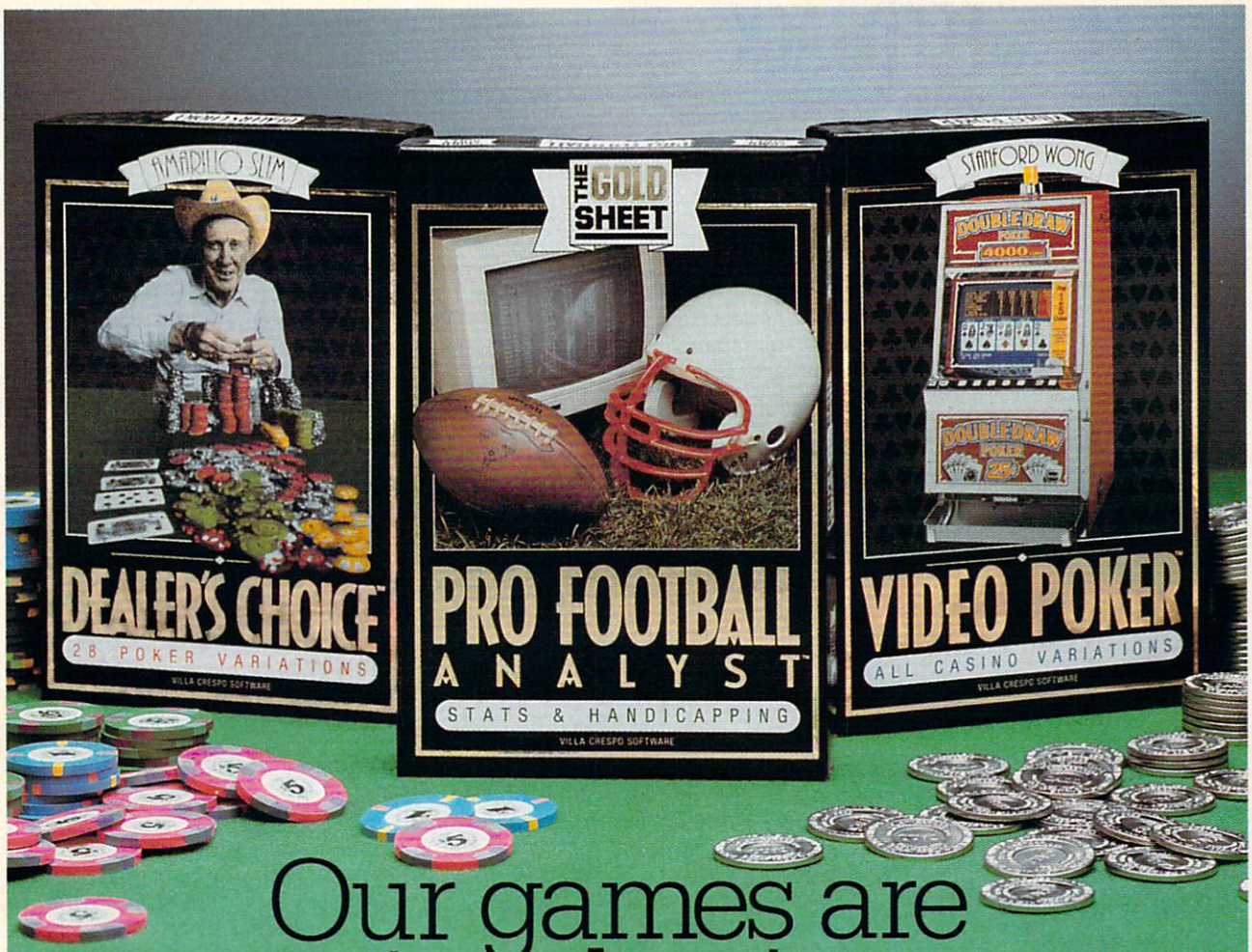
DLMenu allows you to configure and reconfigure printer setup conditions from your computer—without exiting your current application. *Creative Faces,* offered free with the purchase of a color upgrade kit for the DL3600, is a *Windows* 3.0 driver that allows you to print charts, graphs, and other graphics in seven colors.

The wide-carriage DL3600 prints up to 360 cps (characters per second) for drafts and 108 cps for letter quality printouts. It accepts both continuous-feed and cut paper; handles four-part forms up to 16½ inches wide—with exceptional last-copy legibility; allows automatic paper loading, first-line printing, and top-of-form tear-off; and includes a paper-parking feature.

Optional single- and double-bin sheet feeders for preloading different cut paper stocks are also available. The DL3600 boasts an 8000-hour MTBF (Mean Time Between Failures) reliability rating and comes with a two-year warranty—one of the longest in the midrange class of printers.

Bundled with *ZipType* and *DLMenu,* the PrintPartner package lists for $949 and includes coupon offers for a free copy of *Creative Faces* with the purchase of a color upgrade kit, two free font cards with the purchase of a cut-sheet feeder, and a two-for-one offer on black ribbons.

For more information on the PrintPartner package, contact Fujitsu America Computer Products Group, 3055 Orchard Drive, San Jose, California 95134; (800) 626-4686.
JILL CHAMPION ❐



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Villa Crespo SOFTWARE

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FEEDBACK

Kudos for GeoWorks, case reversal, reliable brands, Imperium lost in Kuwait, requests for new features, and more

GeoWorks Spooler

As a longtime subscriber I've found that your answers to problems and questions have been excellent. But I have a bone to pick with you about one reply. I tried using *GeoWorks Ensemble*'s spooler and *Windows'* spooler while playing solitaire as you suggested. For all levels of print quality in both environments, the time it took the documents to begin printing was between 10 and 12 seconds. *GeoWorks Ensemble* is superb software.

JOHN F. HOWARD
VIRGINIA BEACH, VA

Protection and Unprotection

In response to your reply to Travis May in the June 1991 issue, most manufacturers now employ off-disk copy protection because on-disk protection is a nuisance to them and to the consumer. This means that the disks can easily be backed up with standard DOS copy commands like DISKCOPY, but copies are useless to anyone but the original purchaser because the programs won't run unless you enter the correct response from a code wheel or a hard-to-photocopy sheet of dark-colored paper.

TERENCE LAU
CENTERVILLE, OH

petscii sTRIKES aGAIN

I have a PC now, but for years I did all my correspondence on Commodore 8-bit computers. I bought SOGWAP's *Big Blue Reader* to transfer my old letter files to PC disks. Now I've lost the Commodore disks and can't correct an error I discovered in every single file: The upper- and lowercase letters are reversed. I've been able to find utilities that convert files to all uppercase or all lowercase, but so far I haven't found anything that reverses case. Is there any way I could convert my files with a simple GW-BASIC program?

JAMES KILMARTIN CONDON
SCOTIA, NY

PET ASCII, for no known reason, reversed the codes for upper- and lowercase letters. Big Blue Reader *will compensate for that—if you're aware of the problem—making the switch as it transfers the files. Unfortunately, since you don't have the original disks anymore, you can't simply transfer the files again.*

Here's a brief conversion program written in Microsoft QuickBASIC *(GW-BASIC is simply too limited to write an equivalent program). All it does is change lowercase letters to uppercase and vice versa. We named the program CAPNO.EXE. The syntax is CAPNO* filename.

```
CLS
NAME$=COMMAND$
OPEN NAME$ FOR BINARY AS #1
A=LOF(1)
FOR J = A TO 1 STEP -1
GET #1, J, S$
GOSUB CONVERT
PUT #1, J, S$
NEXT
CLOSE
END
CONVERT:
IF S$=" " THEN S$="  "
IF S$<"a" THEN GOTO CHECKCAP
IF S$>"z" THEN RETURN
S$=CHR$(ASC(S$)-32):RETURN
CHECKCAP:
IF S$<"A" THEN RETURN
IF S$<="Z" THEN S$=CHR$
  (ASC(S$)+32)
RETURN
```

A Lifetime Guarantee

The April 1991 issue of *COMPUTE* featured an article about malfunctioning PCs ("Is There a Doctor in the House?"). I read this with great interest because my PC, a four-year-old Tandy 1000HX with a memory-expansion board installed recently, was spending its second week at the shop. The installation booklet that came with my new floppy drive said that floppy drives last five years—but the warranty was only for 90 days. I'd like to know how long PCs run before they require major repairs. And have some brands been found to be more reliable than others?

WILLIAM CIABURRI
HAMDEN, CT

How about it, readers? Let us know what kind of machine you're using and what kind of torture you've put it through. How many years has your PC hung in there? Tell us your hero stories about the PC that ran for the long haul and your horror stories about the PC that gave up the ghost in the first quarter mile. Send your letters to "Feedback" (the address is at the end of this column). Tell us the complete model name and make of the PC (or peripheral) and how many months it has been operating. We'll print the best and tabulate the rest.

Battling BASICs

In the January 1991 issue of *COMPUTE*, in the PC section, there was a letter about an encrypting program. You wrote the reply, but in *QuickBASIC*. Unfortunately, I don't own *QuickBASIC*. Please send me a copy of a GW-BASIC version of this program.

ANDREW ARMOND
RUSTON, LA

Generally, we translate everything into QuickBASIC *for this column for the sake of consistency, but in this case that language was used in part because GW-BASIC lacks the sophisticated file-handling capabilities of a language like* QuickBASIC. *With* QuickBASIC *and other modern BASICs, you can open files as binary files, which allows them to be read byte by byte. GW-*

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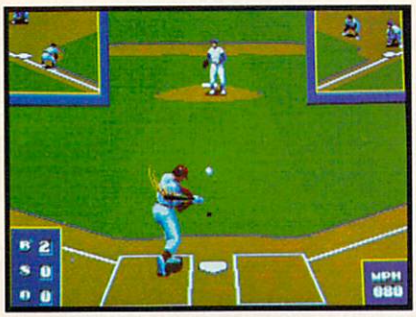

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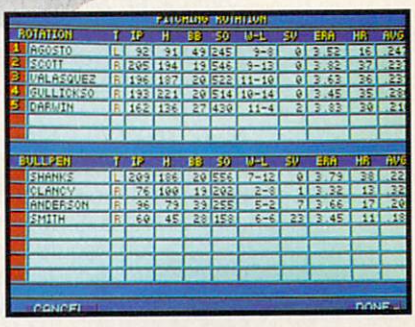

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DATA EAST

FEEDBACK

BASIC can read files, too, but since it's set up to read data files, it reads paragraph by paragraph (records in data files are typically delimited by carriage returns, like paragraphs in a text file). Since there are restrictions on the length of a string variable that can easily be exceeded by the length of a text paragraph, writing the program in GW-BASIC is much more trouble than it's worth.

Compiled BASICs are great bargains, and there are some good ones out there. You might be able to get a bargain if you can find a discontinued, but excellent, language called Turbo Basic. Microsoft QuickBASIC, True BASIC, *and* PowerBASIC *(which is an updated version of* Turbo Basic*) are widely available, inexpensive, powerful, and exceedingly easy to use.*

Here are the addresses of the companies that make these languages: Microsoft QuickBASIC, *Microsoft, One Microsoft Way, Redmond, Washington 98052; (800) 426-9400;* PowerBASIC, *Spectra Publishing, 1030 Duane, Suite D, Sunnyvale, California 94086; (800) 245-6717; and* True BASIC, *True BASIC, 39 South Main Street, Hanover, New Hampshire 03755; (800) 872-2742 or (603) 298-8517 in New Hampshire.*

More Tips

I would appreciate more how-to articles about DOS and *dBASE III PLUS,* which I use a lot. You could include batch files and utilities—not just to copy, but with explanations of how they work.

A. H. STAUB
BANGKOK, THAILAND

Struggling Through

I enjoy your magazine and look forward to it each month—especially the how-to articles that deal with writing small programs in BASIC and BAT files. However, with just one year of computer experience, these articles sometimes are beyond my knowledge and understanding.

There must be other readers who feel the same way. I think that a monthly article aimed at the novice would be of interest to your readers—articles by a less-informed computer person who would experience the same problems and solutions to everyday computing questions.

WILLIAM R. BAILEY
GOSHEN, IN

Lost Imperium

Several years ago I purchased one of the best computer games that I have ever encountered. Unfortunately, I had to leave this game, among others, in Kuwait in August 1990. I would like to replace it, but I have been unable to find it in any local outlet. I don't remember the manufacturer, but the game in question was titled *Imperium Galacticum.* Any help you can provide in this matter will be greatly appreciated.

LARRY W. MYERS
HOUSTON, TX

If anyone recognizes the game, please contact us at the address below, and we'll forward your replies.

Readers whose letters appear in "Feedback" will receive a free COMPUTE's PC clock radio while supplies last. Do you have a question about hardware or software? Or have you discovered something that could help other PC users? If so, we want to hear from you. Write to COMPUTE's Feedback, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. We regret that we cannot provide personal replies to technical questions. ❐

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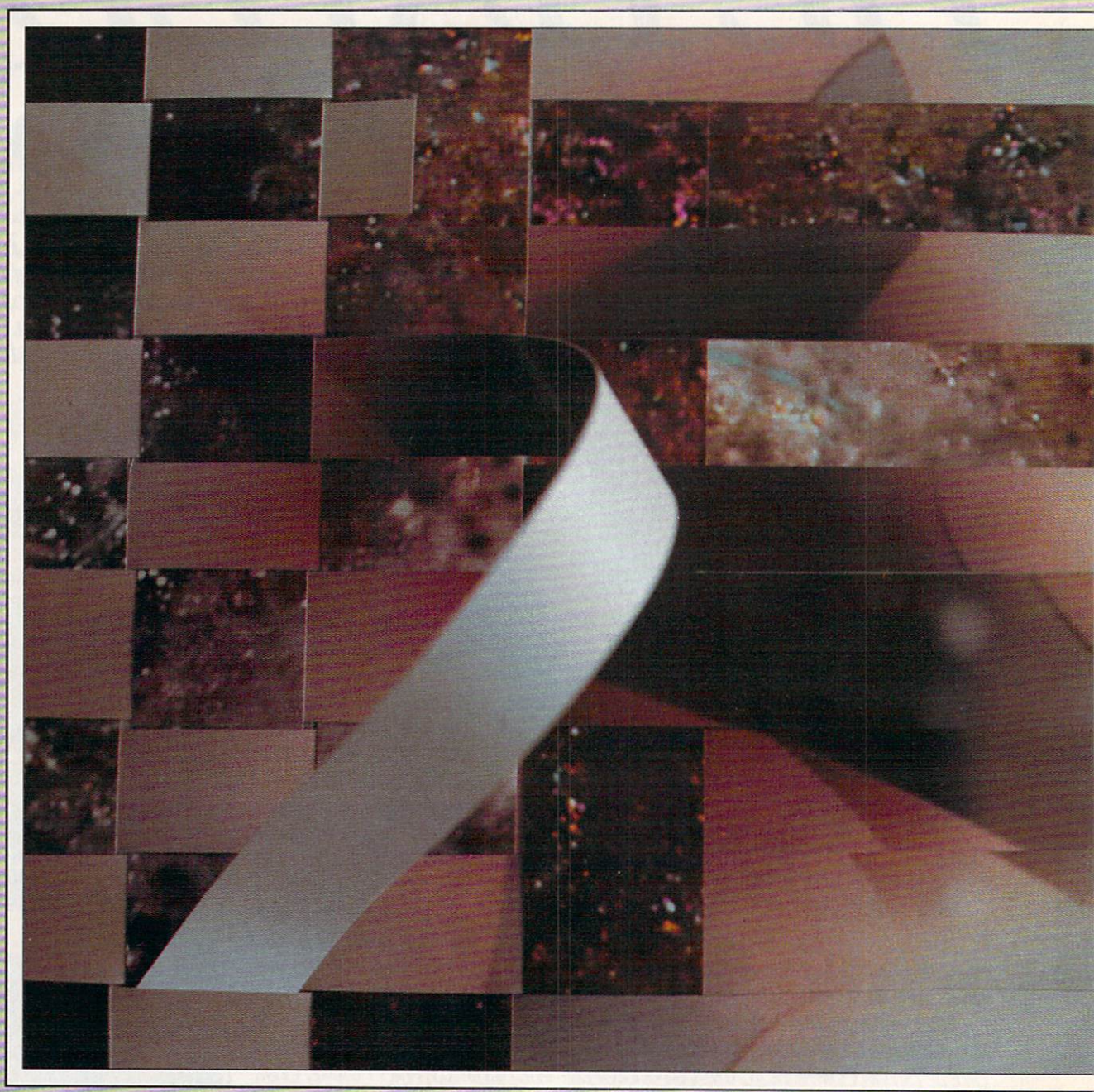


At the vanguard of technological and social change, the computer provides a new tool, a new medium, and a new way to look at art.

The New Renaissance:

The Computer in Fine Art

BY LEE NOEL JR.

A striking vision is poised in the artist's mind, ready to amaze the world. What tools will the artist use to bring this vision to reality? Increasingly, artists are turning to the personal computer and workstation as tools for producing fine art.

This fact shouldn't be surprising. Art and technology have walked hand in hand through most of human history. It isn't unusual for an artist to be using—or even developing—cutting-edge technology. To understand this, you must know something about the history of art and artists. Let's take a brief trip back in time.

It's now fairly clear that humankind began producing art as soon as it realized it could. You might even say that art produced humankind. Art is the uniquely human ability to synthesize the outer, real world and the inner world of thought and emotion into meaningful works. It might have been the ability and the need to express such things that led mankind away from its primitive roots.

Among the earliest preserved pieces of art we know about are the 20,000-year-old cave paintings of France and Spain. Many scholars think these had religious purposes. Highly realistic and beautifully executed, these cave paintings indicate that the artists who created them already had a well-established artistic tradition. Creating the paints for these renderings must have been the result of much experimentation and study—the rudiments of chemistry.

Moving ahead a few centuries, the Sumerians developed the first written language as a derivation of artistic drawings used in commerce. Another Sumerian example of art driving technology was when the potter's wheel took a 90-degree turn and became a chariot wheel.

Leonardo da Vinci (1452–1519) created prophetic designs of flying machines and other undreamed-of marvels. Michelangelo (1475–1564) was a master architect, responsible for the design of the dome of St. Peter's in Rome. Ex-

traordinarily, these men were not at all unique among artists. Artistic projects from prehistoric times to our own have required precise observational skills coupled with a systematic approach to solving problems. Since artists were among the first regular practitioners of scientific methods, it's not surprising that many of their discoveries had technological ramifications.

For Art's Sake

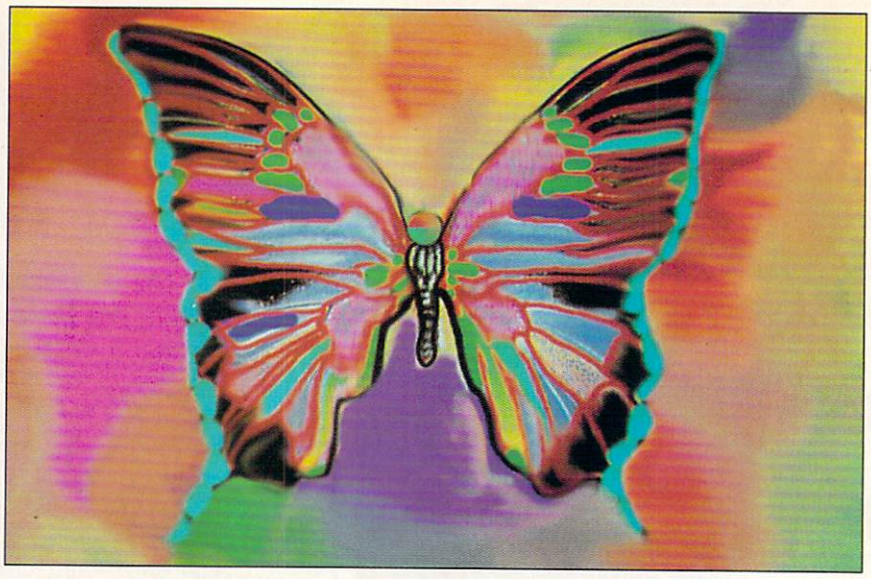
If solving problems is the artist's stock in trade, it should be no surprise that artists would turn to the computer—the most multitalented problem-solving device since the human brain.

A computer is a single device that is paint, brush, and canvas. Modern VGA monitors can display millions of colors, supposedly more than the eye can perceive. Perfect gradations from one color to another are a snap for these machines. Over the years, artists have developed an automated paint box with a range of abilities from drawing perfectly straight lines of any thickness to rapidly painting the inside of a closed figure with an intricate repeating pattern.

Computers can also simulate imperfection. There are computer tools that render the variable weights of calligraphic pen or brush strokes. Through fractal programs, computers have painted everything from fractured planetary surfaces to gnarled vegetable life forms. You can even find clip art of irregular stone surfaces for use in desktop publishing projects.

Preparing the Canvas

When it comes to three-dimensional work, CAD (Computer-Aided Design) applications can aid in the development of sculpture. And CAM (Computer-Aided Manufacturing) computers can directly create 3-D objects. Some are used to drive milling machines that can carve out parts or structures with incredible precision. There are even a couple of prototyping devices that will fit on a large desktop, in which the computer directly forms an object from liquid wax or plastic.



LILLIAN SCHWARTZ

The computer is an electronic matrix embedded with modules of human thought. Putting the right modules in the right machine can result in producing virtually anything that can be thought of. An artistic feast.

New Ideas: Traditional Resistance

In fact, there has been resistance to the use of the computer in art from both the public and a certain portion of the art community itself. Some artists have an instinctive disdain for technology of any kind—some still argue that photography is not an art form.

This resistance is particularly odd, considering the fact that much of modern abstract art seems to have presaged computer art. With their geometric forms, many of the works of Klee, Kandinsky, Duchamp, Mondrian, or the cubists might have been created through the use of a computer.

The Soul of the Machine

Michael Gosney, whose *VERBUM* magazine has long been a beacon for computer art and aesthetics, is due to open an Electronic Art Gallery in New York soon. Exhibitors are likely to include some of our featured artists, as well as Amiga artists Sandra Filippucci and Roz Dimon and Macintosh wizards Barbara Nessim and Burt Monroy.

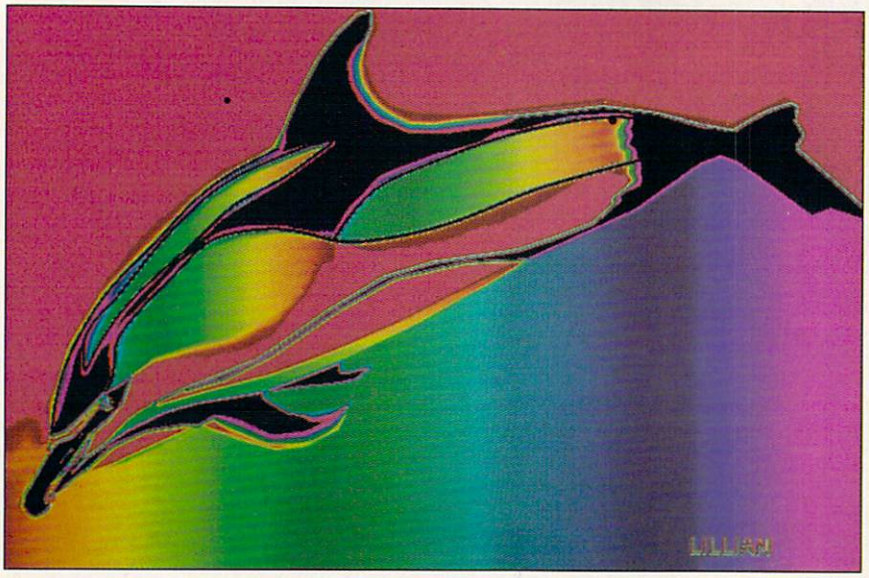
Silicon is the most common element in the earth's crust. With their reliance on silicon and the phosphors that glow on monitor screens, computer artists paint with the very bones of the earth. It would be difficult to think of a clearer connection with the cavern galleries of the ancestral hunt painters. Great artists in every era use all the tools they can find. In the computer, artists find them all in one place.

In the Tradition of the Masters

Lillian Schwartz is the artist who used computers to analyze Leonardo's most famous painting. Commonly called the *Mona Lisa,* this work has long been an enigma. Leonardo seemed to have a special regard for the picture. He never sold it.

Now the mystery is uncovered. According to Schwartz's analysis, the *Mona Lisa* is actually an image of Leonardo da Vinci himself.

Much of Schwartz's corroborating evidence, wrought from rigorous analysis



LILLIAN SCHWARTZ

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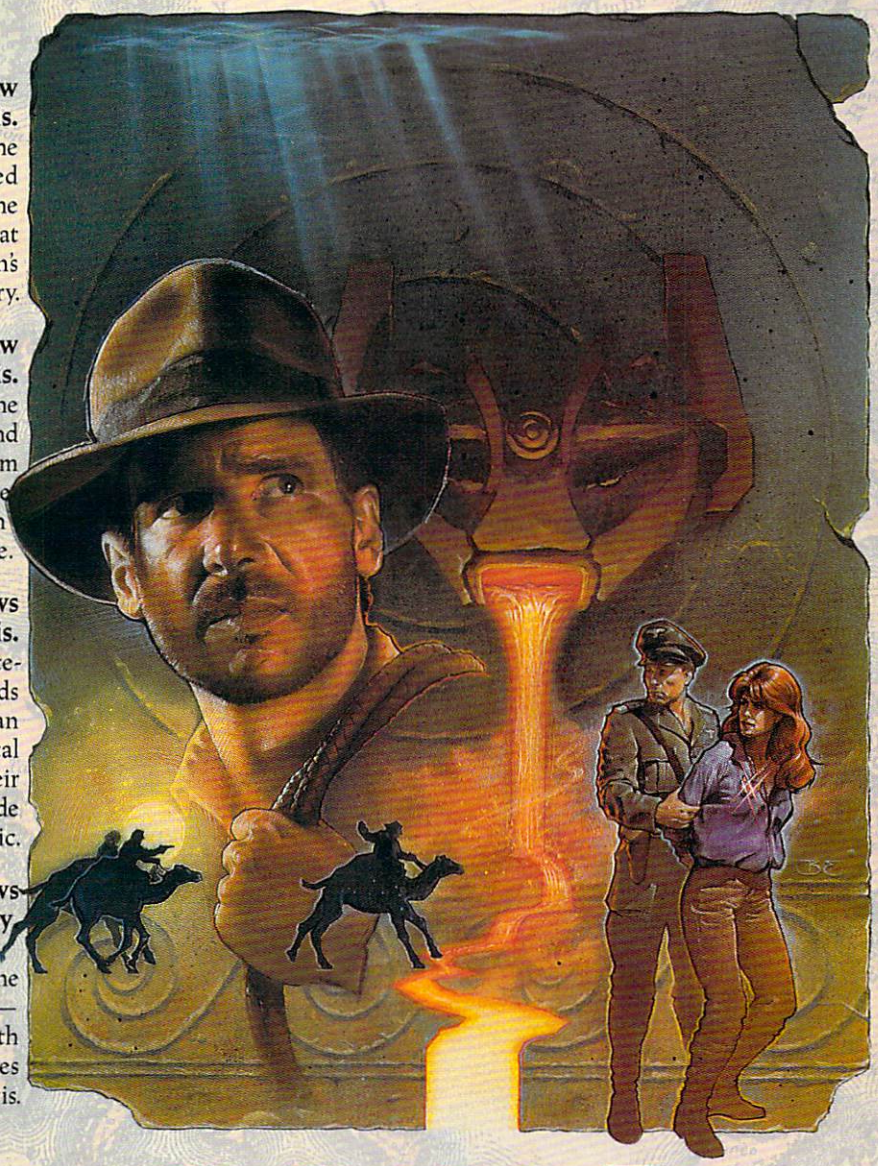
Plato knew about Atlantis.
In a lost dialogue he wrote about the famed city and orichalcum, the mysterious element that powered the Atlantean's amazing machinery.

The Nazis know about Atlantis.
They tracked down the lost dialogue, and realized orichalcum would yield them the ultimate weapon of the age.

Sophia knows about Atlantis.
She unearthed a mysterious necklace and beads of orichalcum during an Icelandic archeological dig with Indy. Their magical properties made her a psychic.

Everyone knows but Indy.
And he's got to learn fast. The Nazis are one step ahead of him — from Iceland to North Africa to the Azores to... Atlantis.



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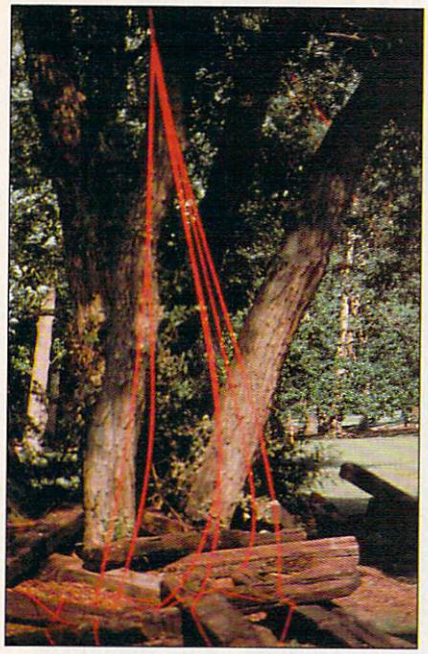

GEORGE SHORTESS

of facial structure, followed an instant of discovery on the computer screen. While testing a new program with one of her colleagues at the AT&T Bell Laboratories in New Jersey, she slid a digitized image of half the *Mona Lisa*'s face alongside a similar section of da Vinci's only known self-portrait. The result: virtually a perfect match.

Schwartz was not only a pioneer in using the computer to analyze other artists' work, but she was also among the first to use it in creating her own artistic efforts. Her recent book, *The Computer Artist's Handbook*, written in collaboration with her son, Laurens, is replete with examples. From an early effort in computer-controlled kinetic (moving) sculpture at the 1964 New York World's Fair to her current paintings, her career encapsulates the history of computer art.

Her interest in the computer followed a decades-long career in art. With her background in Western European traditional art and exposure to Japanese calligraphy (undertaken as therapy to break the grip of polio-induced paralysis), Schwartz has built her electronic work on a rock-solid foundation.

Lillian Schwartz says, "What's wonderful about the computer is that you're creating your own medium."

Computer as Chisel Viewer as Stone

Sculptor George Shortess is a longtime subscriber to *COMPUTE*. Indeed, he still sometimes uses the Commodore VIC-20, an early mainstay of this magazine, in his work. Shortess is both a professor of perceptual psychology and an adjunct professor of art at Lehigh University in Pennsylvania. He prizes the freedom Lehigh gives him to mix disciplines and considers it a factor in the advancement of his art.

Shortess's sculpture, based on traditional art training and including familiar 3-D elements, has won wide recognition. He doesn't stop, however, with merely creating an intrusion into three-dimensional space. He uses computers to enhance the viewer's perception of the piece—and to highlight perception in general.

Mayfair Network is a Shortess sculpture you walk *through*. Its framework is a living willow tree. An array of photocells responds to your location, sending signals to a computer, which triggers assorted sounds.

This is not a typical art museum experience, but Shortess says he must show most of his work indoors to protect the electronic components and few galleries show computer art regularly. Happily, he does find exceptions.

In his interactive book, *What Is* (shown in Canada and at Ars Electronica in Austria), a desktop PC system runs a complex program that scans a photocell array and generates interrogative screen displays. The viewer responds by typing and by changing the light levels on the photocells. Once the process is completed, the sculpture prepares, prints, and delivers a personalized page to the viewer.

Since Shortess's sculpture is not tied to any particular display system, processor, or other device, he uses any computer that seems appropriate for a given project. That's why he is still actively using VIC-20s. He's also used samplers, sequencers, and desktop PCs. As always in art, part of mastery is the judicious selection of tools.

Some people don't react positively to Shortess's work. Some don't see it as art at all, and others question the use of a computer—and especially this use—because sculpture should be separate from the beholder.

"We're still exploring the potential of the computer, and it's not clear what the best way to use a computer is at this point," Shortess points out. But the intent of Shortess's work is serious. He's extending the definition of sculpture into a mysterious territory. He won't allow the viewer to be passive. Instead, the perceiver becomes a participant; the sculpture becomes a process rather than an object.

With Mouse and Macaw

Art is not just the domain of the traditionally trained or widely accepted. Entirely self-taught, Ed Stephens, at 25, is the youngest and least prominent of our artists. Like the others, however, he is well versed in traditional media, having painted both in oils and in acrylics.

The road to artistic fulfillment and success is always a difficult one, but Stephens has additional impediments. A diving accident in the 11th grade left Stephens a quadriplegic. With a considerable range of movement in one hand, however, he can handle a mouse comfortably. It's important to keep in mind that the tough-natured Stephens has, like all the other artists featured here, adopted the computer

ED STEPHENS

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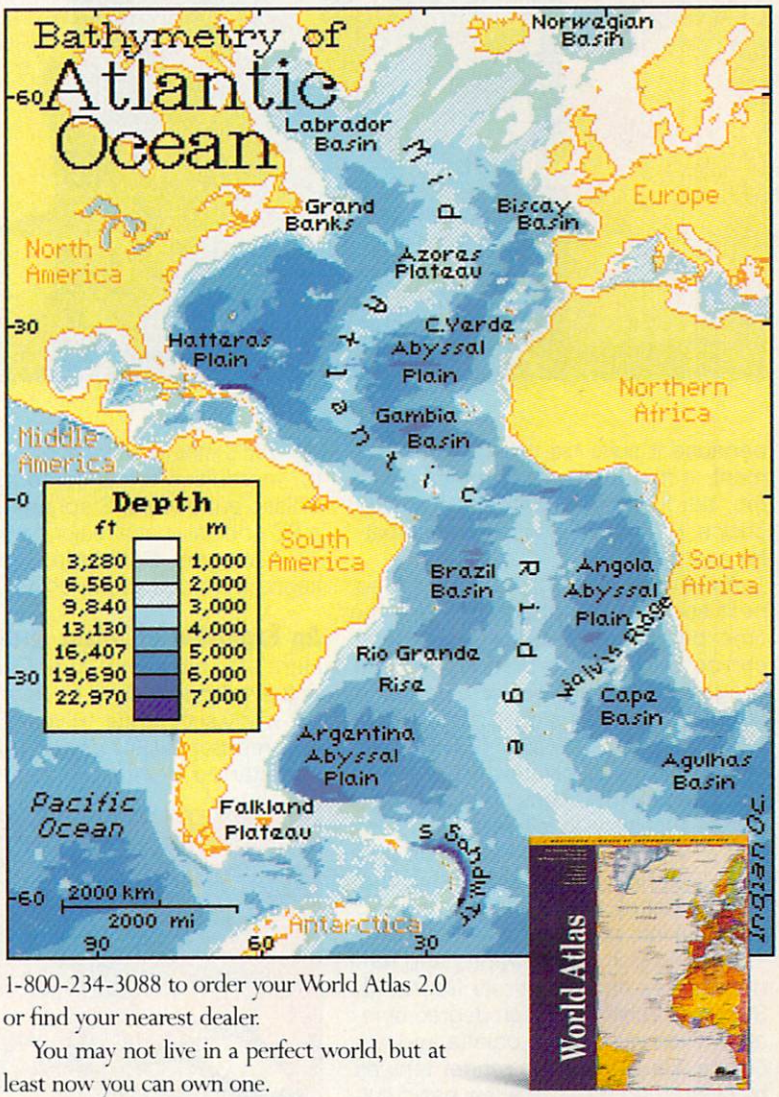

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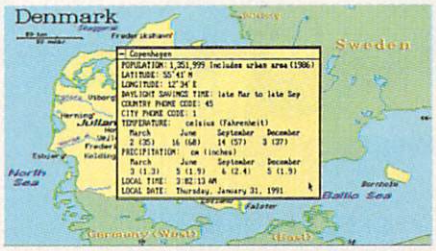

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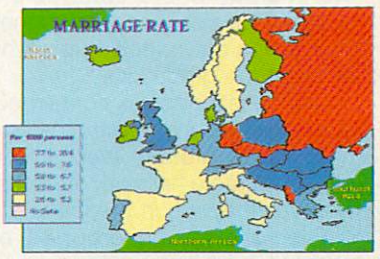

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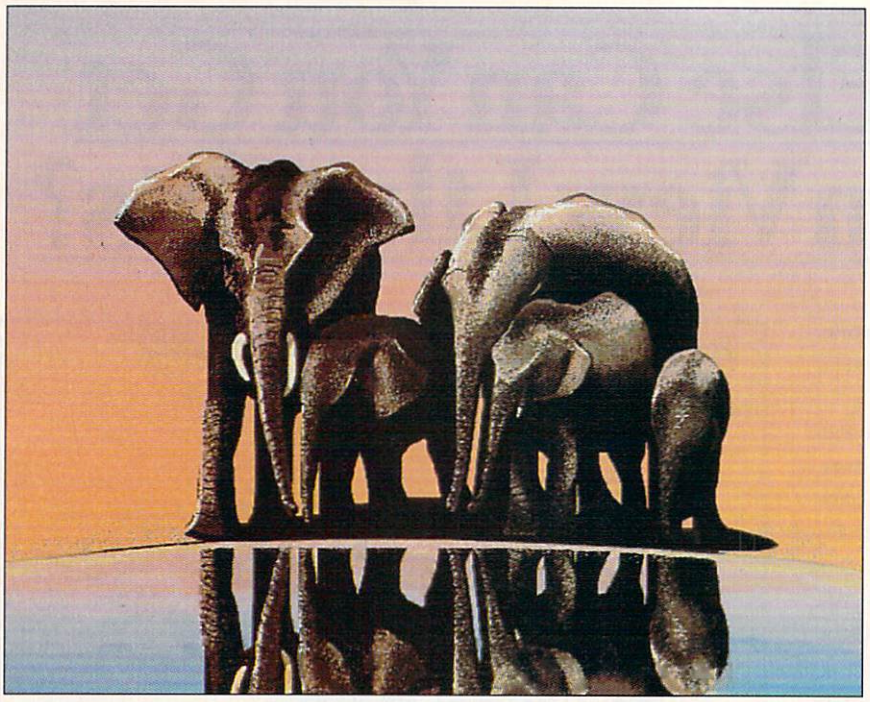
THE SOFTWARE TOOLWORKS



ED STEPHENS

because it suits his artistic temperament. It may be a self-contained studio, but it's merely his current tool of choice. His handicaps are another matter entirely.

As in the case of Joni Carter (see next section), Stephens has, for the time being, fairly well settled on a choice of hardware platform. All the images shown here were created on a 20-MHz 386 PC using *ColoRIX VGA Paint* software in 256 (8-bit) VGA mode. This relatively new art program has enabled Stephens to explore his love of animals with few restrictions. He has a special affection for birds and will admit with a little prompting that he'd be happy to see an "autofeather" tool built into the program.

Working from photographs and rendering his images entirely freehand, Stephens achieves a high degree of realism even with limited palette and resolution. He is forced to render images by intermixing pixels of a few basic colors in areas where other colors are needed. He describes the process as "just sitting down, editing pixel-by-pixel to get the gradations."

Stephens's pictures contain echoes of nineteenth-century French artist Henri Rousseau. Vibrant, even violent, jungle colors are a hallmark of Rousseau's work, as they are in Stephens's.

Even though he dropped out of high school after his accident, Stephens has proved himself in many ways the master of the computer. He explains it simply: "I've always painted and sketched, and it just makes sense that I'd start doing art with the computer. That's mainly why I got interested in it." In addition to his computer-based artistic endeavors, Stephens works as a PC specialist at a major bottled-water producer in California, where he keeps a macaw at the office.

An Explosion of Talent and Energy

Here's a paradox: Joni Carter has achieved many firsts or near firsts in her wildly successful 16-year career as a computer artist, yet in 1975 when she started painting in her late 20s, she'd never touched a brush before.

Her first pictures reflected her love of sports. She made rapid progress, selling everything she painted, almost always on a sports theme. Although she did not have a conventional art education, she spent the next few years working intensively in the most traditional of media—paint, brush, and canvas.

In the early 1980s she heard about art on computers and moved decisively to adopt the new medium. Once she'd achieved mastery, she found a great advantage in the environment. She could take a computer on the road and set it up at the sites of the sports events she wanted to portray. With marketing savvy to match her artistic flair, she began to appear on television, producing live art on the computer that matched the compelling immediacy of the events taking place on the course, field, or racetrack behind her.

"After my first brush with technology, I never went back to the conventional method," she says. Something must have clicked because the business grew so fast that she soon had her whole family, including her mother, father, and sister Kate, working with her.

Recently, Carter created a set of commemorative Olympic track and field stamps, released by the U.S. Postal Service in the tens of millions. She is among the first women ever commissioned to paint stamps, and she is the first artist ever to create a series of stamps entirely on computer.

In the process of creating the stamps, Carter has invented a new twin-computer, mobile art studio. Run-

JONI CARTER

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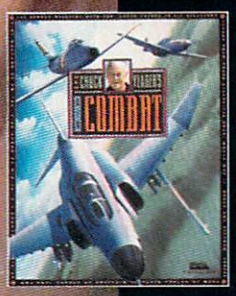

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JONI CARTER

ning paired IBM PS/2s, she's developed an ingenious working method. One computer acts as a video controller. This is her "model." She uses it to zero in on a desired frame of sports videotape, which is then blown up and used as the basis for the sketching and painting she does on the other machine. There, she has 24-bit paint software called *Lumena* that enables her to create images of the highest quality. Of course, since the images are computer based, they're easy to resize and recolor—a process the postal service had her go through again and again in the making of the stamps.

Carter sticks to a fairly settled hardware/software mix for lengthy periods of time. And she's unstinting in her praise for and devotion to IBM. That very first computer she took on the road was a genuine IBM AT. She believes that this machine's reliability was a major factor in making her touring art show a success.

She's also adamant that new computer art possibilities will open vast numbers of careers. Carter's own career is an example without parallel. As she puts it, "I want artists out there to know that there's this huge chance now that hasn't been there [before]."

Ambassador of Light and Space

Now in his late 30s, David Em creates works that glow with the emotional power and technical mastery of the mature artist in his prime. He is also gifted with a unique perspective and philosophy on his place in the brief history of computer art, and on art in general.

In the mid 1970s and early 1980s, Em's works were among the most frequently seen computer art images. He was working with Dr. James Blinn at the Jet Propulsion Laboratory (JPL) in Pasadena, California. Blinn was the pilot who created software spaceships that gave us highly realistic simulated views of the planets being surveyed by space probes like Voyager and the Viking Mars lander. Blinn's programs and JPL's success became Em's studio and inspiration. Not surprisingly, Em's work from that phase has something of a science fiction flavor.

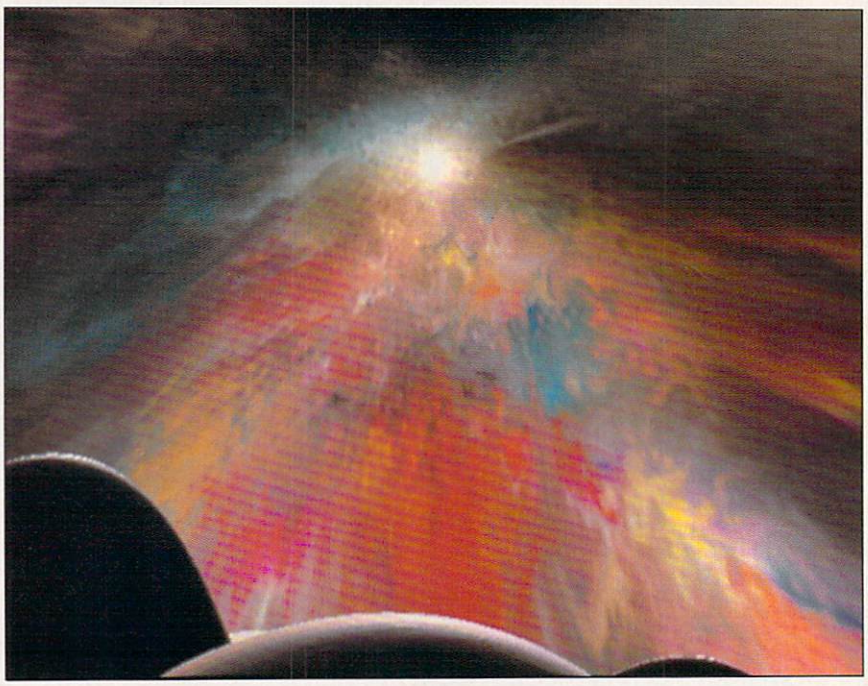
In a typical picture of the period, structures rise from a vast plain unfolding under the watchful eye of a satellite. For all their power to strike awe and wonderment into viewers, images from this period may seem a little cold, almost as if the vacuum of space is insulating the observer from direct contact.

Although he occasionally refreshes himself through refuge in traditional painting or plastic sculpture, Em has always returned to the computer.

He's pleased that things are moving "to a hardware-independent zone." Although the time at JPL gave Em access to the leading technology in the world, he's happier to be a little behind the leading edge, concentrating on his art rather than the tools used to produce it. He works with a number of systems and programs but is quite impressed with Adobe's *PhotoShop* for the Macintosh, finding the finish of commercial software a welcome change from fighting with undocumented experimental programs and devices.

As for the question of whether the computer is an appropriate tool for art, his viewpoint is straightforward. "The device is an extension of sensibility, so . . . whether it's a medium or not has always seemed a nonissue."

Em is modest about his achievement. As he puts it, "We're all standing on the shoulders of people who were really putting it on the line." He says that children growing up today with ready access to powerful computers with high resolution graphics have enormous potential. "Now is when we're really going to see the Leonardos and the Michelangelos come out." ❐



DAVID EM

MORE BABES. MORE BREWSKIS. MORE BAD JOKES.

Ah, college life! Tree-lined walks. Hushed study halls. Ivy-covered professors. The days are filled with the quiet pursuit of knowledge. The nights, however, are a different story!

ERNIE IS BACK!

Welcome to *Spellcasting 201: The Sorcerer's Appliance.* Ernie Eaglebeak is back at Sorcerer University for his sophomore year and he wants to join a fraternity. No problem, except for those quaint, harmless initiation rituals known collectively as... HELL WEEK!

RETURN TO ANIMAL HOUSE

Every night, in a mysterious chamber below the fraternity house, a vindictive pledgemaster dons a ceremonial chicken suit and burdens Ernie with a series of ridiculously impossible hazing tasks. Fortunately, Ernie knows where to get help. He creates it!

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Join Ernie and Eve in this hilarious romp through the bedrooms, turrets, and tunnels of both Sorcerer University and nearby Barmaid U (where grading on a curve takes on a whole new meaning). To pass this course you'll need to cast ridiculous spells, solve ribald puzzles and "interact" with gorgeous women. Any questions? We didn't think so. Class dismissed.

From the scandalous imagination of Steve Meretzky, *Spellcasting 201* is the sequel to his award-winning hit, *Spellcasting 101: Sorcerers Get All The Girls.* These games may be considered unsuitable for young minds, as they contain material and situations that children have already seen in far greater detail on daytime television. Available for MS-DOS and compatibles.

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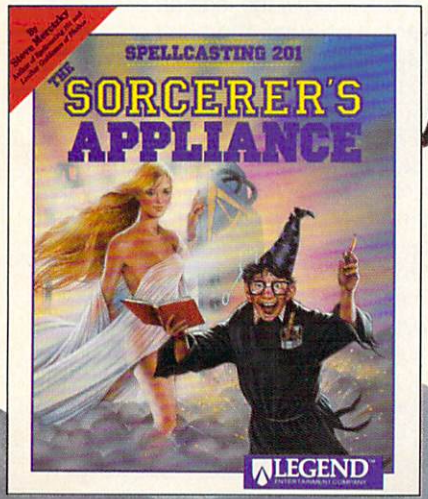

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SHAREPAK

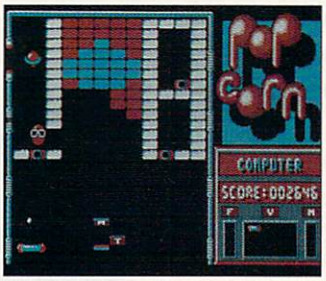
Richard C. Leinecker

A FIVE-STAR NOVEMBER

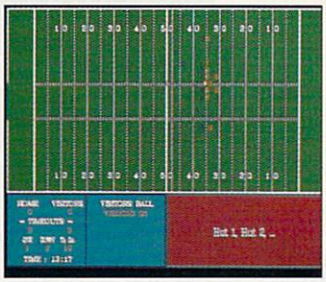
This month's *SharePak* brings you five stellar performers you'll want to keep on your hard drive for a long time.

For gamers, *POPCORN* reminds me of *Breakout* and *Arkanoid,* while *CUNNING FOOTBALL* makes me feel like Don Shula, the Miami Dolphins football coach. In the utilities department, you'll find *Copy Tree,* a backup-and-copy program for everyday use; *Directory Enhancer,* a utility that improves on the old DOS display in a colorful way; and *AMORTZ,* a convenient loan amortization program you can count on to count your dollars.

November brings five great shareware programs you'll want to keep right at your fingertips.



Catch the tiles in POPCORN, *this month's addictive time passer.*



Fall is CUNNING FOOTBALL *season for sports fans.*

When you buy COMPUTE's *SharePak* disk, you get the best shareware without paying expensive connect-time and long-distance charges. Plus, we offer a money-back guarantee if you're unhappy with your disk for any reason.

POPCORN

This game takes the prize for most addictive time waster. It's like the old *Breakout* game where you try to knock out tiles with a paddle, only *POPCORN* adds some new twists.

Tiles turn into falling objects you catch for special powers—one tile makes your paddle bigger, one creates a wall to bounce the ball back if you miss it, and there are more.

The game's graphics are well executed, even though they're in CGA. It doesn't matter if your computer is fast or slow—you can set the speed for virtually any system. Either a mouse or keyboard will work great with *POPCORN.* A high-score list gives you a goal each time you play.

CUNNING FOOTBALL 4.0

This dynamic, menu-driven football game will keep you busy and entertained for hours. It challenges your skill and strategy as you maneuver the players *and* call the plays. There are interceptions, penalties, and other subtleties found in real football. Game control with a keypad, joystick, or mouse makes playing easy since you choose the device.

One of the nice things about *CUNNING FOOTBALL* is that it plays on just about any monitor—Hercules, CGA, EGA, and VGA video cards are all supported. And a 384K memory requirement doesn't omit many systems.

Copy Tree

Here's a utility you'll put in your DOS directory and use daily. It's as easy as the simplest DOS command. Just type *CT* followed by the path mask and the destination, and *Copy Tree* copies the files you've specified to their destination. If you forget how to use the program, just type *CT* by itself, and you'll be prompted for the correct responses.

Copy Tree runs on any IBM compatible and monitor.

Directory Enhancer 1.41

Directory Enhancer makes DOS friendlier by adding color to its otherwise bland screen. Files and directories are highlighted so you can quickly find what you're looking for.

Directory Enhancer is a memory-resident program, but it takes up only 1.3K of memory and even loads into high memory with programs like *QEMM* and *386Max.* To use it, you just add a line that says *DE* to your AUTOEXEC.BAT file. Then, when you reboot, the program is there. It couldn't be simpler.

You can run *Directory Enhancer* on any IBM compatible system, although it's best on color systems. Monochrome users can change highlights and underline text.

AMORTZ 1.3

So you want to buy a car or a house. Can you afford it? You could see a CPA or a financial planner, but wouldn't you rather figure out the interest and payments on your own? *AMORTZ* lets you do just that quickly and easily without a lot of bells and whistles.

You'll be surprised at how fast this program, designed by a CPA, calculates your payments for different loans. Plug in the loan amount, interest rate, and number of years to see what your payments will be, including the percentages that go toward interest and principal and your total interest paid during the life of the loan. Plug in different variables, using whatever amounts you choose, and let *AMORTZ* help you decide on the most affordable terms for a loan. It gets my vote for the amortization program I'd rather use.

AMORTZ runs on any IBM compatible with 256K of memory and any monitor. ❐

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JAN 90: *Directory Master,* customize with this DOS shell; *Quick Type,* improve your typing skills; *Skullduggery,* tricky game of mystery; *MathMagic,* four educational games. **(#CDSK0190)**

MAY 90: *QHELP* and *QHCOMPIL,* create TSRs to give online help; *Levy Adventure Development System,* create your own adventure games; *GEEWHIZ,* TSR BASIC manual; *Sounds Good,* make sounds for programs. **(#CDSK0590)**

OCT 90: *Amado,* match scrambled blocks to the computer pattern; *Captain Comic,* great EGA graphic adventure game; *Funny Face,* Mr. Potato Head–type animation faces; *Fusion,* great game similar to *Tetris; Power Poker,* create poker hands in two dimensions. **(#CDSK1090)**

MAR 91: *Cash Control,* simplify financial recordkeeping; *Personal Inventory* 2.11, maintain a record of household items. **(#CDSK0391)**

APR 91: *Schedule*Master,* manage your daily schedule; *MealMaster,* menu-driven database system for managing recipes; *The Monuments of Mars!,* great graphic arcade/adventure game. **(#CDSK0491)**

AUG 91: *TurboPaint* 1.5, full-featured paint program; *Math Voyager,* guide starship by answering math problems; *EARTHWATCH,* graphically displays 24-hour day-and-night cycles. **(#CDSK0891)**

COMPUTE's *SharePak* disk contains the best of shareware—handpicked and tested by our staff—to complement this month's focus. You'll sample entertainment, learning, and home office software at a great savings. Each *SharePak* disk includes two to five programs plus complete documentation for one low price:

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TEST LAB

The 80386SX desktop computer has never been more capable or more affordable. A year ago, SX machines were underpowered or overpriced. Today, it's a different story, as this month's Test Lab shows. The 9 machines reviewed here—7 running at 16 MHz and 2 running at 20 MHz—offer both tremendous value *and* impressive features. Why are we seeing these improvements in pricing and features? Improvements in computer technology, new microprocessors, and competition have driven prices down and produced a dizzying array of choices. Now you can have your choice of hard drives, memory, monitors, microprocessors, warranties, service, expansion capabilities, keyboards, software bundles, and much, much more. So whether you're new to computing and have modest needs or you're an experienced hacker with a hunger for storage, speed, and power, our benchmark statistics, sidebars, and hands-on reviews will help you make the right decision.

CMS 386SX/16-40

The CMS 386SX/16-40 has everything I find indispensable in a desktop system: VGA graphics, dual floppy drives (5¼- and 3½-inch), a 40MB hard drive, and 2MB of RAM. Right out of the box it's a machine that's ready to do business.

MS-DOS 4.01, GW-BASIC 3.23, and TriGem EMM driver software are furnished with the machine, and an optional hi-res 14-inch VGA color monitor with .29-mm dot pitch completes the system reviewed here. The VGA board has 256K of video RAM and yields a maximum resolution of 800 × 600 pixels. The Oak Technology video BIOS is multimode, providing EGA, CGA, MDA, and Hercules graphic modes in addition to VGA.

CMS ENHANCEMENTS
2722 Michelson Dr.
Irvine, CA 92715
(714) 222-6000
List Price: $1,665.00
Street Price: $1,041.67*

The CPU case gives you plenty of room for expansion with two 8-bit and four 16-bit slots (the VGA board uses one of the 16-bit slots, however). Occupying a footprint 14¾ inches wide by 16¾ inches deep, the box itself isn't space hungry. Since the expansion cards mount into the slots vertically (rather than horizontally as in some "low profile" desktops), the case is about 6½ inches tall, which will allow it to stand with stability on its side next to your desk if you wish.

Although there is no dedicated mouse port, two 9-pin serial ports are provided for serial device I/Os, along with a parallel port. The VGA card has D connectors for 9- or 15-pin monitor cables, along with a bank of DIP switches for video mode selection.

The keyboard connects via a standard 5-pin port also mounted at the rear of the cabinet. The 101-key keyboard is very nice, offering a very light and springy (not mushy) touch. Good tactile and audio feedback make it a pleasure to use, especially if you're a relatively fast touch-typist. Indicator lights for Num Lock, Caps Lock, and Scroll Lock keys show keyboard conditions at a glance; dedicated cursor control keys and a full numeric keypad make data entry fast and accurate.

I popped the four Phillips screws on the back of the system cabinet, slid the case cover forward, and took a look "under the hood." In keeping with the latest engineering and manufacturing practices, the motherboard makes extensive use of VLSI (Very Large Scale Integration) technology, with only a handful of chips performing numerous tasks. This type of design not only keeps manufacturing costs low (resulting in lower consumer prices), but it also allows the machine to run cooler and more reliably, since there are fewer components to generate heat and possibly fail.

The 145-watt power supply has an extra pigtail connector for attaching another peripheral device (for example, an internal CD-ROM drive or a second hard drive). While this should be adequate for most users, if you're a power user intending to fill up every slot and add an additional drive (magnetic or optical), you might want to upgrade the power supply to a 200-watt unit to handle the extra demands for juice these peripherals will require.

The review unit came equipped with a high-density 1.2MB 5¼-inch floppy drive in the upper bay position and a high-density 1.44MB 3½-inch drive in

**Test Lab street prices are an average of prices advertised in computer magazines and national newspapers during August.*

the lower bay. Unfortunately, no additional exposed bays are available, so adding an internal CD-ROM drive, an internal high-speed tape backup unit, or another floppy drive isn't an option. Another hard drive could easily be mounted inside the cabinet, however, since you wouldn't need to access it physically from outside the machine.

All of the components and all of the workmanship appear to be of very good quality, and the overall layout and design of the machine's interior are excellent.

A socket for an 80387 math coprocessor is provided on the motherboard, as well as space for RAM expansion of up to 8MB. The AMI software BIOS performs a complete set of diagnostic tests with a single keystroke on boot-up, and changing the CMOS configuration to reflect any changes made to the system (such as adding extra RAM) is a breeze as well.

The documentation for the CMS 386SX/16-40 is truly first-rate: clear, well organized, and uncommonly complete in what it covers. Virtually anything you'd like to know about the system is contained in the operations guide. In addition to the system specifications, you get useful information regarding various memory configurations, I/O addresses, connector pin-outs, and more—even a section on removing the motherboard and running diagnostics.

The system performs admirably, thanks to its 16-MHz 80386-SX CPU and a very quick 40MB IDE hard drive. During my review I ran several programs under DOS version 4.01 (included with the system) as well as *Windows* 3.0 and found the CMS to be quick and reliable. If you're a DOS aficionado, upgrading to DOS 5.0 should make it perform even better. The included TriGem EMM drivers and utilities disk facilitate taking advantage of the expanded memory above the base 640K and configuring it for use in your applications.

CMS backs the machine with a one-year parts and labor warranty covering repair or replacement when it's returned to the factory.

If the configuration reviewed here doesn't fit your requirements precisely, the base system can be ordered to your specific configuration requirements with more (or less) RAM, higher capacity hard drives, a math coprocessor, and more. If you're of the hands-on, do-it-yourself persuasion, you can order a barebones unit consisting of the basic cabinet, motherboard, and power supply only and dress it up according to your own particular recipe. Or you can order it with some components in place and add others at a later time yourself. You get the idea; CMS custom-builds the units any way you wish.

Overall, I was very favorably impressed with the appearance, performance, and design of the CMS 386SX/16-40. It's a "real world" machine that delivers plenty at a price that won't break the bank.

TOM BENFORD

Circle Reader Service Number 301

DELL 320SX

Outstanding quality, support, and reputation make the Dell 320SX a computer you should consider.

DELL COMPUTER CORPORATION
9505 Arboretum Blvd.
Austin, TX 78759-7299
(800) 289-3355
List Price: $2218
Street Price: n/a

The first thing I noticed about the Dell 320SX is how neatly the computer and monitor are packed. Everything has its own place. The monitor comes packed in four pieces of styrofoam rather than two. When you remove the monitor, you don't have to wedge your arms in and around the packing and pull everything out at the same time, so you're less likely to drop the monitor or injure your back.

Setup is a breeze, thanks to Dell's excellent Getting Started manual. Step by step it covers everything you need to know and provides great sketches.

The case is sturdy and compact, taking up no more space than is absolutely necessary. To open it, simply remove four screws, and the cover pops right off, ready for your next upgrade. Once inside, I was amazed at the roominess of this compact case; it should provide adequate ventilation, and almost everything is easily accessible. Configured with two megabytes of SIMM memory, the motherboard can very easily take up to eight megabytes of memory.

You switch between the Dell's 8-MHz and 20-MHz speeds with software commands; there's no reset button, but the power switch is conveniently located below the

floppy drive. For security, Dell provides a lock.

This review system came with a 40MB IDE drive, one 5¼-inch floppy drive, a VGA monitor, DOS 4.01, a package of Dell utilities, and the keyboard. There's one more drive bay available, which you might use for a tape backup system, a CD-ROM drive, or another floppy drive. The three 16-bit expansion slots may not seem like a lot, but all serial, parallel, video, and mouse ports are built into the motherboard. You should be aware of one drawback to this type of motherboard; if the built-in controller or video adapter fails, the entire motherboard will probably have to be replaced, and replacing the motherboard will cost you more than replacing a controller card or a video adapter card.

The monitor has an antiglare screen and a .31-millimeter dot pitch to ease eyestrain. However, stepping up to a .28-millimeter pitch might be easier on your eyes and worth the extra cost. There was a noticeable flicker when I changed screens in *Windows* 3.0 and other graphic-intensive packages. The monitor's tilt swivel base seems to easily point in any direction you need.

The motherboard video configuration that came with this machine supports standard VGA modes. You can install an additional 256K of video RAM to get additional high-resolution modes, another option worth the money.

Like the rest of the machine, the keyboard has a nice tight feel to it—not at all cheap or wobbly. I personally like smaller keyboards, but I quickly fell into sync with it. The keys feel solid, aren't crowded, and have a quiet but audible click. The standard 101 keyboard does not have the oversize Enter key.

The 320SX uses a Phoenix BIOS and should run any software on the market today. I tried *Prodigy, Windows* 3.0, *PC Tools* 7.0, *WordPerfect* 5.1, and several games, all of which ran without a hitch. *Windows,* however, was relatively slow (I have run *Windows* faster on other machines), and after running the *PC Tools* 7.0 Disk Benchmark Test, I found out why. The disk came in at a seek time somewhere between 24.70 and 29.98 milliseconds.

Technical support is toll-free. The address is conveniently located on the back of most of the manuals.

I gave the 800 technical support line a try and was impressed. The technicians know what they're talking about. If you have a question, first give the technician the UPC code from the back of your machine; he or she has the exact configuration of your machine. From there you can get answers to any of your questions.

Another impressive point: I didn't stay on hold for 15–20 minutes waiting for a technician to answer the phone. Once finished with technical support, I was quickly transferred to the sales department for other information. All the staff members I spoke with, from the sales department to technical support to the spare parts people, were knowledgeable, courteous, and ready to help.

The Dell 320SX comes with a one-year on-site warranty through the Xerox corporation as long as you are in the Xerox service range. Before your purchase, technical support can quickly tell you if you are located in a service area. However, if you are out of the service area, you can always ship your computer back to Dell. You pay shipping to Dell; Dell pays shipping to you.

The warranty covers all manufacturing defects for one year. Dell's "Total Satisfaction" return policy is a nice feature and is becoming more widespread with other organizations these days. Dell offers a 30-day money-back guarantee. You must, understandably, return the equipment in its original packaging.

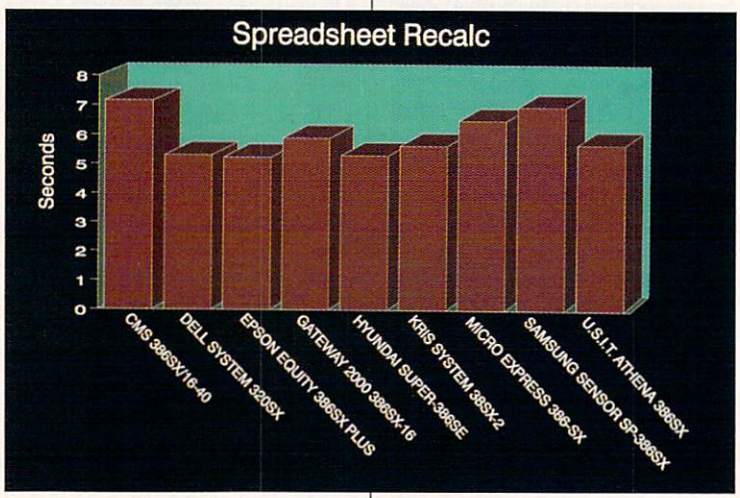
The system I reviewed sells for $2,218. Dell custom-configures its computers, so you get the sys-

COMPUTE APPLICATION INDEXES

Since the Test Lab section is designed to give you the best information about how systems will perform when you take them home or to your office, we performed a set of tests involving commonly used applications.

The timings indicate how long it took a particular computer to sort a database, perform a search and replace in a word processor, recalculate a spreadsheet, and redraw an object in a CADD (Computer Aided Design and Drafting) program.

—RICHARD C. LEINECKER



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CITIZEN™

Circle Reader Service Number 166

tem that meets your needs. There are less expensive machines on the market than the Dell. There are other machines that operate a little faster or that come with a higher-resolution monitor or something standard that is extra on the Dell. However, you get what you pay for. Here, you pay for rugged equipment, superior technical support, and a company that will be here tomorrow to back up the product it sold you today. All Dell's computers are assembled, and some parts are manufactured, here in the U.S.—another reason to buy a Dell.

My only two recommendations before purchasing this machine would be to upgrade to a faster, larger hard drive (100MB if your budget permits) and to purchase a monitor with a .28 pitch.

PEER PLAUT

Circle Reader Service Number 302

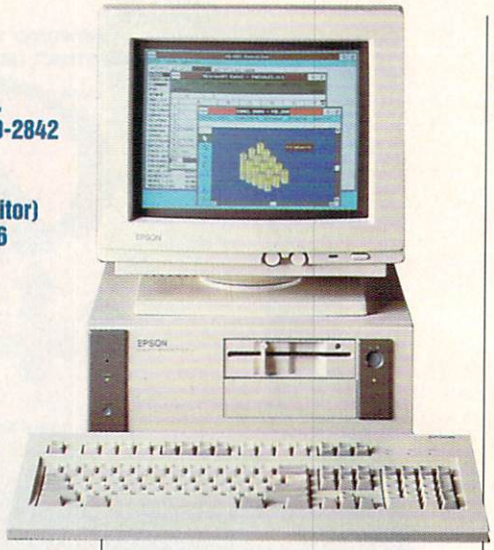
EPSON EQUITY 386SX PLUS

I've enjoyed the benefits of a 386SX at the office for quite a while now, so when asked to take a look at the Epson EQUITY 386SX PLUS, I eagerly agreed.

The EQUITY 386SX PLUS features an Intel CPU operating at 16 MHz turbo speed and 8 MHz nonturbo. It has serial and parallel ports built in and a PS/2-compatible mouse port as well. No mouse was provided with the machine, however, so I operated it with a Logitech MouseMan for a while and then switched to a Summagraphics digitizing tablet plugged into the serial port.

You can order this machine with either a 1.44MB 3½-inch or a 1.2MB 5¼-inch floppy drive. I use the 3½-inch format almost exclusively, and it does appear to be very much an industry standard. But if you still have an abundance of 5¼-inch disks in your collection, it's nice to have a choice. A 40MB IDE hard drive comes standard. There are three internal

EPSON AMERICA
2770 Madrona Ave.
Torrance, CA 90509-2842
(800) 922-8911
List Price: $1,989
(not including monitor)
Street Price: $1,246



drive bays, allowing you to customize the machine with a hard drive and two floppies or two hard drives and a single floppy.

This Epson offers you quick and easy access to the system box, thanks to a well-designed plastic case with a sturdy flip-top cover. Turn a knob, press two buttons on the back of the case, lift the top, and you'll find four expansion slots—three 16-bit and one 8-bit. Installing cards and extra memory won't have you fumbling about in a too small space. Expansive and comfortable, the keyboard sports keys that click—an unusual detail for a machine designed and marketed for discount and department store sale. Its VGA monitor provides bright, sharp color.

The starter machine comes with 2MB of RAM and can expand to 14MB on the motherboard. If you go with a memory card option instead, the ultimate capacity of the Epson EQUITY 386SX PLUS peaks at 16MB.

The VGA included with the base machine is flexible. Using bundled utilities, you can use up to 800 × 600, 16-color, and 132-column text mode.

Despite its built-in mouse port and video card, the EQUITY isn't too difficult to upgrade. To move up to Super VGA, for example, you merely disable the existing video board by pulling a jumper on the motherboard and then slip your new graphics card into a slot on the expansion bus. While this kind of integration is reliable and perfectly suited for the beginner, it does squander resources. For this reason, consider carefully whether you really want to purchase a fully integrated PC rather than a standard architecture PC—especially if you think you'll be expanding the system over a period of time.

For security, there's a power-on option allowing you to require that a password be entered before anyone can use the computer after a cold start or a reset.

Despite some frustrating waits for technical support, when I did get through, they were always courteous and helpful.

The computer was a comfortable fit in a crowded office space—quiet, comfortable for typing, and visually attractive. Epson enjoys a longstanding reputation for solid, dependable computers and peripherals, and this machine would be a perfect first computer for a student or the head of a home office. If you have modest needs for a personal computer, you'll enjoy owning and operating the EQUITY. The test unit gave me no problems worth mentioning, and its finer points make it an amiable workmate for most situations.

ROBERT BIXBY

Circle Reader Service Number 303

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GATEWAY 2000
610 Gateway Dr.
N. Sioux City, SD 57049
(800) 523-2000
(605) 232-2000
List Price: $1,495
Street Price: n/a (only through Gateway)

GATEWAY 2000 386SX-16

Gateway's 2000 386SX-16 offers you plenty of attractive features at a very competitive price. With a 14-inch antiglare Super VGA monitor, 2MB of memory, a 40MB hard drive, five 8- or 16-bit open expansion slots, and more, this computer should appeal in a big way to the average-income consumer.

I needed approximately five minutes to set up this Gateway 2000 system. The 40MB hard drive was already formatted, and *Microsoft Windows* was installed. I simply checked the user guide for anything unusual, plugged in the appropriate cables and power cord, removed the cardboard insert from the 5¼-inch drive, and flipped the switch.

The easy-to-understand Gateway 2000 Complete Systems User's Guide provides you with all the necessary information as well as helpful illustrations and troubleshooting tips. Other documentation includes the MS-DOS Operating System Guide, the *Microsoft Windows* User's Guide, and an operations manual for the CrystalSCAN 1024 monitor.

The MS-DOS guide is divided into four sections with a table of contents and index for each. The *Windows* guide is divided into sections for beginning users and advanced users; I like the conversational, nontechnical language that the manual uses.

To check the 2000's compatibility, I ran a variety of applications, including *Telix,* a shareware telecommunications program; *Wing Commander; Express Publisher; XyWrite* 3.0; and several other commercial programs. All of these programs ran without a hitch on the Gateway.

Inside the 2000, a riser card vertically houses the open expansion slots. All but the lowest card located next to the power supply unit allow easy access. The system's integrated design—with mouse port, parallel and serial ports, floppy and hard drive controllers, and video adapter as part of the system board—leaves the expansion slots open to other options. Since the video adapter is integrated, however, upgrading the video won't be as easy as changing video cards. The 2000's adapter is first-rate, though, so this shouldn't be considered much of a negative.

Vents along the lower left side of the unit keep the system's power supply from overheating. After I left the unit on for most of the day, the shell over the power supply unit wasn't even warm.

Easy access to Reset and On/Off buttons is essential, and both these buttons are located on the front of the Gateway 2000. The Turbo button is also located on the front for easy access.

Many computers now use AA alkaline batteries to keep CMOS RAM intact. The Gateway 2000 is no exception. The four AA batteries reside between the power supply unit and the 5¼-inch disk drive—definitely close quarters. I wouldn't want to have to change those batteries.

You might eventually want to make the leap from 16 MHz to 20, and the Gateway 2000 entices you to hit the upgrade path by making the process a simple one. Just remove the CPU module connected to the system board and replace it with a 386SX 20-MHz module. This won't invalidate your warranty.

You can easily access the 2MB of SIMM RAM chips on the motherboard. Two empty RAM sockets are available if you'd like to add more memory in the form of 30-pin SIMM memory modules. RAM prices change constantly, but the price I was quoted for 1MB of RAM was $62.50. So for $125.00, you could add 2MB of RAM for a total of 4MB—not bad.

The first-class monitor that Gateway supplies with the 2000 provides a flicker-free, dark-tinted, antiglare picture tube sure to minimize eye fatigue. The brightness and contrast controls are conveniently located on the front right-hand corner of the monitor while the other controls are located on the back of the unit.

The unique AnyKey keyboard supplied with the 2000 is top of the line. You get two sets of function keys as well as a Program Macro key, a Repeat Rate key, and a Remap key. With the Program Macro key, you can enter sequences of keystrokes (macros) into a single key. Entering macros on this keyboard can be accomplished in a few seconds, and you no longer have to create script files for your keyboard macro program. Moreover, you can just do away with those memory-consuming macro-generating TSRs alto-

gether; this hardware solution's the perfect replacement. Want to suspend your macros while you run an application that comes with preassigned Alt-key combinations? Just toggle your macros off with the Suspend Macro key.

You can store your new keyboard configuration to your hard drive with the ANYKEY utility included in the system software; this allows you to have several different keyboard setups on tap. The Repeat Rate key lets you adjust the keyboard's repeat rate, and the Remap key makes tinkering with key assignments fun and quite useful. If you have trouble finding a particular key, for instance, just remap it to a function key that you can easily locate.

The keyboard itself feels slightly mushy, though you still hear a click when the keys are pressed. When I first began my review, I disliked the softness, but the more I typed, the better I liked it. Diehard fans of firm keys can order a standard 101-key keyboard to go with the 2000 at no additional cost.

In comparison to those offered with a lot of other systems, the 2000's one-year limited warranty rates better than some. Gateway offers toll-free customer service and technical support numbers.

A solid system, the standard issue 16-MHz 2000 won't disappoint most users. Programmers, though, would probably be better off with the 20-MHz system, since compile time means idle time. From novice user to computing professional, Gateway promises value and service.

JOYCE SIDES

Circle Reader Service Number 304

HYUNDAI SUPER-386SE

The Hyundai Super-386SE appears to be perfectly cut out for general office or home office use. Though it's not a top-of-the-line corporate screamer, it has plenty of ability to handle a variety of computing tasks. The Super-386SE is a serviceable low-end entry into the world of 386 computing.

The machine I tested—configured with 2MB RAM, a VGA monitor, a Conner 40MB hard drive, and a 1.2MB 5¼-inch floppy drive—should be able to handle just about anything a home/office generalist needs it to do. The system includes one parallel and two serial ports and a disk drive interface built into the motherboard. No disk controller board is required unless you plan to add a second hard disk. The system is set up to accommodate a second floppy disk drive without additional hardware.

HYUNDAI ELECTRONICS AMERICA
166 Baypointe Pkwy.
San Jose, CA 95134
(800) 727-6972
List Price: $2,524
(review configuration)
Street Price: $1,781

This small-footprint system (15.9 × 15.2 × 6 inches) includes five expansion slots (four 16-bit and one 8-bit), allows for up to 8MB of memory on the motherboard using 256K or 1MB SIMMs, and includes a socket for a math coprocessor. The video adapter occupies one of the system's five slots. Although the system seems to invite expansion, it comes with a 130-watt power supply, which probably would need upgrading before you could load the Super-386SE to the hilt.

The generic Super VGA card can handle resolutions up to 1024 × 768, and the Hyundai 14-inch color VGA monitor has a dot pitch of .28. The video card includes an automatic monitor detection feature allowing it to configure itself for the monitor in use without operator intervention.

The Super-386SE uses a Phoenix BIOS and a chip set by Headland. BIOS and video ROM can be copied into shadow RAM if the extra 384K of the first megabyte of system RAM is configured as EMS memory. This arrangement improves system performance by copying often-used BIOS code from ROM to faster RAM. If you don't opt for ROM shadowing, the extra 384K can be configured as extended memory.

The Hyundai Super-386SE was a snap to set up right out of the boxes. The monitor power cable plugs into the power supply rather than a wall outlet, making switched operation of the whole system possible. The machine came with DOS 4.01 and a full set of documentation for MS-DOS and GW-BASIC as well as a system User's Guide and small manuals for the monitor and video adapter.

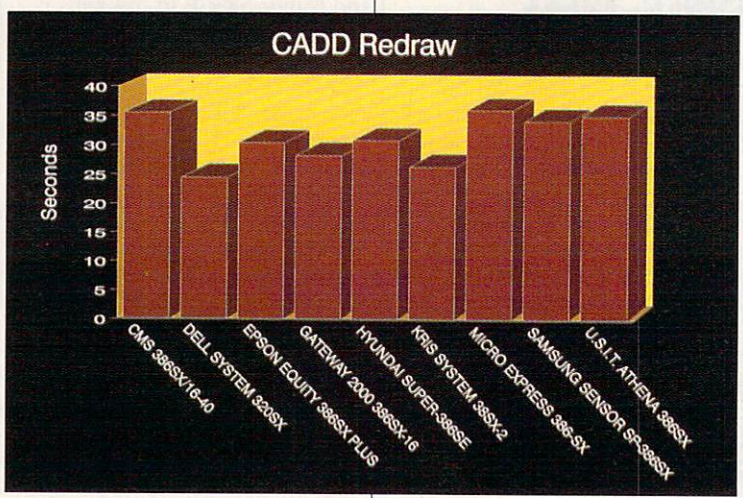
The User's Guide provides adequate technical information on the machine and an ample number of illustrated tips on adding additional disk drives and memory. Digging through the User's Guide is somewhat difficult, though, as it includes introductory tutorials on MS-DOS and GW-BASIC inter-

mixed with the technical data.

Among the disks in the DOS package is a utilities disk that includes diagnostic programs used to check the health of system components. Although DOS 4.01 came with the system, I quickly upgraded to MS-DOS 5.0 without difficulty. Other software including word processors, *Windows* applications, a wide variety of commercial utility packages, and a host of games ran without problem. One game, a 256-color version of a popular graphic adventure game, failed to run, however, owing to a memory shortage on the video adapter, which sported only 256K of video memory. The adapter needs at least 512K to display more than 16 colors at resolutions of 640 × 480 or 800 × 600, or more than 4 colors at 1024 × 768.

Software performance was typical for a 16-MHz 386SX. The Super-386SE offers a significant performance improvement over a 286 system in graphics environments such as *Windows* or when running a large database application or spreadsheet. Nevertheless, if you know going in that you'll spend a majority of your computing time with graphics-intensive programs, huge spreadsheets, or databases, or if you intend to make frequent use of the 386's multitasking capabilities, consider a machine with a little more speed and power.

As with many of today's machines, the inside of the Hyundai is simple and clean-looking. The motherboard, though small, contains more components than motherboards of days past. Hyundai positioned the expansion slots at the rear left of the machine and the SIMM memory sockets to the right of the card slots. These memory sockets are easily accessible as long as the card cage isn't full. The User's Guide provides information on inserting and removing the memory modules, but the illustrations in the guide are a bit confusing since their orientation is the opposite of that of the actual memory sockets. In our system, all eight banks were filled with 256K SIMMs for a total of two megabytes. Expanding memory would require removing the 256K SIMMs and replacing them with either four or eight 1MB SIMMs.



Operating speeds of the Hyundai Super-386SE are 8 MHz and 16 MHz. Select your preferred boot-up speed via the setup routine and store it in CMOS memory. You can change clock speed by pressing the Ctrl-Alt-Plus or Ctrl-Alt-Minus key combinations. Front panel LEDs indicate the current system speed setting. The Hyundai also includes a hard disk activity LED, which confirms that the nearly silent Conner hard drive is accessing information.

Other front panel controls include a push-button on/off switch and a reset button. The 2¼-inch speaker on this model has the normal tinny qualities we've grown accustomed to in the sound systems on DOS systems, but the Hyundai's design introduces an additional level of irritation. When playing notes of certain frequencies, the speaker's vibrations induce rattles and vibrations elsewhere in the system—specifically in one component of the on/off switch.

While the Hyundai's power supply is at the system's rear, the on/off switch is on the front panel. A small tube connects the two. It is this lightweight metal tube that rattles disturbingly when the speaker plays certain notes. This feature is most noticeable and annoying during gameplay where soundtracks set off this sympathetic vibration with alarming frequency.

All in all, this computer system has what it takes to be a competent general-purpose workstation.

TONY ROBERTS

Circle Reader Service Number 305

KRIS SYSTEM 38SX-2

Try this at home. Pop any tape into your VCR. If your machine has a Pause/Slow key, run the tape in slow motion. Remember how that looks. Resume normal speed; then, while the tape's still playing, hold down the Fast Forward button for a quick scan in fast motion. Remember how that looks. Got it?

Good, because now you know how I felt going from my trusty old IBM XT–compatible personal computer with its 8086-type microprocessor to KRIS System's 38SX-2, a PC with an 80386 microprocessor running at 20 MHz. Besides taking me from a Model T crawl to a Porsche sprint, the KRIS System 38SX-2 and the accompany-

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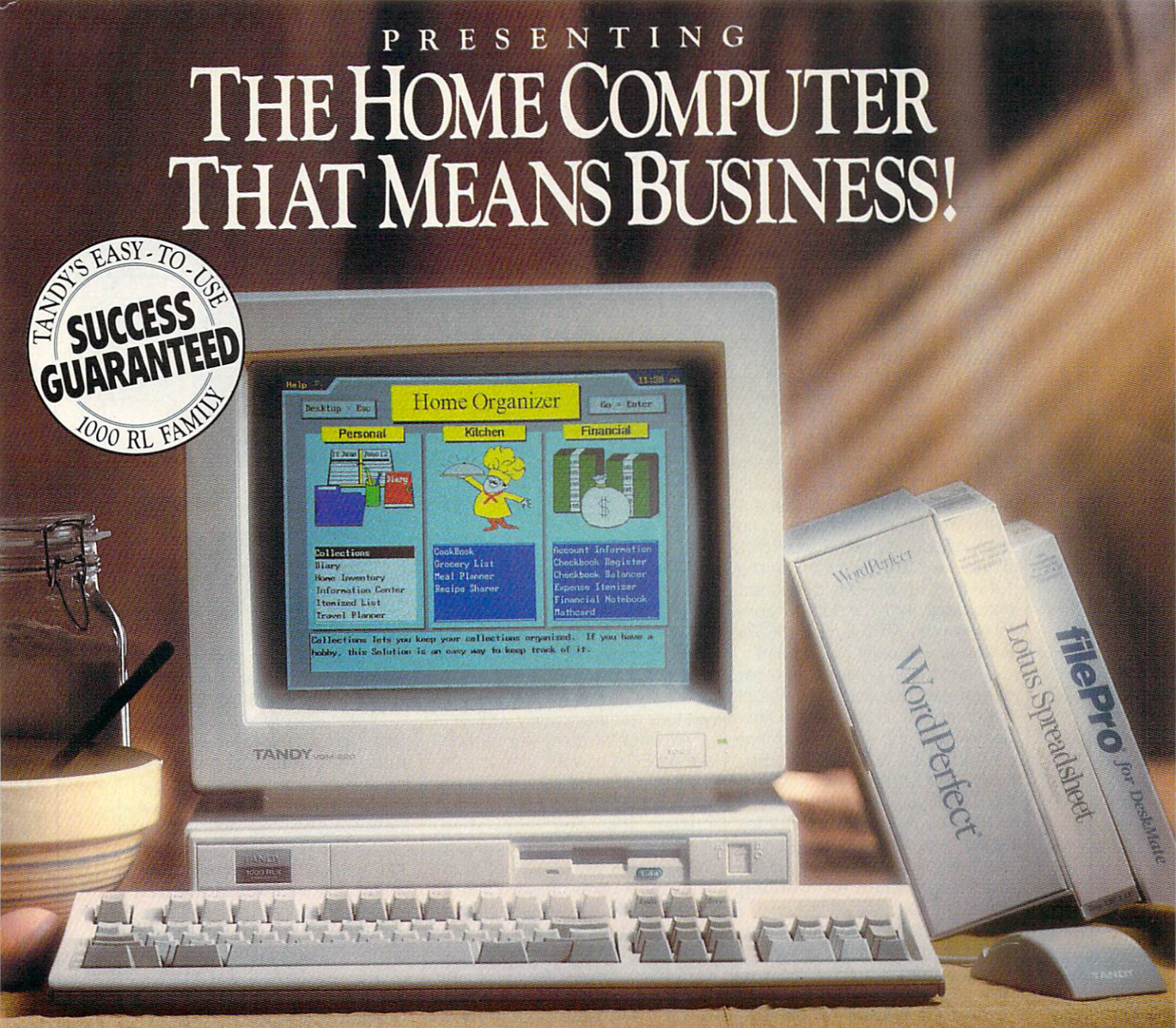

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Circle Reader Service Number 143

KRIS TECHNOLOGIES
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S. San Francisco, CA
94080
(800) 282-KRIS
List Price: $1,803
Street Price: n/a

ing PMV14VC Super VGA monitor also proved to be generally well designed, easy to set up, and agreeable to use.

After opening the boxes and separating the PC and monitor from their packaging, I had the system up and running in only about five minutes. This desktop computer comes equipped with a base perfect for setting it up out of the way on the floor, freeing up desk space. Its two floppy disk drives—a 1.2MB 5¼-inch and a 1.44MB 3½-inch—are positioned accordingly, with the slots horizontal when the KRIS System 38SX-2 stands vertically on its base.

The monitor, printer, and other peripherals plug into the back of the computer. However, the keyboard does, too—a configuration I found to be a drawback. Because the front of the machine must face you to provide access to the floppy drives and Turbo, Power, and Reset buttons, having the keyboard plug in at the rear necessitates an overlong stretch of its cord. As a result, I had a little trouble keeping the keyboard on my desktop.

Aside from the less-than-elegant cord stretching, though, the keyboard is perfectly acceptable, with keys neither too crowded nor too scattered. The 12 function keys are arrayed in one horizontal row across the top, with the basic letter keyboard gravitating to the lower left corner. I found it a little awkward doing most of my typing toward one end of the keyboard, but that's certainly not a major gripe. There are two sets of Ctrl and Alt keys—one on either side of the space bar. The number keypad lies at the far right, with four distinct arrow keys and the other directional keys—such as Home and End—situated between the letter and number keyboards. The keys responded well, clicking audibly, although they weren't quite as crisp as I'd like them to be.

I made no special adjustments for any software I tried with the KRIS System 38SX-2. It handled my word processor, business ledger, and a couple of complex adventure games equally well.

Although the computer can handle an EGA or VGA monitor, the PMV14VC Super VGA monitor is a particularly good one, offering crisper lines and more vivid, lifelike colors than my standard VGA monitor. Making its good display better takes only the adjustment of a couple of perfectly accessible knobs located just under and to the side of the monitor's lower right corner. Unfortunately, the PMV14VC Super VGA's one obvious flaw couldn't be ignored: The pronounced frame surrounding the recessed screen casts an arch-shaped shadow across the top of the screen, lapping over any display and detracting from an otherwise excellent picture.

As for the inner workings of the computer, a quick glance inside the case revealed the KRIS System 38SX-2 to be a well-designed machine. The removal of four readily accessible screws at the back of the machine allows the sturdy case to slide off easily, and the vertical design of the KRIS System 38SX-2 makes for easy access to the disk drives and motherboard from two directions. Given the machine's deep, relatively open setup, you should have few problems adding new cards in expansion slots or installing additional memory chips. Before opening the case, however, I noticed that the fan operated at average-to-above-average loudness.

The exterior proved less acceptable. A plastic overlay marking the Turbo and Reset buttons was loose, flaring out to give the machine a somewhat cheaper feel; the flaw was basically inconsequential, yet hard not to notice. In addition, the round, white Turbo and Reset buttons are identical and side by side, making an accidental reset virtually inevitable at some point. The buttons should have been given distinct designs and separated. A larger round white button nearby controls the power, but its size and placement are distinct enough not to cause confusion when your fingers fumble around under your desk in search of the correct button. The arrangement of the floppy drives is more satisfactory, with the 5¼-inch drive placed above the 3½-inch drive at the top of the PC's face. A row of small lights indicates whether turbo has been engaged, the presence of a high-density disk, and activity by the hard drive.

Whatever they're doing, chances are the KRIS System 38SX-2 and accompanying PMV14VC Super VGA monitor are doing it well. Solid and fast, this machine offers exhilarating computing to anyone accustomed to older models.

EDDIE HUFFMAN

Circle Reader Service Number 306

Smartcom Exec,™ the newest communications software from Hayes, is remarkably easy to operate. In fact, Computer Shopper said "Many people...will be able to install and use the program without touching a book, because the interface is quite self-explanatory and help is just a function key away."

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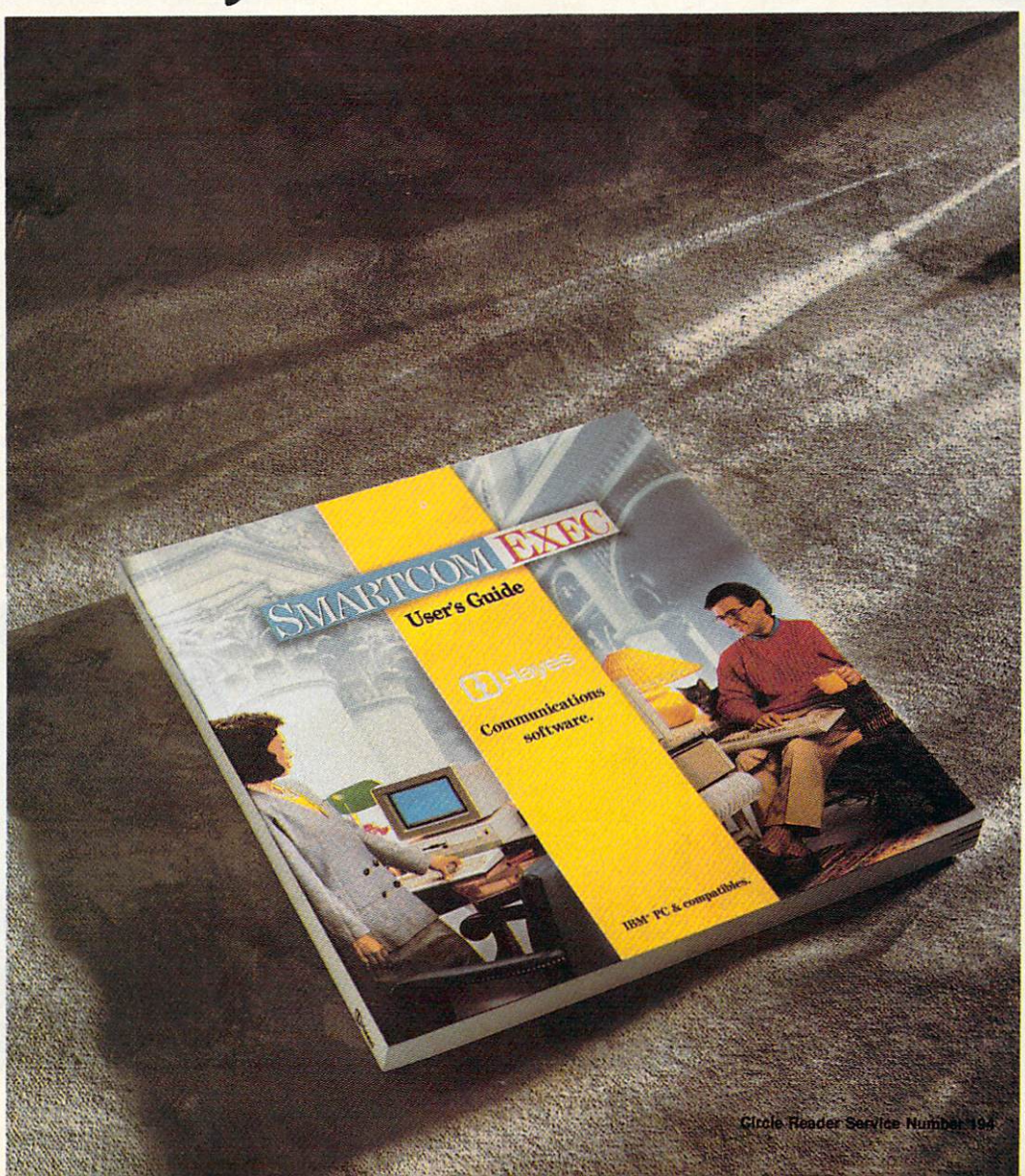

Circle Reader Service Number 194

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MICRO EXPRESS
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List Price: $1,394
Street Price: n/a (only through Micro Express)

MICRO EXPRESS 386-SX

As I pulled the Micro Express 386-SX unit out of its cardboard box, I breathed a sigh of relief. Important elements of the machine's architecture—VGA card, hard drive controller, and I/O ports—were all distinctly separate from the motherboard. Some newer machines have all the cards and I/O ports as part of the motherboard. This may save the manufacturer a few dollars, but when there's a breakdown, replacing the hard drive controller means replacing the entire motherboard. This can be expensive, costing only about $300 less than a new computer. Standard architecture also allows for use of inexpensive clone hardware for future upgrades and replacement, keeping both of these costs well within reason. With six expansion slots available to you (four 16-bit and two 8-bit), you can expand your system at will, budget allowing.

The machine comes with 2MB of SIMMs (Single In-line Memory Modules) and will expand to 4MB. Easy to replace or upgrade, these SIMMs cost even a bit less than DRAMs (Dynamic Random Access Memory). If you choose to install the memory yourself, you may find it easier to remove the motherboard than to wrestle with the SIMMs in cramped quarters.

Located just above the Reset button, the computer's readily accessible Turbo switch bumps the processing speed up to 16 MHz. Be aware that both the Turbo switch and the Reset switch are exactly the same shape and color as the case. You could easily reset the machine by accident when you intend to hit the Turbo switch; I did. Most of the time you'll probably run the processor at 16 MHz anyway. Probably the only time you'll want to intentionally slow down the motherboard is when you want to play games.

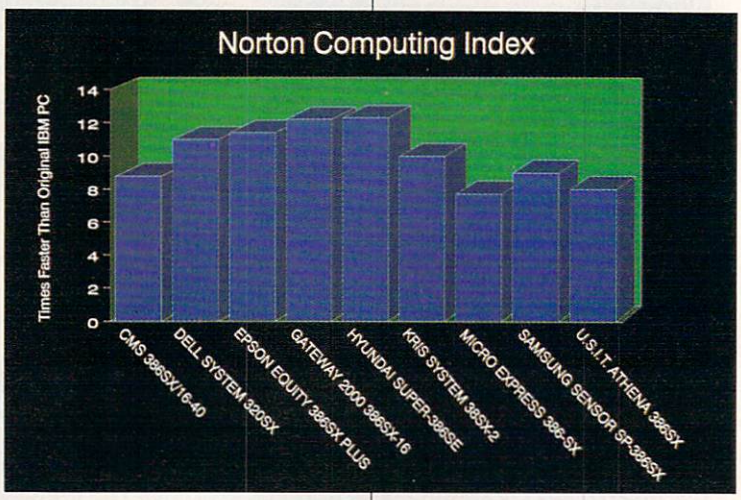
The Micro Express comes standard with a 3½-inch 33MB IDE (Integrated Device Electronics) hard drive manufactured by Quantum. Included in the drive package is also one 5¼-inch 1.2MB floppy drive. There's plenty of room to add the 3½-inch floppy disk drive and a tape backup system or one more hard drive. If you call Micro Express, it will configure the machine any way you desire before you buy it. I suggest these extras: the popular 1.44MB floppy disk drive and a 100MB drive instead of a 33MB. This may sound like a lot of hard drive space, but given the size of today's programs, it's not. Take advantage of Micro Express flexibility and order exactly what you

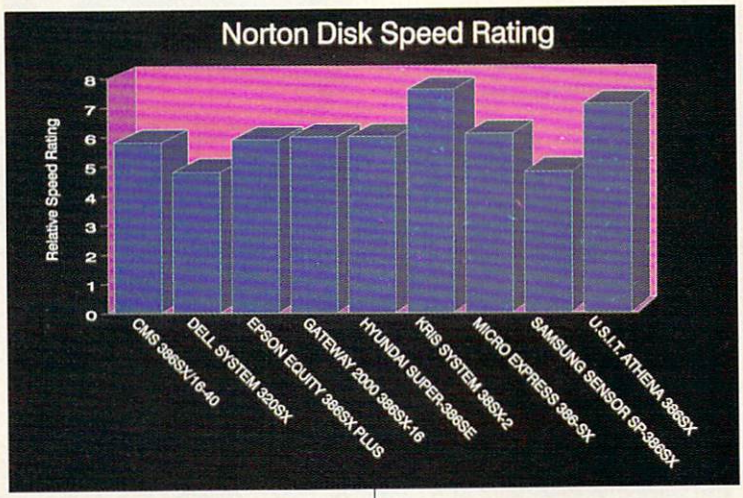
NORTON INDEXES

The Norton computing, disk, and overall indexes show how well a computer performs when compared to a 4.77-MHz XT (the original IBM PC). Such an XT has an index value of 1.0. If a computer is twice as fast, it will have a value of 2.0. The greater the index value, the faster the computer—and the faster your applications will run.

The computing index rates a computer's processing performance based on integer operations, such as addition, subtraction, multiplication, and division. The disk index rates the performance of a system's hard drive. The overall performance index factors in the computing and disk indexes among other things.

—RICHARD C. LEINECKER





want and need for the computer. From an aesthetic point of view, the case won't win any prizes. However, thanks to its small size, the case can sit under your desk and never be noticed. One problem with this setup, and also when the machine rests on a desktop, is that the power switch is located on the back of the machine—very awkward.

Ventilation should not be a problem—the case seems large enough, and the fan located in the power supply is standard fare. The computer is no noisier or quieter than the average desktop. Its footprint, too, takes up an average amount of space on your desk.

My Micro Express 386-SX shipped with a 14-inch analog Super VGA color monitor with resolution up to 1024 × 768 and a .28 dot pitch. The colors on this monitor did not appear especially bright, but the picture was crisp because of the .28 pitch. The nonglare screen helps when you're working at odd angles for long periods of time, giving your eyes a little more mileage.

Keyboard layout ranks high on the list of significant attributes for any computer. Micro Express's keyboard (a standard clone) has the familiar row of 12 function keys across the top, an extended numeric keypad, and cursor movement keys. An audible click accompanies each keystroke, and each key feels solid. Still, I prefer a more compact keyboard. Trim the borders and move the function keys a little closer to the numeric keys across the top, and the keyboard would work well. Nevertheless, this machine and I were up to speed in no time.

The standard Micro Express 386-SX sells for $1,394 and will serve two purposes extremely well. If you're looking for a replacement 386SX, this machine will meet your needs. If you don't like the keyboard, keep it as a spare. Any of your existing hardware and software should transfer readily to this machine.

If this is your first experience shopping for a 386 computer, and you already own some software, this standard system is a good place to start. You can easily install more memory and add a mouse or a 3½-inch disk drive. Be forewarned, however, that the Micro Express comes with no software outside of your choice of DOS 3.1 to 4.01. Manufacturer-installed software often helps computer newcomers get in the swing. With the Micro Express 386-SX, you'll start almost from scratch.

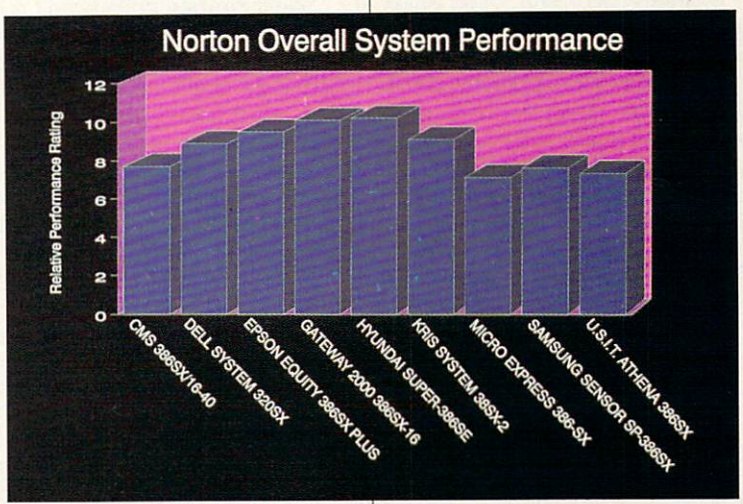
Technical support has always been important to me. Nowhere in the manual did I find a technical support number or even a mailing address—true to form for a lot of mail-order businesses. Hang on to the toll-free technical support number that shows up on Micro Express invoices; that's your ticket to unlimited free, knowledgeable, and friendly technical support.

PEER PLAUT

Circle Reader Service Number 307

SAMSUNG SENSOR SP-386SX

The Samsung Sensor SP-386SX offers a lot to those entering the computer world. Easy setup, compact design, and built-in features—which cost extra with other systems—make the Sensor a



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San Jose, CA 95134
(800) 624-8999
List Price: $1,995
Street Price: $1,599

remarkably complete package.

Getting the system up and running took me only about ten minutes, thanks to the installation and setup guide packed with clear illustrations. If you lack computer experience or need more reassurance, the VHS videotape manual and the User's Guide lead you from setup through your first work session with step-by-step introductions to the system's hardware and software.

Samsung packs quite a bit into its system box, which has a small 15 × 13¾ inch footprint. The sturdy metal case opens easily. Inside, you'll notice a roomy and accessible layout, which should simplify installation of boards and extra memory.

However, you may consider additions and upgrades unnecessary. The Sensor comes with a mouse port, parallel port, serial port, Super VGA graphics, and 2400-baud internal modem—all built into the motherboard. In addition, the Sensor has an external floppy disk drive connector for adding the Sensor SP-FDD 5¼-inch External Disk Drive. For most computer users, especially for those just entering the computer world, these features will make the two IBM AT–compatible expansion slots more than sufficient.

The Sensor comes with 2MB of RAM, expandable to 8MB on the motherboard using SIMM chips. Adding memory expansion boards lets you expand to 16MB. The motherboard's speed is factory set at 16 MHz but can be switched to the slower 8 MHz.

The fan, located at the back of the case, remains relatively quiet—just loud enough to let you know the computer's on. And there's enough space in the system box to allow for adequate ventilation.

The system includes a mouse and a sleek keyboard. Function keys line the top of the curved, 101-key keyboard. Slightly crisp, the keys offer an audible click, adequate resistance, and enough space for good finger maneuverability. I especially like the oversize Enter key and the location of the Ctrl key in the lower left-hand side of the keyboard. The mouse rolls smoothly, and it comfortably fits the contours of the hand.

The motherboard video configuration supports 256 colors at 1024 × 768 screen resolution. With a .31-mm pitch and antiglare screen, the Sensor's Super VGA monitor helps ease the strain of using a computer. My eyes and neck appreciate the size and tilt-swivel capabilities of the 14-inch monitor. Conveniently, the monitor power switch is located on the front of the monitor, and the brightness and contrast controls are within reaching distance to the side. Likewise, for convenience, the computer power and reset buttons are located on the front of the case.

Samsung has covered all the bases in the Sensor's complete documentation, and misplacing one of the eight sunflower-bright manuals should be next to impossible. The clear and thorough manuals divide discussions of the system and application software into individual sections, each with its own table of contents and index. Most of the manuals include tech support or troubleshooting sections of some sort, and many include a glossary. The manuals are easy to read, and many include helpful illustrations.

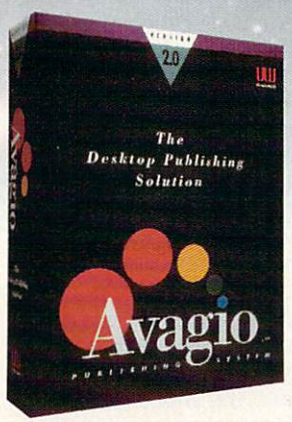
Although designed for almost everyone, the Sensor really shines in its attention to quelling the fears of those new to the computer world. The video manual and the User's Guide suggest that users take a tour of the system through the *System Tutorial,* perhaps the most informative application that accompanies the Sensor.

The *System Tutorial* impressed me with its realistic graphics and detail. It goes beyond the system's basics to include information on computers and disks in general, quite comforting for the computer wary. It also takes you on a tour of your computer's insides if you're not confident enough to open it up and look for yourself. (And just in case you haven't plugged in your computer at this point, it shows you how.)

Several of the other applications included with the Sensor help keep you organized. You get *YourWay,* a personal management system; *Balance Point,* an application for check writing and personal finance; *The Norton Utilities; The Norton Backup; GW-BASIC; Microsoft Windows* 3.0; and MS-DOS 4.01. (An offer to upgrade to *YourWay* 2.0 for $49.95 is included in the Sensor paperwork.) As an added bonus, the Sensor also comes with a free month of Prodigy, the interactive personal service that provides news, educational programs, games, shopping opportunities, and more.

To test the Sensor's performance, I added XYQUEST's

What in the world will make your job easier?



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XyWrite, Interplay's *Dvorak on Typing*, and Disney's *Arachnophobia* to the system's applications. The Sensor handled these with no hangups. I found *Dvorak on Typing* and *Arachnophobia* a bit hard to hear. This computer's sound system, like that of most PCs, would greatly benefit from an external volume control.

The hardware technical support staff responded courteously and calmly to my volume control inquiries but told me a technician would have to check out the system. The Sensor provides a 6-month on-site labor/12-month parts warranty, clearly detailed in the documentation. Samsung provides hardware support for free through a toll-free number, but software support costs $1.50 per minute after the first minute.

With all it has to offer, the Sensor successfully fulfills its goal of being operable and productive for users without any specialized knowledge or training. The 40MB hard drive and two expansion slots may not be powerful enough or offer enough flexibility for every computer user. But the price, compact design, thorough documentation, and added hardware bonuses make the Samsung Sensor a formidable contender in the 386 race.

ERIN RICHTER

Circle Reader Service Number 308

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3023 Research Dr.
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(800) 628-8312
(415) 223-1001
List Price: $1,995
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U.S.I.T. ATHENA 386SX

The US Integrated Technologies Athena comes well packaged, and setup takes little time.

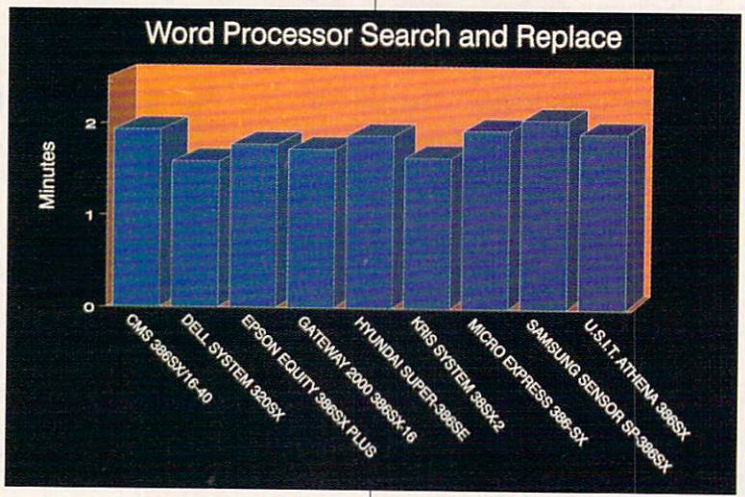
Longtime computer users could probably set it up blindfolded, but even computer novices should have little difficulty. The Getting Started chapter in the manual is straightforward and well illustrated with photographs outlining each step of the assembly process. U.S.I.T. has clearly labeled the ports on the back of the system box. As with most computers, all you'll need is a small flat-head screwdriver to tighten the monitor connection. Although plugging in the hardware poses no problems, the Athena comes to you bare, without any version of MS-DOS.

An attractive machine overall, the Athena has a design vaguely reminiscent of ancient Grecian architecture. I wish the small Power andResetswitcheshadmoredistinctive markings, however, to prevent confusion between the two.

Once inside the medium-footprint case, you'll find plenty of room to move around. And with this much room, don't expect any ventilation problems. The fan located in the back of the case runs quietly. In addition to the 5¼-inch floppy drive, there's one more drive bay that can be accessed from the outside of the machine, and there's room in the hard drive bay to add another hard drive.

The video adapter, mouse port, keyboard port, one parallel port, and two serial ports are all integrated into the motherboard. This configuration leaves you with three open 16-bit expansion slots to install whatever cards you wish.

This computer uses SIMMs (Single In-line Memory Module), and you can upgrade to 8MB. The review unit shipped with 1MB of mem-



All Benchmark/Performance Testing is conducted by Computer Product Testing Services (CPTS), an independent testing and evaluation laboratory based in Manasquan, New Jersey. Every effort has been made to ensure the accuracy and completeness of this data as of the date of testing. Performance may vary among samples.

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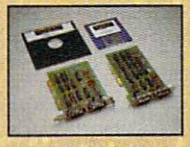

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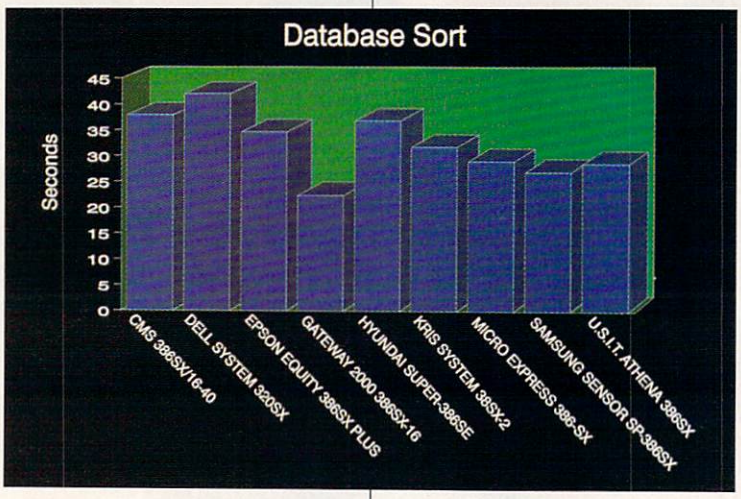
ory, but you should upgrade to at least 2MB if you plan to run *Windows* 3.0. For most desktop applications, 1MB should suffice.

U.S.I.T. sells only one keyboard, which compares favorably with most other keyboards. If you dislike a smaller-than-usual Enter key, though, you might want to hold on to the keyboard from your old machine. A nifty perk for those who use the U.S.I.T. stock keyboard: the Caps Lock, Scroll Lock, and Num Lock keys have their own on/off lights located conveniently on the keys themselves. This feature proved very helpful.

The shining star of this hardware bundle—the .28-pitch VGA monitor—insists on pampering your eyes by supporting only 640 × 480 resolution. Running *Windows* 3.0, I thought my eyes were playing tricks on me; the screen appeared tiny. I quickly whipped out my tape measure, only to find that the diagonal screen measurement was 11½ inches across—something I never would have noticed until I ran a graphics-intensive program like *Windows*. I like the .28 pitch and would choose the smaller monitor with this high resolution over a 14½-inch screen with a lower resolution any day. When I asked about the availability of a different monitor, I was told different monitors come with different products. I found this answer a little confusing; all I wanted to know was if I could upgrade to a different monitor. You can always go to your local dealer to see what is available if U.S.I.T. doesn't have a monitor that suits your needs.

The video adapter card supports resolutions up to 1024 × 768 but only in two colors and only with the 512K memory upgrade—information best confirmed by talking with technical support, since there's no monitor manual included in the package.



This computer's video adapter leaves a lot to be desired; most people use more than two colors on their Super VGA monitors. With the 512K video memory upgrade, the video adapter will support 256 colors in 640 × 480 mode. This is also the capability of the monitor that is standard with the computer. You can, however, disable your on-board video adapter and add your own. Since the expansion slots are industry standard 16-bit, the video card of your choice should work.

The installed 42MB Western Digital IDE hard drive rates at less than 18 milliseconds—fast enough for most users.

I tried several applications on the Athena, and all ran without a hitch. The better-known software I ran was *Windows* 3.0, *Microsoft*

PLANNING AHEAD

Buying a computer is a big decision—one you should base on future needs as well as current ones. As you look ahead, ask yourself the following:

1. Will I use *Windows?* You'll need at least 2MB of RAM to run *Windows* adequately, and if you use other memory-intensive software or require more speed, you should plan on even more memory.
2. How many applications will I run, and how big will they be? While 20MB hard drives seemed plenty big at one time, today's massive applications gobble up that much disk space in no time. So many standard drive configurations specify at least a 40MB drive, and usually you'll have the option to move up to bigger drives. This is an option you should seriously consider.
3. How much expansion might I need? While integration of the video adapter, drive controller, ports, and more keeps slots open for expansion, there are more ways than ever to use your slots. Fax cards, modems, scanners, and other peripherals can require a slot. Think about what you might add, and choose accordingly.
4. Am I willing and able to work inside my computer? If you're afraid to go inside to add a drive or upgrade your memory, you'd be wise to anticipate your needs and order enough memory and storage for the future if you can afford it. Otherwise, you'll have to pay someone to do the upgrade or find a friend to do it for you. Pay attention, also, to the warranty and service policy. Readily available help could make a tremendous difference, especially if you depend on your computer for business.

If you aren't afraid to go into the computer yourself, pay attention to how accessible the case is and consider how easy or difficult it might be to make the upgrade.

—MIKE HUDNALL

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I had the opportunity to call the technical support people twice. On both occasions they were courteous and helpful. The Athena line is sold through Value Added Resellers (VARs) and Inacomp. Technical support, should you need it with the Athena model, isn't toll-free. Since the computer is sold through VARs, I suggest you contact your reseller before calling U.S.I.T., which supplies many different lines to many different resellers with many different options. The Athena could be packaged any number of ways. Because of this, technical support had trouble identifying my equipment and telling me if the equipment I had was right for the machine I had.

The computer comes with a standard 12-month warranty but with no standard on-site service. However, you can purchase an on-site service contract. The warranty is backed by U.S.I.T. but is handled through your reseller. U.S.I.T. does not have any specific guidelines as to how a reseller handles warranty work. If you buy the Athena from a reseller, find out how he supports the warranty. Does he give you a loaner, or will you be without a computer for three weeks while your computer has been shipped off to California?

An average machine, the Athena runs *Windows* well because of the faster hard drive installed, but processing performance doesn't exceed any other 386SX 16-MHz computer. If the Athena meets your minimum standards and you like the price, it would be a wise purchase.

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Dell System 320SX

Warranty: one year, parts and labor; optional extended service contract available for up to four years

Service Plan: on-site/next-day service plan maintained by Xerox; technical support through toll-free number, BBS, CompuServe, and an Automated Technical Fax System in which the customer can call up online support and receive a fax copy of the tech support information

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Service Plan: through local servicer, on-site service from participating servicers, technical support through Epson

Gateway 2000 386SX-16

Warranty: one year, parts and labor (if computer must be sent to Gateway, customer pays for shipping there; Gateway pays for return shipping)

Service Plan: contract with TRW for on-site service in most locations, or can send to Gateway; after warranty expires, Gateway provides free labor, but the customer must pay for shipping both ways; technical support offered through toll-free number and BBS

Hyundai Super-386SE

Warranty: 18 months, parts and labor, must take in to dealer; optional on-site service warranty available; warranty can be extended each year after 18-month period

Service Plan: through the dealer; plan dependent on dealer

KRIS System 38SX-2

Warranty: two years for parts, 18 months for labor; one-year extensions available through Dow Jones

Service Plan: through Dow Jones, on-site service optional, technical support through toll-free number

Micro Express 386-SX

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Service Plan: toll-free telephone support or walk-in service for local customers, an optional on-site service is available through TRW, Micro Express promises overnight turnaround for board replacements

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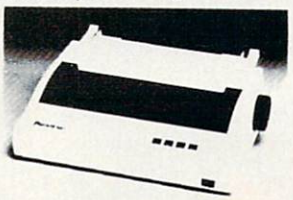

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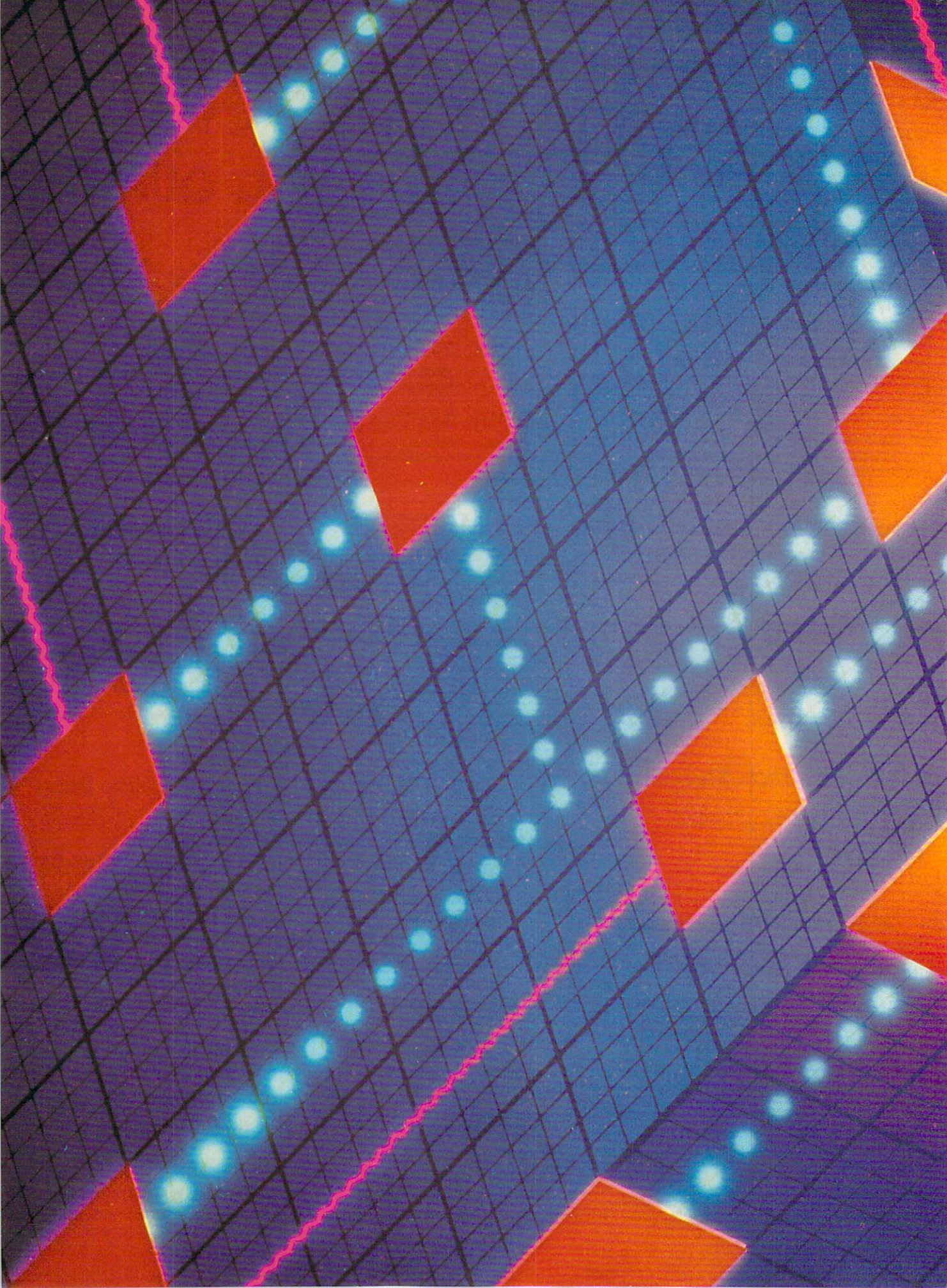

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HOW TO CHOOSE A VGA SYSTEM

Still using that old monochrome monitor? Suffering through video snowstorms whenever your CGA scrolls text? Or just tired of hearing your neighbors and coworkers brag about how great *Windows* looks on their superduper whiz-bang VGA 800s?

In April of 1987, IBM introduced VGA with its PS/2 line. At that time, VGA was about the neatest video around for most PC users. In four short years, however, it has become the minimum ante for new computers. That's largely due to the greater emphasis placed on graphics today. Desktop publishing and *Windows* applications need graphics, and, of course, most games require at least EGA graphics to be attractive.

VGA has spawned a host of new problems, as vendors all seem to be offering their own variations of Super VGA. (And now there's XGA, but mortals like you and me won't be able to afford it—or the monitors it requires—for a while.) How do you know what to buy?

In this article, I'll show you how to choose the right VGA board and monitor for your system. I'll define terms and cost ranges, and keep you from spending a lot of money on a dead-end system that won't meet your needs.

VGA Board Basics

The VGA, or Video Graphics Array, video standard was preceded by several less-powerful standards: the Monochrome Display Adapter and its third-party cousin, the Hercules Graphics Controller; the Color Graphics Adapter (CGA), which offered low-resolution graphics (640 dots—pixels—across the screen, 200 pixels down); and the Enhanced Graphics Adapter (EGA). EGA offers good text and fairly nice graphics (640 × 350 resolution) but lacks 100-percent compatibility with CGA. It also has some design flaws that make writing software for it a bit of a chore.

VGA's entry in 1987 wasn't so much a revolution as a bug fix. VGA offers only slightly better resolution than EGA— 640 × 480—but, more important, it fixes the CGA compatibility problem and the programming design flaws. And it adds *much* better color.

At the same time, IBM offered the 8514/A adapter, an even higher-resolution board (1024 × 768), but it's not that

BY MARK MINASI

popular because it's fairly expensive, and its display is interlaced and thus hard to read.

There's not enough space here to explain interlacing in detail, but basically it's a trick to get a monitor to produce a higher resolution than it's capable of. A neat trick, but there's a side effect—the screen flickers. Work with an interlaced display for a while, and it'll drive you crazy and give you eyestrain headaches, so avoid interlaced video. By the way, the new XGA also has a 1024 × 768 interlaced resolution, so you want to avoid it unless you've got lots of aspirin.

No sooner had VGA come out than vendors began offering Super VGA boards. The first offerings were 800 × 600, a significant step up from 640 × 480. These boards were 800 × 600 interlaced, unfortunately. They were interlaced because the monitors available at the time—the original NEC Multisync, for example—couldn't handle noninterlaced 800 × 600. Today's monitors can display noninterlaced 800 × 600 and better, as we'll see.

How Much Memory?

Most VGA boards nowadays support Super VGA, even the inexpensive clones. You can pick up a no-name VGA board for about $80–$150, and in addition to standard VGA, it'll probably have some kind of 800 × 600 mode. The more expensive Super VGA boards ($200–$300) support 1024 × 768, either in interlaced or noninterlaced mode. More resolution means more dots on the screen, which means that the video board needs more memory to display those dots.

A video board's memory requirements are determined by two things: its resolution and the number of colors it can display. For instance, some VGAs can display 320 × 200 with 256 colors, but when in the higher 640 × 480 resolution, they can only display 16 colors. That has nothing to do with the constraints of the monitor or even of the VGA board except for the amount of memory on the board.

High Resolution

Standard VGA comes with 256K right on the board. Resolutions like 1024 × 768 with 256 colors obviously require more memory—that's why you see ads for VGA cards with an option for either 256K, 512K, or 1024K on the board. If all you're doing is regular old VGA, you only need 256K—there's no point in spending the extra money for 512K or 1024K. (I hear you asking, what resolution *do* I need? Hang on, I'm getting there.) Following is the amount of memory that a video board needs for the most common resolution and color combinations:

Horizontal Resolution × Vertical Resolution with Colors—Memory

640 × 480 with 16 colors—256K
640 × 480 with 256 colors—512K
800 × 600 with 16 colors—256K
800 × 600 with 256 colors—512K
1024 × 768 with 16 colors—512K
1024 × 768 with 256 colors—1024K

Should You Buy Super VGA?

Look in magazine ads, and you'll see that most VGA boards offer some kind of Super VGA mode. In many cases, you get a Super VGA mode free. Sounds like a good deal? It may be, but look closely; there are three catches.

- To use the Super VGA mode, you may have to spend twice as much money for a monitor that can display Super VGA than you would if you just bought standard VGA.
- Your application software may not support the Super VGA mode, and you have no guarantee that the video board vendor will be around in the next few years to supply you with drivers for the software. In a few years, your board's Super VGA mode may be a white elephant.
- Having all those extra pixels on the screen means that the processor must manage them all. Higher resolutions are generally slower.

Suppose you buy a no-name VGA card for about $90. Then you leaf through the documentation that came with the board and notice that it has a Super VGA 800 × 600, 16-color mode. The problem is, a standard VGA monitor (which costs $250–$350) won't display the 800 × 600 mode. You need a multifrequency monitor (which costs $450–$1,000) to display 800 × 600. (The section on monitors is coming up.) So the free Super VGA mode will cost you $200 more for a monitor to see the high resolution.

VGA GLOSSARY

aspect ratio—The relationship between the width of a display and its height. A display with square pixels has a square aspect ratio. In the PC world, only VGA and MCGA have square aspect ratios.

CGA—Color Graphics Adapter. CGA was introduced with the original PC. It offers a maximum resolution of 640 × 200 and a palette of 16 colors.

character matrix—The number of dots that make up a character. CGA's characters are in an 8 × 8 matrix; VGA's, 8 × 16.

dot pitch—The size of a pixel. Generally, the smaller the pixel, the better.

EGA—Enhanced Graphics Adapter. EGA systems offer a maximum resolution of 640 × 350 and a palette of 64 colors. IBM calls EGA's monitor ECD (Enhanced Color Display), but most people simply call it an EGA display.

8514—IBM's 1024 × 768 high-resolution standard. The 8514's display is interlaced. The number 8514 refers to the monitor; 8514/ A is the monitor's adapter card.

horizontal scan frequency—Multiply the horizontal resolution of a monitor by the vertical scan frequency, and you'll have its horizontal scan frequency. Measured in kilohertz (kHz).

interlacing—When a display is interlaced, it requires two scans to display one screen. The first scan displays even-numbered lines; the next scan displays odd-numbered lines.

MCGA—MultiColor Graphics Array. MCGA is a mode between EGA and VGA in performance. It was introduced with the PS/ 2 Model 25 and Model 30.

MHz (Megahertz)—One megahertz is 1,000,000 cycles per second. Megahertz is used to measure a microprocessor's speed or a monitor's refresh rate.

multifrequency—Any monitor that supports a range of vertical and horizontal frequencies. You need multifrequency monitors to display Super VGA and 8514. Also called a VFM, for Variable Frequency Monitor.

Multisync—NEC's brand name for its line of multifrequency monitors.

palette—Because of hardware limitations, most color video cards can display more colors than the monitor can handle. The set of colors that can be displayed at any one time is selected from an overall group of colors called the palette.

pel—IBM's name for a pixel.

pixel—Pixels are the dots that make up a display. Look closely at your monitor, and you'll see thousands of dots, just like on a television set. Those are pixels. Color monitors have three dots per pixel; monochrome, just one. That's why monochrome monitors are always sharper.

resolution—The sharpness of a computer image. Generally, the more pixels a display supports, the sharper the image.

Super VGA—Any resolution of 800 × 600 or higher is considered Super VGA.

vertical scan frequency—The number of times a screen is redisplayed per second. CGA monitors (and most televisions) redraw the screen's image 60 times per second for a vertical scan frequency of 60 Hz. Vertical scan frequency is also called refresh rate.

VGA—Video Graphics Array. VGA was introduced with IBM's PS/2 line in all systems except the Model 25 and Model 30 (both of which use MCGA). VGA incorporates the MCGA modes and adds its own higher-resolution modes.

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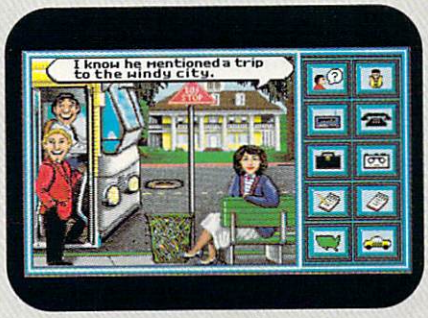

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The second problem arises when you try to do anything with the Super VGA mode. You need a driver program for each of your applications to exploit Super VGA—a driver for *1-2-3*, one for *WordPerfect*, and so on. How do you know that the VGA vendor will be around to continue to support his board? On the other hand, this won't be a problem if you buy your boards from a big-name vendor like Paradise, Orchid, Headlands Technology, Sigma, or ATI—they'll probably all be around for years to come.

The software compatibility problem may be reduced soon, however. A group of VGA vendors called the Video Electronics Standards Association, or VESA, has developed a set of standards for 640 × 480 with 256 colors, 800 × 600 with either 16 or 256 colors, and 1024 × 768 with either 16 or 256 colors.

If enough Super VGA board makers adopt the standard, then software vendors will begin supporting it. Prices on 800 × 600 monitors will soon drop, and 800 × 600 will be a good buy. Until then, consider carefully whether or not you really want Super VGA. Are you willing to put up with the annoyance of loading third-party drivers into *Lotus?* The documentation that comes with some of these boards is atrocious. And do you mind spending almost twice as much for a higher-resolution monitor, when standard VGA may be fine for your purposes?

Going to 1024 × 768 sounds nice, but there is one consideration that you never hear vendors talking about. The extra overhead that high resolution entails. You see, the video boards that we use in the PC world are almost all dumb—the CPU does all the work. For instance, if a program wants to put a picture of a circle on the screen, it must compute the location of all the dots on the screen and activate the corresponding pixels, one by one.

More advanced systems use an object-oriented approach, whereby the CPU just issues a command to the (intelligent) video board. For example, video board, draw a circle, place it here, and color it blue. That way, specialized hardware (called a graphics coprocessor) can be developed to speed up the graphical process.

The CPU could describe an entire screen with a few commands and go back to computing while the graphical hardware handled the tough work. These coprocessor boards are still very expensive—$1,000 and up. But they'd get cheaper if a lot of them were sold. I wish VESA had labored to develop a standard on graphics coprocessors rather than agreeing on how to burden the CPU further with more pixels to shove around.

Putting VGA in Context

Card	Resolution	Color	Number of Colors in Palette	Text	Graphics
Official IBM Graphics Modes					
MDA	720 × 350	Monochrome	Monochrome	■	
CGA	320 × 200	4	Two palettes†	■	■
	640 × 200	2‡	16		■
	640 × 200	16	16	■	
EGA	320 × 200	16	64		■
	320 × 350	16	64	■	
	640 × 200	16	64		■
	640 × 350	16	64	■	■
	720 × 350	Monochrome	Monochrome	■	
MCGA	320 × 200	256	262,144		■
	320 × 400	16	262,144	■	
	640 × 200	2	262,144		■
	640 × 400	16	262,144	■	
	640 × 480	2	262,144		■
VGA	320 × 200	256	262,144		■
	360 × 400	16	262,144	■	
	640 × 200	16	262,144		■
	640 × 350	16	262,144		■
	640 × 480	16	262,144		■
	720 × 400	16	262,144	■	
8514	1024 × 768	16	262,144		■
Special Modes					
PCjr	320 × 200	16	16		■
Tandy	320 × 200	16	16		■
Plantronics	320 × 200	16	16		■
Hercules	720 × 348	Monochrome	Monochrome	■	■
Super VGA	800 × 600	16	262,144		■

† *In 320 × 200 mode, CGA's background can be any of 16 colors. The foreground colors are drawn from either of two three-color palettes: cyan, magenta, and white, or green, red, and yellow.*
‡ *In 640 × 200 mode, only CGA's foreground color is selectable.*

How Many Bits?

Video boards were originally designed to cater to the lowest common denominator. In the PC world, this means XT-class machines. Since XTs aren't very fast, there wasn't any point in designing video boards to be fast. So older VGAs and VGA clones are fairly slow at putting text and graphics up on the screen.

One way to speed up video is to double up on the data transfer rate by buying a 16-bit video board. Older video boards transfer data 8 bits at a time, since that was the maximum rate XTs could handle. But any AT-class 286, 386SX, or 386 system can accommodate a 16-bit video board with no problem. So buy 16-bit video boards, rather than 8-bit boards.

In actuality, you'll find that most of the VGA boards available today are 16-bit boards. But there are still a few 8-bit boards out there, so take a minute to be sure that you're buying a 16-bit board.

There is one more feature you'll see on a few boards: VRAM, Video RAM. It's a special kind of memory chip that is not only high speed but also dual ported. What this means is that the video circuitry can read the memory at the very same time that the program is writing to it. That means snappier screens. It's a nice feature, but it's awfully expensive at the moment. Pass it up unless you need the very best.

Refreshing Monitors

A monitor provides the illusion of a clear, flicker-free display by painting 60 full-screen images on the CRT per second. If there were fewer images painted on the screen per second, you'd see a flashing or flickering effect, particularly on horizontal lines. The number of screens displayed per second is called the refresh rate or the vertical scan frequency. It's measured in hertz, abbreviated *Hz*. For example, 60 screens per second is a 60-Hz refresh rate. CGA, EGA, and VGA use a 60-Hz refresh rate.

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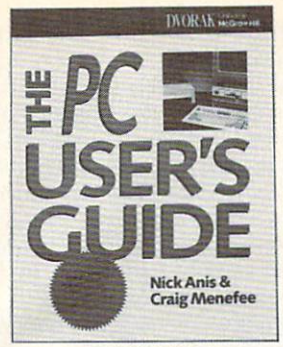

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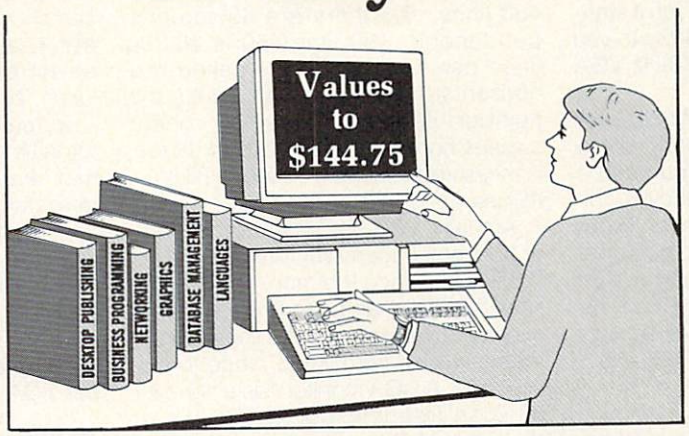

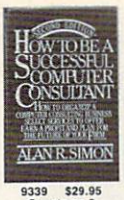

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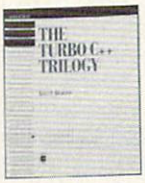

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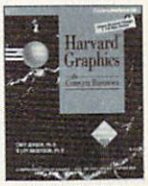

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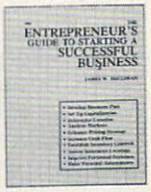

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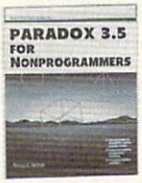

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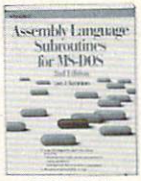

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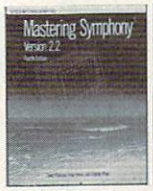

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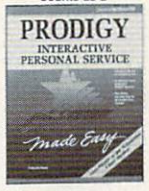

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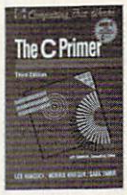

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Some vendors offer Super VGA boards that include 70- or 72-Hz modes, boards that refresh the screen 70 or 72 times per second, leading to a more solid screen. It may not sound exciting, but when you sit down in front of one of these VGAs, you'll know there's something different. Even if standard VGA doesn't seem flickery to you now, it will after you use a 70-Hz VGA for a while.

The downside of 70- or 72-Hz VGA boards is that they won't work with a plain-vanilla VGA monitor. You need a more expensive multifrequency monitor—the same kind you'd use for Super VGA. So if you've decided to go Super VGA, you might as well spend a little more and buy a board with 70- or 72-Hz VGA output, since you're buying the more expensive monitor anyway.

Monitor Mumbo Jumbo

A monitor works by directing a beam of electrons against the inside of its screen. Phosphors on the inside of the screen become excited and glow. Causing phosphors to glow or not to glow defines images on the screen. From a computer's point of view, a video display is just an array of pixels.

Resolution refers to the number of dots that can be put on the screen. The electron beam sweeps across the tube, painting lines of dots. CGA uses 200 lines top to bottom, EGA 350, and VGA 480. Since it uses higher resolutions, Super VGA does even more.

Consider the number of horizontal lines that a monitor must draw per second. In basic VGA, each screen has 480 lines, and there are 60 screens per second. 480 times 60 is 28,800 lines per second. That's called the horizontal scan frequency, as it's the number of times that the beam sweeps horizontally per second. It, too, is measured in hertz or kilohertz (kHz)—thousands of hertz.

Actually, VGA has a somewhat higher horizontal scan rate than 28,800 Hz (28.8 kHz), since the monitor has extra lines that you can't see (they're called overscan). How many extra lines a monitor has varies from video mode to video mode. A CGA monitor has a horizontal scan frequency of 15,750 Hz, or 15.8 kHz. EGA uses 21.8 kHz, and VGA 31.5 kHz. So the horizontal scan frequency your monitor needs to serve your board is determined in part by two important factors: the number of horizontal lines on the screen and the screen's refresh rate.

Dot Pitch

Monitor ads tout .28-mm dot pitch. What are they talking about?

We've seen that more resolution means more dots (pixels) on the screen. The width of the dots that the monitor can display is the monitor's dot pitch, and it's measured in millimeters (mm). The smaller the dots, the higher the horizontal resolution that a monitor can show in a crisp and readable manner. A larger monitor can have a larger dot pitch without sacrificing resolution, since its screen is larger.

In reality, you'll see four dot pitches for VGA monitors: .34, .31, .28, and .26 mm. Avoid .34 on 12-inch VGA monitors, but you may find it quite acceptable on 14-inch monitors—go take a look at one before you buy it. And .34 on a 14-inch monitor or .31 on a 12-inch monitor is fine for VGA only, but buy .28 if you plan to use a Super VGA in 800 × 600 resolution and .26 for a Super VGA using 1024 × 768 resolution.

Multifrequency Monitors

The last important monitor feature I want to mention is multisyncing, the ability to handle multiple resolutions automatically. Recall that the horizontal frequency you need to display an image is determined by the refresh rate (the vertical frequency) and the horizontal resolution.

Until 1986, monitors were fixed-frequency in both horizontal and verti-

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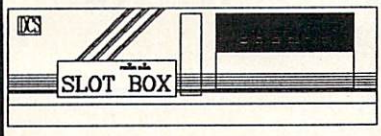

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cal directions. When you bought a CGA monitor, it could only do one set of frequencies: 15.75 kHz horizontal, 60 Hz vertical. The EGA monitor had to be able to do double duty, as it could be attached to either CGA or EGA boards, and so had two sets of fixed frequencies: 15.75 kHz/60 Hz for CGA boards and 21.8 kHz/60 Hz for EGA boards.

Standard VGA knows three sets of frequencies: one for CGA modes, one for EGA modes, and 31.5 kHz/60 Hz for its native standard VGA mode. So a plain-vanilla VGA monitor is a fixed-frequency monitor that only supports CGA, EGA, and VGA—no high-resolution Super VGA modes.

In 1986, NEC changed that with its Multisync monitor. The Multisync could detect and synchronize with any horizontal frequency from 15 to 31.5 kHz and any vertical frequency from 50 to 70 Hz. That meant that a single monitor could work on any kind of video board available at the time. More important, when IBM introduced VGA in 1987, the Multisync was ready—it could handle VGA's 31.5-kHz horizontal frequency with no problem.

Now, most video vendors offer their own Multisync-like monitors. They're generically called variable frequency monitors (VFMs). NEC doesn't sell the original Multisync anymore, but it has Multisync models from the 3D (31.5–38 kHz horizontal, 50–80 Hz vertical; about $620 discounted) to the 5D (30–66 kHz horizontal, 50–90 Hz vertical; $3,700).

The competition's not asleep, however. The most reasonably priced high-resolution VFM is from Sony. The Sony Multiscan HG CPD-1304 (just call it the Sony 1304, and people will know what you're talking about) is a great deal—.26-mm dot pitch; 28–50 kHz horizontal, 50–87 Hz vertical; available discounted for $700. It'll display sharp non-interlaced 1024 × 768 screens, as well as 800 × 600 at a rock-solid 72-Hz refresh rate. For high-end Super VGA, the Sony 1304 just can't be beat.

Buying a VGA Board and Monitor

Whew! That's a lot of information. What's it all boil down to?

First, decide if you'll need standard VGA or Super VGA. In either case, buy a 16-bit board.

If you can be happy with standard VGA, then it's easy. Get a fixed-frequency VGA monitor, like the Gold Star or Samtron VGA. They can be found for about $250 to $350. For the VGA board itself, get a no-name VGA board with 256K of memory and a 16-bit bus interface. Don't waste money on more memory on VGA—it won't do a single thing for you. The board should run around $80–$100 from mail order and discount houses.

If you'd like to use Super VGA or 70- or 72-Hz VGA, you'll need to choose a VFM monitor.

Buy the Super VGA board from a big name—Paradise, ATI, Headlands Technology, Orchid, or Sigma. That way, you'll be able to get drivers for *Windows* version 7, *AutoCAD* version 22, *1-2-3* version 16, or whatever appears in years to come.

Among the five, the ATI boards are fast, flexible, and a bit cheaper than the others. Unfortunately, that lower price has inevitably led to poor support: ATI's support lines are constantly busy, they're often late in delivering drivers, and the drivers often leave something to be desired. (For example, the ATI VGA Wonder can display 1024 × 768 resolution, but the driver retains the low-resolution VGA fonts. The result is unreadably tiny letters. You'll get a headache after looking at the screen for more than a minute.) If you have a question for ATI, fax it in. You can usually get a one-day turnaround on questions faxed to tech support.

Paradise (Western Digital) and Headlands are a bit more expensive, but they're always right out in front with special drivers to allow their boards to strut their stuff. Orchid and Sigma are somewhere in the middle. Any of those five vendors' Super VGA boards are good buys—and don't forget to get enough memory to support the resolution that you intend to use.

And if you're going to get a Super VGA board, spend a couple of bucks more and get one with the 70- or 72-Hz refresh rate option. Your eyes will thank you.

More and more Super VGA boards support both 800 × 600 and 1024 × 768 resolutions. You may have to add some memory to the board in order to support the full 1024 × 768 resolution, however. A 512K Super VGA board from one of these vendors will run about $200–$300 discounted.

Super VGA Monitors

For a Super VGA board, you've got to choose a Super VGA monitor. Note that it will be a VFM. There are very few fixed-frequency Super VGA monitors, although the VESA standard may create a market for them. There are basically three levels of VFMs under $1,000.

The first group can synchronize up to 35.5 kHz horizontal. They're cheapest, and you shouldn't buy them. They can't do 70-Hz VGA, and the only way they can accommodate 800 × 600 is in an interlaced 56-kHz mode. This group is fading out, so they may be quite cheap, but save yourself some eyestrain and resist the temptation.

The remaining two groups are the 800 × 600 and 1024 × 768 camps. The 800 × 600s are represented by the NEC 3D ($620 discounted) or the Seiko 1440 ($480 discounted) that can handle horizontal syncs up to 38 or 40 kHz. (They also do vertical syncs up to 90 Hz). They'll display 70- or 72-Hz VGA and noninterlaced 800 × 600. They may even do interlaced 1024 × 768, but your eyes will fall out from eyestrain if you use that mode. If you're in doubt about whether or not a given monitor will work with your Super VGA board, contact the board's manufacturer for specific compatibility information.

The more expensive 1024 × 768 noninterlaced monitors are VFMs that can synchronize up to 50 kHz or more horizontal and 50 to 87 Hz or higher vertical. (87 Hz is a magic number because it's the frequency that 8514 would use if it were noninterlaced, and a few video board vendors offer a noninterlaced 8514.) If you need this resolution, buy the Sony CDP-1304 or something similar. But it won't come cheaply. Expect to pay $700 or more for the Sony and $250 or more for a Super VGA board with one megabyte of RAM on it.

Again, note that the big cost at high resolutions is the cost of the monitor, not the board. That's why XGA will be expensive for at least a few years. Unlike hard drives and motherboards, monitors aren't new—CRTs have been around for a while, so prices for 1024 × 768 monitors won't do the familiar nosedive that we've seen from memory, motherboards, drives, and the like. Prices will come down, but not tremendously. A 1024 × 768 monitor will probably cost around $500 in 1993.

VGA Bottom Line

To summarize, your choices are the following:

- Standard VGA—board costs around $100, monitor about $300.
- Super VGA (800 × 600)—board costs around $200, monitor about $500.
- 8514/A Super VGA (1024 × 768)—board costs around $250 (it has extra memory), monitor about $700.

So the packages for standard VGA, Super VGA, and high-resolution 8514 cost roughly $400, $700, or $950. Take your pick, and happy viewing! ❐

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Untipping a Tool

In our July "Tips and Tools" column we listed a BASIC program to save your computer's CMOS to disk. Unfortunately, there was a small typo that caused the program not to work properly. Here's the correct BASIC program listing for SAVECMOS.BAS:

```
10 DEFINT A-Z:DIM CMOS(63)
20 FOR I=1 TO 63:OUT 112,I
30 CMOS(I)=INP(113):NEXT I
40 OPEN "CMOS.RAM" FOR OUT
 PUT AS #1
50 FOR I=1 TO 63:WRITE
 #1,CMOS(I)
60 NEXT I
70 CLOSE #1:SYSTEM
```

For those who missed the July 1991 issue, here's the listing for the BASIC program that can be used to restore your computer's CMOS, RESTCMOS.BAT:

```
10 DEFINT A-Z:DIM CMOS(63)
20 OPEN "CMOS.RAM" FOR
 INPUT AS #1
30 FOR I=1 to 63:INPUT
 #1,CMOS(I)
40 NEXT I:CLOSE #1
50 FOR I=1 to 63:OUT 112,I
60 OUT 113,CMOS(I):NEXT I
70 SYSTEM
```

Mouse Routines for C

Now that most computers have mice, you'd think mouse support would be universal. Far from it. But here's a set of routines that cover the basics you'll need for accessing the mouse from a C program.

Start by creating the following module containing the four routines you'll use. The mvector pointer that you see is a precaution for DOS 2.1 where the mouse vector is NULL, and calling the mouse interrupt will crash the system. If this pointer is any nonzero value, then it's safe to call the mouse interrupt. The mouse handler follows.

```
#include <dos.h>

int InitMouse( void );
void ShowMouse( void );
void HideMouse( void );
void GetMouse( int *, int *,
 int * );

/* Returns 0 for no mouse, nonze-
ro if it finds an active mouse driv-
er */
int InitMouse( void )
{
long far *mvector;
union REGS in, out;

 FP_SEG( mvector ) = 0x0000;
 FP_OFF( mvector ) = 0x00cc;

 if( *mvector ){
  in.x.ax = 0;
  int86( 0x33, &in, &out );
  return( out.x.ax );
  }
 else return( 0 );

}

void ShowMouse( void )
{
long far *mvector;
union REGS in, out;

 FP_SEG( mvector ) = 0x0000;
 FP_OFF( mvector ) = 0x00cc;

 if( *mvector ){
  in.x.ax = 1;
  int86( 0x33, &in, &out );
  }

}

void HideMouse( void )
{
long far *mvector;
union REGS in, out;

 FP_SEG( mvector ) = 0x0000;
 FP_OFF( mvector ) = 0x00cc;
 if( *mvector ){
  in.x.ax = 2;
  int86( 0x33, &in, &out );
  }

}

void GetMouse( int *mx, int
 *my, int *button )
{
long far *mvector;
union REGS in, out;

 FP_SEG( mvector ) = 0x0000;
 FP_OFF( mvector ) = 0x00cc;

 if( *mvector ){
  in.x.ax = 3;
  in.x.bx = in.x.cx = in.x.dx = 0;
  int86( 0x33, &in, &out );
  *mx = out.x.cx;
  *my = out.x.dx;
  *button = out.x.bx;
  }

}
```

Using the routines is simple. Start your program by calling InitMouse( ). If it returns a 0, there is no active mouse driver. Your program can still safely call all of the other mouse routines. They just won't do anything. If your program ever changes video modes, you should call InitMouse( ) again.

The mouse pointer is invisible until you call the ShowMouse( ) routine. Make sure that every time you draw or print to the screen you first call HideMouse( ), and then when you're done, call ShowMouse( ). If you don't, your draw operations may overwrite the mouse, which can be very messy.

To find out where the mouse's position is, you need to call GetMouse( ). You have to pass the address of three integers. The first is the *x*-coordinate variable, the second the *y*-coordinate variable, and the third the Button variable.

Here's an example that assumes you're linking in the above code.

```
#include <stdio.h>

int MouseFlag, Mx, My, Button;

void main( void )
{

 MouseFlag = InitMouse();
```

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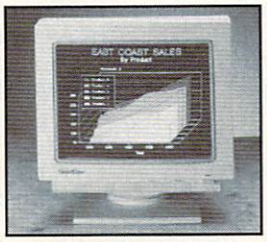

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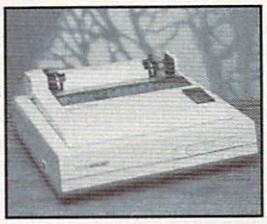

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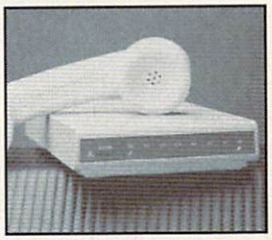

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```
 ShowMouse();

 while( Button != 3 ){

  GetMouse( &Mx, &My,
   &Button );

  HideMouse();
  printf( "X:%d Y:%d
   Button:%d\n",
   Mx, My, Button );
  ShowMouse();

 HideMouse();

}
```

RICHARD C. LEINECKER
REIDSVILLE, NC

Graphics to the Max

This simple C code loads PCX paint files for three video modes. To use other video modes, change the value assigned to linebytes and change the value in the while(y < 200) condition.

```
#include <dos.h>
#include <conio.h>
#include <stdio.h>

/*If you want to prototype the
functions use the following lines.
void LoadPCX( char * );
void PutLine( int,
 unsigned char *);*/

char far *VideoMode;
unsigned char far *ScreenMemory;
unsigned int CGABank;

void LoadPCX( char *filename )
{
unsigned char Buffer[768];
FILE *fp;
unsigned int y = 0;
unsigned int linebytes;
unsigned int currentbyte = 0;
unsigned char data;
unsigned char reps;
unsigned char count;

 fp = fopen( filename, "rb" );
 if( !fp ) return;
 fread( Buffer, 128, 1, fp );
 VideoMode = ( char far * )
  0x00000449;
 switch( *VideoMode ){
 case 4: /* CGA 320x200x4 */
  ScreenMemory = ( unsigned
   char far * ) 0xb8000000;
  CGABank = 0;
  linebytes = 80;
  break;
 case 13: /* EGA 320x200x16 */
  ScreenMemory = ( unsigned
   char far * ) 0xa0000000;
  linebytes = 160;
  /* Set the EGA card for the
  writes that we'll be doing */
  outpw( 0x3ce, 3 );
  outpw( 0x3ce, 5 );
  outpw( 0x3ce, 7 );
  outpw( 0x3ce, 0xff08 );
  break;
 case 19:/*MCGA 320x200x256*/
  ScreenMemory = ( unsigned
   char far * ) 0xa0000000;
  linebytes = 320;
  break;
 }
while( y < 200 ){
 fread( &data, 1,1, fp );
 if( ( data & 0xc0 ) == 0xc0 ){
  reps = data & 0x3f;
  fread( &data, 1, 1, fp );
  for( count=0; count<reps;
   count++ ){
   Buffer[currentbyte++] = data;
   if( currentbyte == linebytes ){
    PutLine( y, Buffer );
    currentbyte = 0;
    y++;
    }
   }
  }
 else Buffer[currentbyte++] =
  data;
 if( currentbyte == linebytes ){
  PutLine( y, Buffer );
  currentbyte = 0;
  y++;
  }
 }
if( *VideoMode == 13 ){
 /*Reset EGA card defaults*/
 outpw( 0x3c4, 0x0f02 );
 outpw( 0x3ce, 0x0f07 );
}
else if( *VideoMode == 19 ){
 /* Set the MCGA palette */
 fread( &data, 1, 1, fp );
 fread( Buffer, 768, 1, fp );
 outp( 0x3c8, 0 );
 for( y=0; y<768; y++ )
  outp(0x3c9, Buffer[y] >> 2 );
 }
 fclose( fp );
}

/*One line of data on the screen*/
void PutLine( int y, unsigned char
 *Buffer )
{
int i, j;
unsigned int egaregs;
 switch( *VideoMode ){
  case 4:
   for( i=0; i<80; i++ )
    *ScreenMemory++ = Buffer[i];
   ScreenMemory -= 80;
   CGABank ^= 8192;
   FP_OFF(ScreenMemory ) ^=
    CGABank;
   if( !CGABank ) ScreenMemory
    += 80;
   break;
  case 13:
   egaregs = 0x0102;
   /* Four bit planes */
   for( i=0; i<4; i++ ){
    outpw( 0x3c4, egaregs );
    /* 40 bytes per bit plane */
    for( j=0; j<40; j++ )
     *ScreenMemory++ =
     Buffer[j+i*40];
    egaregs = ( egaregs &
     0x00ff ) ( ( egaregs &
     0xff00) << 1 );
    ScreenMemory -= 40;
    }
   ScreenMemory += 40;
   break;
  case 19:
   for( i=0; i<320; i++ )
    *ScreenMemory++ = Buffer[i];
   break;
  }
}
```

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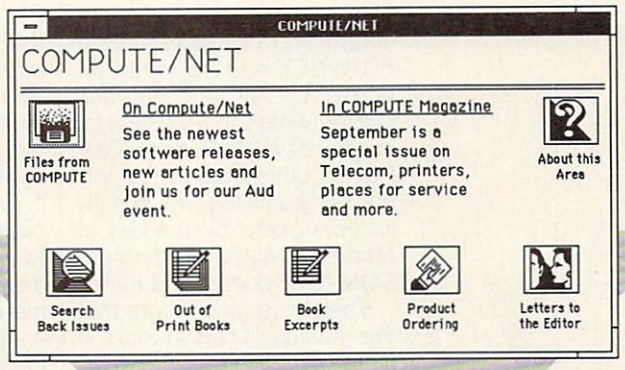

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5612/PC

COMPUTE/NET

Richard C. Leinecker

SOMETHING NEW ONLINE

There's a new source of online information. It's called COMPUTE/NET, and it's found on GEnie, Q-Link, and America Online. What's there? Back issues of *COMPUTE* and COMPUTE's other magazines, terrific programs that we've published, colorful picture files of official NASA photos, COMPUTE books, and more.

There's so much there that this month all I can squeeze in is an orientation tour. Exploring online services is fun. And you won't soon run out of places to go on COMPUTE/NET.

Get to know us better online, through the new COMPUTE/NET service on GEnie, Q-Link, and America Online.

Let's start with the lighter side of our *COMPUTE* editorial staff. On COMPUTE/NET you can read the biographies of our editors. Here are some fast facts that'll surprise you: Pete Scisco earned the Dantzler-Dantzler Award as an undergraduate. Clif Karnes has a master's degree in music theory, but he can program a computer with the best. David English has a B.A. and two M.A.'s and has nearly completed his coursework for a Ph.D. in cinema studies. Mike Hudnall was an assistant professor at Berry University, where his students often referred to him as Dr. Harbrace. David Sears loves music from the fringe by such artists as Skinny Puppy and My Life with the Thrill Kill Kult. Rob Bixby is a prolifically published author who likes rock-'n'-roll, computer graphics, and artificial creativity. Tom Netsel plays the bagpipes for any audience who will supply him with malt whiskeys. Jill Champion is owned by her four-year-old cat, Liesl. And Denny Atkin was born to one of the last remaining families of nomads.

For the complete details, do one of the following: On GEnie, from the main COMPUTE RoundTable menu, pick menu item 6, About COMPUTE and the COMPUTE Editors. On America Online, from the COMPUTE/NET window, click on the icon with the question mark and the text that says About This Area. If you want to really get to know these people, go to the COMPUTE Bulletin Board on GEnie, Category 1, Topic 2. On America Online click on the COMPUTE Letters to the Editor icon. Once in the message area, you can leave messages to the editors and make suggestions or ask them questions. They want to hear from you. Go ahead; make their day.

If you're on GEnie, after reading about the *COMPUTE* editors, you'll want to play our online games. (The games are only available on GEnie; all the other items mentioned are available on GEnie, America Online, and Q-Link.) They're easy to play—all multiple choice questions. And if you're really smart (or maybe lucky), you can win a prize. You could win a free subscription to one of several General Media magazines like *OMNI, Four Wheeler, COMPUTE,* or *Longevity;* a free COMPUTE disk product; a free COMPUTE book; or free connect time for GEnie. To play, make sure you're at the COMPUTE RoundTable main menu. Choose menu item 14 and then pick the game you want to play. There's a scavenger hunt in which you answer questions by scanning *COMPUTE* magazine, a computer trivia game, and a puzzle-and-riddle game that will perplex, entertain, and delight you.

Don't you love seeing photorealistic pictures on your screen? Don't you love pointing at them and telling your spouse "*That's* what I got for all the money I spent on this computer system"? You might even be a space buff and want official NASA photos for your collection. If you fit into any of the above categories (or just like cool pictures), here's how you get them. From the main COMPUTE RoundTable menu on GEnie, pick menu item 3, Software Libraries. From the COMPUTE/NET window on America Online, click on the COMPUTE Files icon in the upper left corner. Now, search the directory using the keyword *NASA*. You'll see a list of digitized photos that we scanned from official NASA releases. They're all in GIF format. If you don't have a program that loads in GIF pictures, download *VPIC* from our software section.

If you're like a lot of readers, you often remember useful consumer information presented months back in *COMPUTE*. Maybe you would like to reread it because there was a lot of useful information about buying a monitor or about desktop publishing, or maybe there was a sidebar that made you smile. But you can't find the issue anywhere. You're in luck. You can download any of our back issues or read them online. By the time you read this, we'll have the magazines as far back as mid 1989 available. Within a couple of months, we'll complete the collection, and you can have a field day browsing the articles. From the GEnie main menu, pick item 11, Back Issue Database, and follow the prompts to find what you want. On America Online click on the Back Issue icon and follow the prompts.

You can ask questions or make comments in our Bulletin Board on GEnie or the America Online Message section. If you want to send me E-mail, my GEnie address is RLEINECKER, my America Online screen name is Rick CL, and my CompuServe number is 75300,2104. ❐

INTRODUCING

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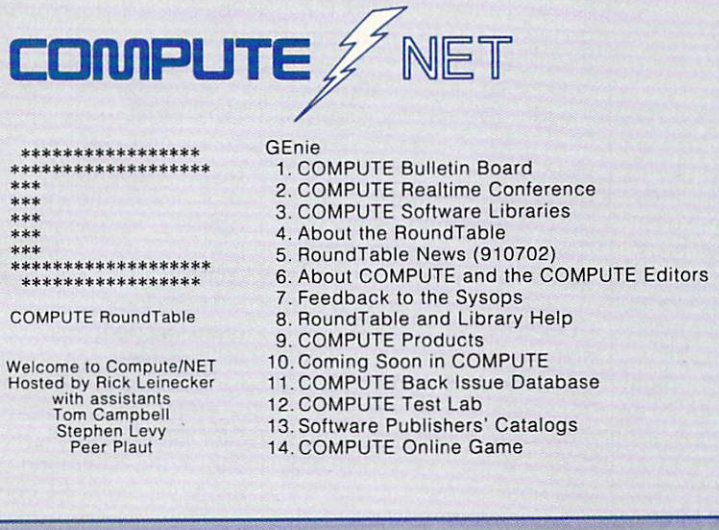

COMPUTE/NET on GEnie had a terrific grand opening. The comments ranged from "I've never seen a RoundTable open up with so much information" to "This makes my modem and computer system worth their price."

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INTRODOS

Tony Roberts

BATTLE OF THE FIVE-Os

Microsoft's MS-DOS 5.0 has made its big splash, and many PC users are pondering whether to make the upgrade.

The issue is clouded a bit by Digital Research, which unveiled its DR DOS 5.0 in mid 1990. DR DOS was considered by many to be a sneak preview of what MS-DOS 5.0 was to become. DR DOS's advantage was that it beat MS-DOS 5.0 to market, but it carried a list price of $199, which scared off more than a few customers.

As the release of Microsoft's long-awaited MS-DOS 5.0 grew near, however, Digital Research sought to increase its market share by announcing a "Toss Your DOS" special. The promotion offered DR DOS 5.0 to upgraders for a more competitive $79, and the offer was eagerly accepted by users anxious to take advantage of DR DOS's memory management capabilities.

It's a great time to upgrade your DOS. And now you have two choices instead of just one.

So should *you* upgrade your DOS? Without a doubt. It's time to have the latest and greatest on your system, but whether to go with Digital Research's or Microsoft's product is a tossup.

I latched on to DR DOS several months ago because I needed the ability to load device drivers and TSRs into high memory. The goal was to have enough conventional memory left to run my regular DOS applications and *Windows* without running into memory problems. DR DOS met these needs and provided several pleasant surprises including a command line retriever, extended directory and delete commands, and a full-screen text editor.

Microsoft's new product offers its own array of enhancements, including a command line retriever, full-screen text editor, and undelete utility; but in general, I like DR DOS better than MS-DOS.

Despite my preference, though, I've switched to MS-DOS 5.0 because it seems to work a little better with *Windows*. Since I earn a good part of my living using *Windows* applications, that stability is comforting.

I find that I'm able to load DOS, drivers, and TSRs into high memory more efficiently with MS-DOS, leaving more conventional memory free.

If I didn't run *Windows*, however, I'd stay with DR DOS, and here's why.

- Enhanced CONFIG.SYS. DR DOS makes it easy to change the system configuration at boot-up because its CONFIG.SYS files support labels, as well as GOTO and ECHO commands. At boot-up, you can have the system ask you how you want the system configured, and you can specify on the fly whether any or all of your favorite device drivers should be loaded.
- Powerful XDIR and XDEL commands. DR DOS provides extended directory and delete commands that are more powerful and more flexible than those offered in MS-DOS 5.0. The command XDEL *.TMP /S can delete all the files with a TMP extension anywhere on your hard disk. As the command works, the names of all the deleted files are displayed so you can see what has been erased and, if necessary, bring an undelete program to the rescue.
- Handy TREE command. DR DOS has turned this command into something useful. Not only can you get a graphical look at your hard disk's organization, but TREE tells you how many files are in each subdirectory and how much space those files occupy. This is a great help during those disk cleanup sessions. You can tell at a glance which directories are the most likely candidates for saving space.
- Interactive setup. DR DOS provides an interactive setup and configuration program that can be rerun as your needs change. This is a big help to users who dread the thought of editing their CONFIG.SYS files. MS-DOS 5.0 includes an installation program that performs a basic setup, but users are on their own for fine-tuning.
- Flexible command line. DR DOS is generally more flexible on the command line. For example, the XDEL command permits naming of multiple files for deletion, the /P switch can be added to any command to pause the display after each screen is full, wildcards can be used with commands such as TYPE (as in TYPE *.TXT), and the DR DOS RENAME command can be used to move files from one subdirectory to another.

Despite coming in second in some areas, MS-DOS has a decided advantage in other areas. MS-DOS 5.0 now offers an UNDELETE command—an essential program for any computer user. It also includes the *QuickBASIC* interpreter as well as quick FORMAT and UNFORMAT commands.

Both operating systems make help available from the command line, and both offer a DOS shell. Although I don't use shells often, I favor the MS-DOS shell over its DR DOS counterpart, which, with its application and data icons, bears a resemblance to the Atari ST interface. Also, Microsoft's shell permits a limited form of task switching.

So if you're contemplating a DOS upgrade, don't delay. Both Microsoft's and Digital's products offer significant enough improvements over previous DOS versions to justify making the switch. ❐

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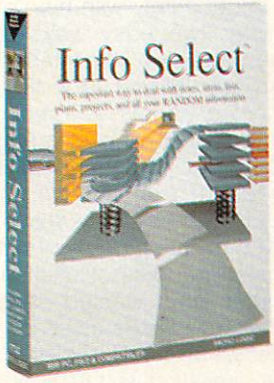

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HARDWARE CLINIC

Mark Minasi

INCREASE YOUR MEMORY POWER

DOS's elusive Upper Memory Blocks are explained in plain English.

One of the neatest things in the new MS-DOS 5.0 is the addition of a memory manager, a program that you once had to buy separately. A memory manager's most important job is to create and manage things Microsoft calls UMBs—Upper Memory Blocks. The whole idea with UMBs is that they give DOS more memory.

The trouble is that the DOS 5.0 installation program still doesn't do anything about setting up UMBs for you. This month, I'll get started telling you what UMBs are, why you want them, and how to set them up.

First of all—what is a UMB, really? Well, you no doubt are aware of the annoying 640K memory restriction that DOS lives under. The 640K restriction is actually caused by two things: the original PC's processor chip—the 8088—and the way IBM designed the first PC. The 8088 provided a restriction in that it's incapable of working with more than 1024K, one megabyte, of memory. DOS was (and still is) written for the 8088, so it shares the 8088's limitation. The hardware limitation of DOS, then, is really 1024K, not 640K.

The 640K limitation comes from IBM's design of the PC. IBM needed to set aside some of that 1024K for system use. Here's how it originally was divvied up: 0K–639K (DOS and user programs), 640K–767K (special RAM allocated to video), 768K–959K (ROMs and RAM buffers used by expansion boards), and 960K–1023K (System BIOS).

I could discuss all of these memory areas in gruesome detail for pages and pages—in fact, I have, in my PC troubleshooting book published by COMPUTE—but let me briefly summarize what each of these areas does. The user memory area is self-explanatory; it's the 640K you've been limited to all of these years and is sometimes called conventional memory. The video RAM area isn't that interesting, except to note that all video boards must have memory on them. Video memory doesn't count in the system memory count-up that you see when you turn your machine on. If you've got 640K of memory, that's 640K in addition to your video RAM.

The 64K above the video area, between 960K and 1023K, is the system BIOS, a chip on your system's motherboard that contains the Basic Input/Output System—a bunch of software on a chip that's vital to your system's operation. BIOS software isn't shipped on a disk like other software; it's contained in a special chip called a ROM (Read Only Memory).

I left the 768K–959K area for last because it's the place where we'll spend the rest of our time. IBM knew that some add-on boards would have ROM on them. For example, every VGA board has ROM on it. What's in the ROM? It's an extension of the system BIOS that enables the system to use the board.

Not all boards have ROM. Looking at a small sample—the three computers on my desk—one of the three computers has a hard disk controller with ROM, all three have video boards with ROM, and one has a scanner interface card with ROM on it. The occasional board also has a small RAM buffer addressed somewhere in the 768K–959K range, so keep an eye out for them.

You probably noticed ROM addresses when you poked through an expansion board's documentation, but the hexadecimal addresses may have put you off. Stuff like "the VGA BIOS uses addresses C0000 hex through C7FFF hex" makes me want to forget this nonsense, go outside, and play Frisbee, too. But you've got to get comfy with hex, so I'll offer two easy ways to cope with hex a little later.

Anyway, IBM set aside 192K of memory addresses as places for potential ROMs. Most systems don't use the whole space. For example, on my main PC, there's only 48K of ROM in the area, leaving 144K of memory addresses unused. Unused and wasted—and that's where UMBs come in.

Remember that DOS's "hardware" limitation isn't 640K; it's 1024K. If we could stuff memory into unused memory addresses between 768K and 959K, we could put programs up there. Consider my main PC. Here's how addresses 768K through 959K are used: 768K–799K (used by video ROM), 800K–815K (unused memory address), 816K–831K (used by hard disk controller), and 832K–959K (unused memory address).

In the case of this particular PC, I could use the memory in the two unused areas, 800K–815K and 832K–959K. Those areas are the UMBs.

What Do I Need?

First of all, you must have a 386-class computer: 386 or 486, SX or DX. Second, you must have at least 1MB of accessible memory. Third, you need a memory manager, which DOS 5.0 supplies as two programs: HIMEM.SYS and EMM386.EXE. Fourth, you need to know the addresses of any ROMs or RAM buffers on your circuit boards. Drag out that documentation or harass your dealer. But don't be lazy; this can be a bit tricky if you're working with inadequate information.

My examples so far have been in friendly old decimal—768K, 800K, and all that. But you've got to know hex, be-

cause that's the only thing that the documentation reports and because memory managers insist that you communicate with them in hex.

You can use the *Calculator* in *Windows*, a terrific hex-to-decimal converter. Or you can use the power of the *QuickBASIC* interpreter that comes with DOS 5.0. Just type in this four-line program with any ASCII text editor such as *Notepad* in *Windows* or DOS's *EDIT* or *EDLIN*. Call the file CONVHEX.BAS.

```
INPUT "Number to convert from
  hex"; a$
inval& = VAL("&h" + LTRIM$(a$)
  + "&")
PRINT "Decimal equivalent=";
  inval&;" or ";inval&/1024;"K"
SYSTEM
```

To run it, just put it in your DOS subdirectory and type *qbasic /run convhex.bas*. It will prompt you for a hex value; type one in, press the Enter key, and it will report the converted decimal value.

Creating UMBs

Look back at the PC with the video ROM and the hard disk controller ROM; I'll use that PC as my example machine. To get the DOS 5.0 memory manager to work, you first need to load the HIMEM.SYS and EMM386.EXE drivers and use the new DOS=HIGH,UMB command. Now, if you've got a 386-class machine, the DOS installation program has probably already set up your CONFIG.SYS so that it looks something like this:

```
DEVICE=C:\DOS\HIMEM.SYS
DOS=HIGH
```

I'm going to assume that your DOS programs are sitting in a subdirectory called C:\DOS. If that's not true, change the subdirectory references accordingly. We're next going to change the DOS= line and add another line:

```
DEVICE=C:\DOS\HIMEM.SYS
DEVICE=C:\DOS\EMM386.EXE
  NOEMS
DOS=HIGH,UMB
```

That's the basic CONFIG.SYS, but we need to tweak the EMM386.EXE line. EMM386 attempts to figure out for itself which areas in memory are available, but it's not too bright. It usually misses altogether the 64K from 896K–959K. So we'll help it out. The upper memory situation in my PC looks like this: hex A0000–C7FFF (decimal 640K–799K, video RAM and ROM), hex C8000–CBFFF (decimal 800K–815K, free), hex CC000–CFFFF (decimal 816K–831K, hard disk controller ROM), hex D0000–EFFFF (decimal 832K–959K, free).

Next, we tell EMM386.EXE to exclude the used areas and include the unused areas. You do that with the X= and I= parameters. You put these parameters on the same CONFIG.SYS line as EMM386.EXE. The ranges must be in hex, and you have to drop the rightmost digit: C0000 becomes C000, CFFFF becomes CFFF. Updated, the CONFIG.SYS statements look like this:

```
DEVICE=C:\HIMEM.SYS
DEVICE=C:\DOS\EMM386.EXE
  NOEMS X=A000-C7FF I=C800-
  CBFF X=CC00-CFFF I=D000-EFFF
DOS=HIGH,UMB
```

If you were having trouble figuring that out from the DOS manual, don't feel bad. The manual doesn't even offer a clue that multiple I= and X= parameters are legal; I just stumbled onto it. Remember that all you have to do is (1) find out where your ROMs and RAM buffers are by checking over your documentation, (2) use that information to build the I= and X= parameters, and (3) put the EMM386 and DOS=HIGH,UMB statement into your CONFIG.SYS.

Using UMBs

You can now load device drivers and TSR programs into your newly created UMBs. Instead of loading a device driver with DEVICE=, load the device driver into a UMB with DEVICEHIGH=. To load a TSR into a UMB, use the command LOADHIGH.

I use the SMARTDRV.SYS disk cache that comes with *Windows* and DOS. It's a device driver that I load with a line something like this:

```
DEVICE=C:\DOS\
  SMARTDRV.SYS 512
```

The 512 configures the cache to be 512K in size. To load it into a UMB, substitute the following CONFIG.SYS line:

```
DEVICEHIGH=C:\DOS\
  SMARTDRV.SYS 512
```

For a TSR example, let's use that nifty DOSKEY program that comes with DOS 5.0. It's a little 4K TSR that remembers the last 20 or so commands that you've typed to DOS and lets you recall them with the Up Arrow key. You'd generally load it by putting the line C:\DOS\DOSKEY in your AUTOEXEC.BAT. But to load it in a UMB, you'd put this line in AUTOEXEC.BAT:

```
LOADHIGH C:\DOS\DOSKEY
```

To see the effects of the LOADHIGH and DEVICEHIGH statements, run the MEM command before you install LOADHIGH or DEVICEHIGH and note the amount of free memory you have. Install the new commands, reboot, and run MEM again. I think you'll be pleased with the result. ❐

POINT & CLICK

Clifton Karnes

EASY WINDOWS PROGRAMMING

The release of *Microsoft Visual Basic* (Microsoft, One Microsoft Way, Redmond, Washington 98052; 206-882-8080; $199) means one thing: fast and easy *Windows* programming!

Visual Basic (VB) is the combination of a screen design toolkit and a full-featured BASIC compiler. With it, you can create real *Windows* EXE files that will run on any *Windows*-based system and look great.

The *VB* programming environment is a functional masterpiece, consisting of a main window, a toolbox window, a project window, and a form window. The main window is the control center with a menu bar and a properties bar.

In 1974, Bill Gates invented microcomputer BASIC. This year, he reinvented it, opening Windows to easier programming.

Below the main window at the left is the toolbox—a palette of controls. At the right is the project window—an automated make file that keeps track of all the program elements in each project. In the screen's center is the form window—the canvas on which you create your *VB* program.

To create a *VB* program, you begin by selecting controls from the toolbox and placing them on forms. The toolbox provides all the standard *Windows* controls, including command or push buttons, option or radio buttons, check buttons, text fields, labels, combo boxes, list boxes, pictures, scroll bars, and selectors for drives, directories, and files.

Every control in the toolbox has a list of properties displayed in the properties combo box on the properties bar of the main window. And each property has settings you select or type in using the settings combo box to the right of the properties box.

To give an example of a control, property, and setting, let's look at a command button. All command buttons have a caption property—a label that appears on the button—which can have any number of settings. A button might have a caption setting of *OK, Run,* or *Exit,* for example. This same button might have its background color property set to gray.

After you've chosen and arranged your controls and set their properties, you're ready to attach code to the controls.

VB, like *Windows* itself, is event-driven. A model *VB* program simply responds to events—like clicking the mouse on a control or pressing a key—the user initiates.

Just as each *VB* control has a group of properties that can be set, it also has a group of events to which it can respond.

For example, a command button can respond to a click event. If you want this button to do something when the user clicks it, you write a subprogram, or event procedure, to handle it. To write an event procedure, double-click on the control, and a code window pops up. Choose the event you want from the combo box on the procedures bar of the code window.

After writing your first event procedure, you can test the program by choosing Start from the Run menu. You can halt execution at any time and test code fragments in the immediate window, or you can single-step through your program.

If you're satisfied with your *VB* program, you can create an EXE file by selecting Make EXE File from the File menu. Your *VB* EXE program will require a 270K runtime module, VBRUN100.DLL (which you can distribute free of charge), but the EXE files themselves are very small and quite fast.

One of the most exciting things about *VB* is that its environment can be extended. The most interesting way to extend *VB* is with custom controls. These extensions are special-purpose or enhanced *Windows* controls that appear on your toolbox alongside standard *VB* controls. Some give more power to standard controls; others introduce completely new control types.

The other way *VB* can be notably enhanced is with custom DLLs. These libraries are like the special link libraries BASIC programmers have been using for years, but with *Windows,* DLL code can be dynamically linked in at runtime.

There are already a large number of these extensions available, and next month, I'll look at the best of the *VB* custom controls and libraries. ❐

DISK UPDATE

Richard C. Leinecker

AT COMPUTE, DISK SAFETY IS NO ACCIDENT

Every time my computer acts strangely, I begin to wonder if it has a virus. And many of our subscribers are the same way. *COMPUTE's PC Disks* are as safe as any disk product can be—we go to great lengths to ensure this. But in spite of our periodic assurances to our audience, we still get a few calls each year.

How can we be sure that our disks aren't infected with viruses? We start by getting the final version of each program directly from the author. Although the online services check rigorously for viruses, we get a disk straight from the programmer, so there's no risk of tampering.

Our computers here at COMPUTE are scanned every week with the latest virus-scanning software. And we watch for any telltale signs of infection on our computers.

We inspect each *PC Disk* master with virus software and put it through special testing that we've developed. Each file in each archive is checked. We even test *CMOS*.

The COMPUTE staff members all practice safety habits that prevent most viruses from spreading. If you're interested in finding out how to keep from catching a virus, read "Computer Viruses from A to Z," in our October issue.

OK, so now you believe me. But you have our latest disk, and after running scanning software, you've discovered a virus on your hard drive. The first thing you suspect is our disk because of the reputation that shareware has gotten and because the last program you ran was from our disk.

Let's set the record straight. Shareware rarely contains viruses. The more likely suspect is pirated software. And most viruses are controlled by sophisticated time delays—they are rarely triggered when first transmitted.

If you should find a virus on our disk, our disk was the recipient, not the transmitter. I recently received a call from someone who had scanned his hard drive and our disk and found the Stoned Virus. That's a boot sector virus. That type of infection only spreads when you boot from an infected disk. Since COMPUTE's disks aren't bootable, it's impossible for them to spread any boot sector viruses.

New Program, Old Face

COMPUTE's Menu Operating System has been rewritten. Sure, it looks the same, but every line of code is new. The old menu program uncompressed slowly under *Windows*, probably due to slow runtime disk routines. We thought it was important to change this, since many of you are running *Windows*.

We're also starting to include more programs than our old system could accommodate. If you see the word *More* on the menu, there's another page of programs. You can press P to show the next page or click on More.

Our December disk has more changes. It will use the words *Previous* and *Next* to navigate among pages. Then you'll be able to click the mouse on Previous or Next, or press P or N to go between pages.

We fixed another problem that occurred when several programs had support files with the same name. We used to install all the programs on a disk to the same subdirectory. When the files were installed, any existing files with the same name as those being created were overwritten. There are probably a million programs with files called README. Because of that, each program and its support files are now installed in their own directory.

File Allocation Table Blues

One of our subscribers wrote in to say that after he uncompressed a program from our April 1991 disk, the COMPUTE disk developed problems. *Norton Disk Doctor* reported an unrecoverable file allocation table. I couldn't contact the reader by phone to get to the bottom of things, but this illustrates several points about using our disks.

You should always make a backup copy of the disk before running it. That way, any mishaps or accidents won't leave you empty-handed. Never install files on the distribution disk (or even the copy). If you're running our menu program from a 5¼-inch disk, there's simply no room to uncompress the files.

A lack of disk space shouldn't cause any serious problems, but there's always the chance that some older versions of DOS or an off-brand BIOS might not correctly send the proper Disk Full error message to our program. The last thing to remember is to write-protect the disk before you install the programs. That way nothing will be written to your disk, and there's no possibility of ruining it.

If you have trouble when you run our disk, try other disks of yours that you know are good. If they don't work, either, make a visual inspection of your computer equipment and check it with a diagnostic program. If you're still convinced that our disk is bad, send it, along with a note of explanation, to PC Disk Problems, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. ❐

When it comes to computer viruses, one small bit of prevention is worth ten megabytes of cure.

HOME OFFICE

COMPUTE CHOICE. This powerful spreadsheet exhibits more talents than ever, including the surprising ability to make music.

Keith Ferrell

QUATTRO PRO 3.0

Less than a year after the release of *Quattro Pro* 2.0, Borland has introduced an even more ambitious revision of what has been from the beginning the most compact and elegant spreadsheet on the market. Not only does *Quattro Pro* 3.0 offer outstanding WYSIWYG and presentation features, but its bells and whistles can also make real music. A sound and visual effects package comes with the program. Whether or not the world is ready for an audible spreadsheet, it's here.

Sound is, of course, pure lagniappe; what matters in a spreadsheet is its number-crunching ability, and here *Quattro* more than excels. For operations ranging from simple row and column math to complex linked spreadsheets, *Quattro Pro* provides the user with a great deal of automation and a number of sensible shortcuts. Thorough mouse and macro support leaves you free to focus on your data. Menus and push-button commands are logically arrayed around an easy-to-read screen.

Screen display is one of the high points of the new version. This is a true WYSIWYG program, offering graphical features that are carefully and thoughtfully incorporated into the program's overall performance. I particularly like the ability to preview my spreadsheet output on the fly, as it were, taking an advance look at how my work will appear in print. The program's zoom feature lets you reduce the screen image, making more data available at a high-speed glance.

Quattro's graphing capabilities are the equal of graphing capabilities in any spreadsheet. Graphs can be defined and displayed with a few clicks of the mouse. The type of graph—pie, bar, and so on—can be changed with equal ease. Labeling and incorporating text within these graphs cause only slight complications.

Elegance of code remains a Borland hallmark, amazingly so in *Quattro Pro* 3.0. In fact, the aspect of *Quattro* that I find most impressive is its size. Borland has stuck to its determination to deliver a product that runs effectively in the smallest possible memory area. In this case that's 512K. This is one full-featured business product that can still run on the XTs of the world. Naturally, the program runs better on a 386 machine, but that's beside the point. What's important here is that a company that has grown with users has not neglected those early *Quattro Pro* fans still content with less powerful equipment.

Microsoft Windows users should be aware that this remains primarily a DOS-based program; a fully optimized *Windows* version is in the works. *Quattro* does, however, run well enough as a DOS application under *Windows*.

Quattro Pro 3.0 takes advantage of expanded memory for large spreadsheets. You can also simultaneously display a large number of spreadsheets. Borland's documentation reports the capability of a whopping 32 concurrent spreadsheet windows, but I've not needed more than a third of that at a time. Individual windows can be stacked, tiled, or arranged to your particular tastes. Use either the mouse or keyboard to transfer data among different windows simply by defining source blocks and targeting their destination.

You can also link spreadsheets easily, drawing upon the contents of one sheet for calculations in another. Again, either keyboard or mouse commands can be used, but linkage really flies under mouse control. It's a matter of a few

clicks to bind diversely located information into a formula on your central spreadsheet. This powerful feature—one that seemed ferociously complex a couple of years ago—has now become routine and almost transparent.

Through its macros, visual orientation, and superb mouse support, *Quattro* effectively offers you a self-contained, object-oriented programming environment. Because spreadsheets are in some ways an adjunct to my work, rather than its primary focus, I've tended in the past to go only deep enough into their operation to get my work done. *Quattro Pro* 3.0's object orientation—everything that can be made visual *has* been made visual—made it simple and appealing for me to go farther. In a short time I learned to build more sophisticated linkages and formulas, leaning on the mouse as much as the keyboard. A particularly nice feature is the Transcript function, which records your scripts as you create them.

I've even gotten to the point where I'm willing to show my onscreen work to professional bean counters. Part of that willingness rests upon the first-rate—and increasingly essential—presentation tools that come with *Quattro*. Not everyone's a born showman, but this spreadsheet wants to bring out the entertainer and financial wizard in us all.

Special effects may not be something you customarily associate with spreadsheets, but the *ProView PowerPack* included with *Quattro Pro* 3.0 comes equipped with a variety of visual and sound effects aimed at enhancing presentations. Text and graphics can be scaled and shaded, lending 3-D effects to the display. "Slide shows" based on your work can be livened up with any of two dozen transitional effects such as dissolves, wipes, and redraws. A library of useful presentation macros is included in the *PowerPack*.

Then there's sound. Incorporating digitized sounds into a presentation has at least one initial advantage; you can startle unexpected onlookers (onlisteners?). Although they could be louder, the sounds work surprisingly well on a standard PC speaker; I haven't tried the program with a sound board. Many of the sounds are self-congratulatory: applause, trumpet fanfares, and the like. These are fun, but there's a part of me that would like to have "Spike Jones" capability—wilder groans, shrieks of agony, and so on.

Paper presentations remain my most frequent output, and again *Quattro Pro* 3.0 delivers more features than I need. Printer support meets Borland's high standards, providing shading, sideways printing, and the especially noteworthy print-to-fit feature.

The print-to-fit option will bring a smile to the face of harried spreadsheet users. When you need to fit a spreadsheet on a single sheet of paper and you don't want to spend time fussing with font size, *Quattro Pro* 3.0 will reduce your work automatically. For single print blocks, *Quattro* will choose an optimum size; your work will never shrink beyond all readability. Yet another significant addition to the print options menu, banner printing allows you to print very large spreadsheets across multiple sheets of fanfold paper. Unlike the landscape printing option

(still available in this version of *Quattro*), the text output isn't interrupted from page to page, resulting in one impressively long table of information.

Quattro Pro 3.0 installs as easily as it works. Documentation is divided among three volumes, the slimmest of which is called Getting Started and warrants a glance from even experienced users. Existing spreadsheets can be imported and automatically translated from *Lotus 1-2-3* but not from *Excel*. Raw data can be brought into *Quattro* in ASCII or delimited formats.

I have no serious qualms about *Quattro Pro* 3.0, but to be honest, the program is so powerful and feature-laden that I am still nibbling at its upper levels. At the same time, I don't doubt that as I incorporate more sophisticated features and functions into my work, *Quattro Pro* 3.0 will continue to delight and deliver. ❐

IBM PC and compatibles; 512K RAM; CGA, EGA, MCGA, or VGA; hard disk with 5MB free—$495.00 (Owners of *Quattro Pro* 1.0 can upgrade for $99.95; owners of 2.0 can upgrade for $49.95.)

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WORKPLACE

Daniel Janal

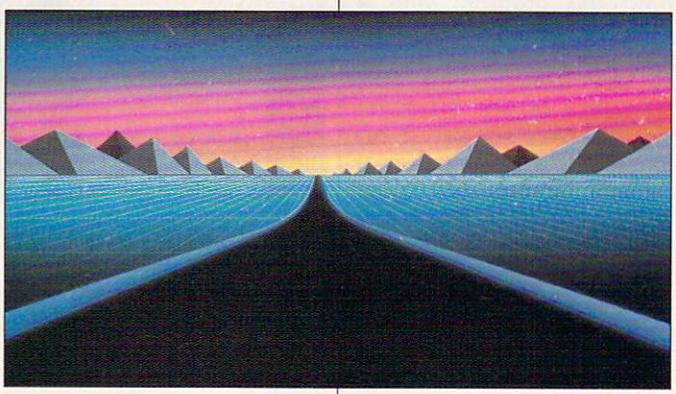
HARD DISKS TO GO

Every night at six o'clock, Tim Berry packs up his files and heads home to eat dinner with his family—and then settles down to a night of work.

As president of Palo Alto Software and Consulting, Berry gives sales training seminars for high-tech companies and takes the extra time at home to write course materials. Forgetting a file would mean a wasted evening. That hasn't happened since Berry began using a transportable hard disk to shuttle data between home and office.

"Floppy disks have become less practical because work files have become so big," Berry says. So he just unplugs the drive, takes it home, and plugs it into his Mac. Once he calls it a night at home, he copies the revised files back to the portable drive to go back to his office.

Removable hard disks are the wave of the future for office executives who take work home, says Joel Levine, vice president of marketing for SyQuest Technology (47071 Bayside Parkway, Fremont, California 94538; 415-226-4000), which has shipped more than 600,000 of the drives. Yet the idea is hardly new.



Headed for far reaches of the world? Take your office with you on a portable hard disk.

"This disk is a response to being a unified family," Berry says. "We might be the last family in America that sits down to dinner at 6:00 p.m. with Mom and Dad and five kids. I have to close shop every day to do this, and I need to have a few more hours to finish work. Those few hours come from this disk."

"This disk" is a removable hard drive from Liberty Systems (160 Saratoga Avenue, Suite 38, Santa Clara, California 95051; 408-983-1127). It's another 80MB of storage for Berry's computers and another four hours to his workday. With the $1,000 device, Berry's assured of having every file and font when he needs it.

When mainframes ruled in the 1960s and 1970s, transportable hard drives were the norm. "Disk drives were designed to be removable," Levine says, "so users would have unlimited storage capabilities as well as total security for their data." With the advent of PCs, however, disk drives became fixed internally.

Iomega (1821 West 4000th S, Roy, Utah 84067; 801-778-1000), another leader in the mass-storage industry, recently introduced the Bernoulli Transportable 90, a 90MB hard drive that can connect to PCs and laptops through a variety of options, including a laptop's parallel printer port. The drive looks like a transportable car radio, weighs 8½ pounds, and retails for $1,149. And it's rugged enough for the mail.

Before copying your corporate program files to a removable hard disk, however, you should check with your MIS director to make sure you aren't violating any copyright laws or licensing agreements that were made between your company and a software vendor.

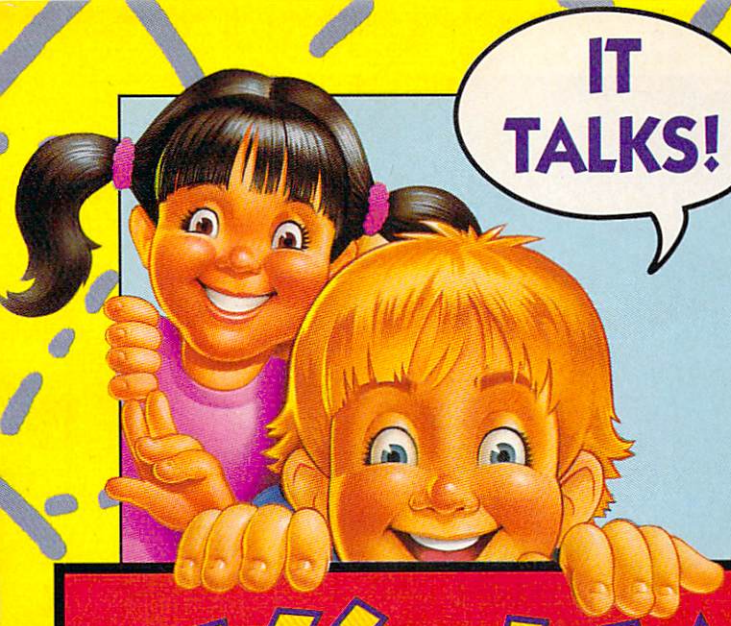
Only the copyright holder—the software vendor—has the right to make a copy, according to Ken Wasch, executive director of the Software Publishers Association, which wages a vigorous antipiracy campaign. Companies that license from software publishers, however, might have *permission* to make extra copies. Just be sure you carefully follow the licensing agreements.

Companies who violate the law can find themselves sued for unregistered copies, fined for the practice, and embarrassed in the media. The SPA monitors software piracy and helps companies monitor their own software usage with *SPAudit,* a disk-based software program available free from the SPA (1730 M Street NW, Suite 700, Washington, DC 20036; 800-388-7478).

Another advantage of the transportable hard disk is that it provides Berry with a complete copy of his computing environment, including program and data files, so he can take the disk with him when he visits clients or holds seminars in far reaches of the world.

"Since I travel a lot, my portable goes with me," Berry says. "It's assurance that I'll have everything I need. You don't want to be in Hong Kong and find out you don't have the right fonts. When I go with my own disk, I have all the fonts and software I need."

That's a good feeling to have when you're computing away from the office. ❐



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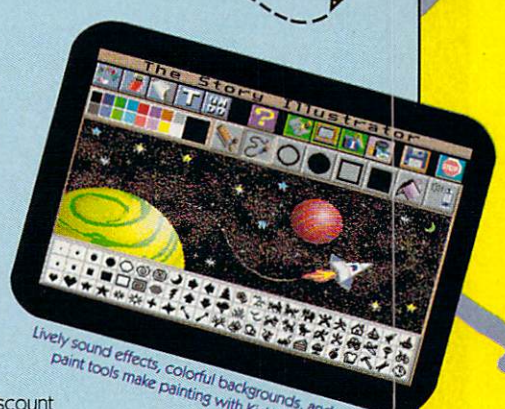

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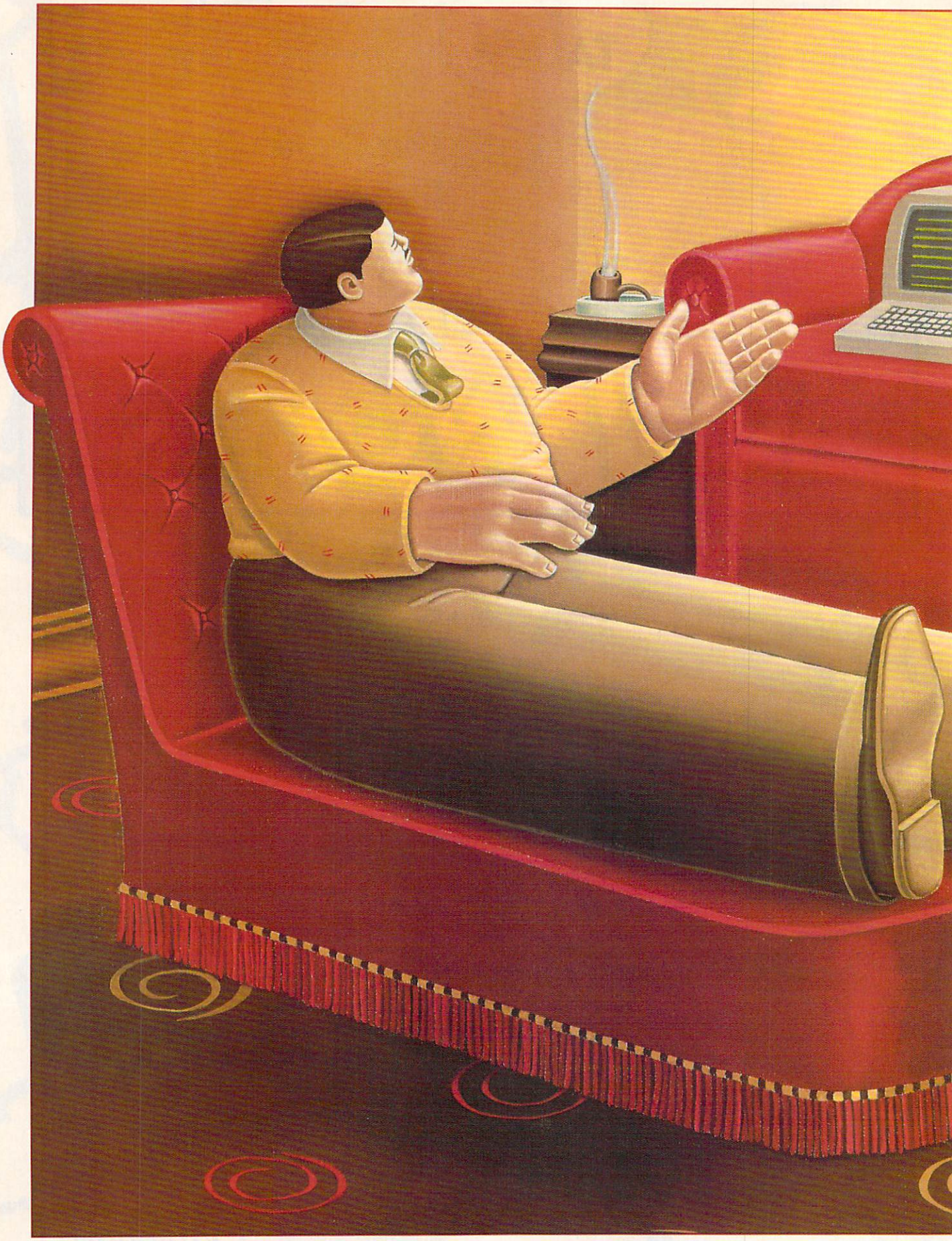

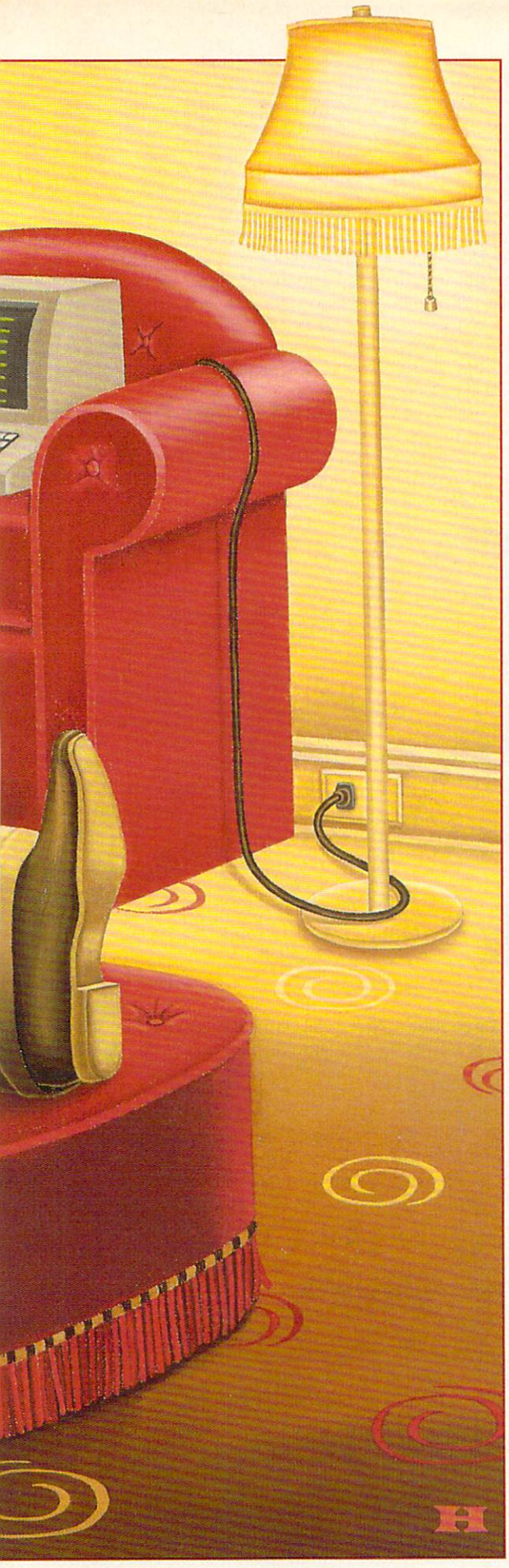

DESIGNING A HOME OFFICE FOR COMFORT AND SUCCESS IS EASY—IF YOU KNOW THE POTENTIAL PITFALLS.

DESIGN INSPIRATION

BY SHERRY ROBERTS

Millions of people go to work every day and never step out the front door. They manage this trick, for the most part, by using their computers, modems, fax machines, laser printers, and telephones as their electronic eyes and ears. Their ranks include writers, artists, accountants, executives, entrepreneurs, desktop publishers, and consultants of almost every persuasion. Unfortunately, few of them are professional interior designers.

And there's the rub: How can a home office worker create a comfortable, efficient, and productive work environment next door to the laundry room with the rattling washer or adjacent to the nursery with the colicky baby? What do you do if your home office shares a room with the Nintendo? Is it possible to create a professional home office that you would be proud to show clients—a place where professionalism can live in harmony with domesticity?

More people than ever before are finding themselves working in an "electronic cottage" and facing these questions. According to *Entrepreneur* magazine, there were 18.3 million home-based businesses in 1989—a 23-percent increase over 1988 when about 14.9 million businesses were run from the home.

Office Sweet Office

Whether you are founding the next corporate dynasty or simply searching for a quiet place to pay the monthly bills, the first and most difficult step is determining where to put the office. Don't decide too quickly. Don't leap to the conclusion that the perfect location is the spare bedroom, vacant basement, or never-used attic. A home office has to fulfill all the requirements of a corporate office—and more.

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Circle Reader Service Number 110

"Eyeball your house," says Mark Alvarez, author of *The Home Office Book: How to Set Up and Use an Efficient Personal Workspace in the Computer Age* (Goodwood Press, 1990). "The most obvious space may not really be the best space."

Alvarez, who works from his home office in Woodbury, Connecticut, even has a rule about bad space: No matter how tempting it is, never establish your home office in a location that will often be uncomfortable. Forget the uninsulated attic that's freezing in winter and boiling in summer or the basement with a single light bulb dangling from a cord, unless you are willing to spend the time and money to make them habitable. After all, a home office is a habitat, a place where the typical home-based entrepreneur spends more than eight hours a day.

Nancy W. Lasater, owner of Design Associates, a Greensboro, North Carolina, interior design firm specializing in commercial office space, says, "Most people start off with the attitude of where can they fit the office instead of asking what are their needs."

Lasater, who was an in-house corporate designer responsible for the interior design of RJR Nabisco's world headquarters and company offices, started her business in a home office. She recommends that home office dwellers select a space big enough to fit their needs three years from now.

Thinking big is especially important for the high-tech cubbyhole. If you have ever-changing equipment and technological needs, Lasater says, flexibility is the key to both the size and the layout of your office.

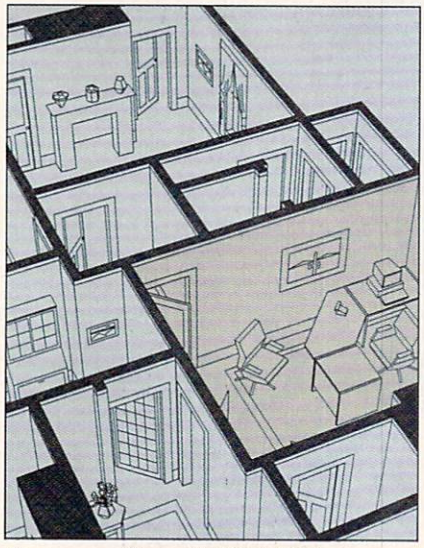
Another consideration in locating your home office is the amount of traffic your business will generate. "You want your clients to walk through as little of your house as possible," Lasater says. "For example, if you plan to put your office in a bedroom, locate it in the bedroom nearest to the living room, since the living room tends to become the lobby of most home offices."

But what if your office must share space with the television, the Nintendo, or a dollhouse? Many home office workers set their space apart, not with walls but with time, negotiating schedules with the other family members.

Even so, both Lasater and Alvarez suggest that you find some way to distinguish your office space, to make it your own, to capture symbolic privacy if not actual privacy. A rug or platform can mark the limits of your office. Use barriers such as plants, screens, panels, and bookcases. And if all else fails, don't forget Les Nesman, the newscaster of "WKRP in Cincinnati," who carved his niche out of a crowded communal office using only a roll of tape.

The Layout for Your Dream Office

"Design your office the same way you design a kitchen," Alvarez says. "You don't want it to get in the way, to be a problem. It ought to be efficient, given the way you work."



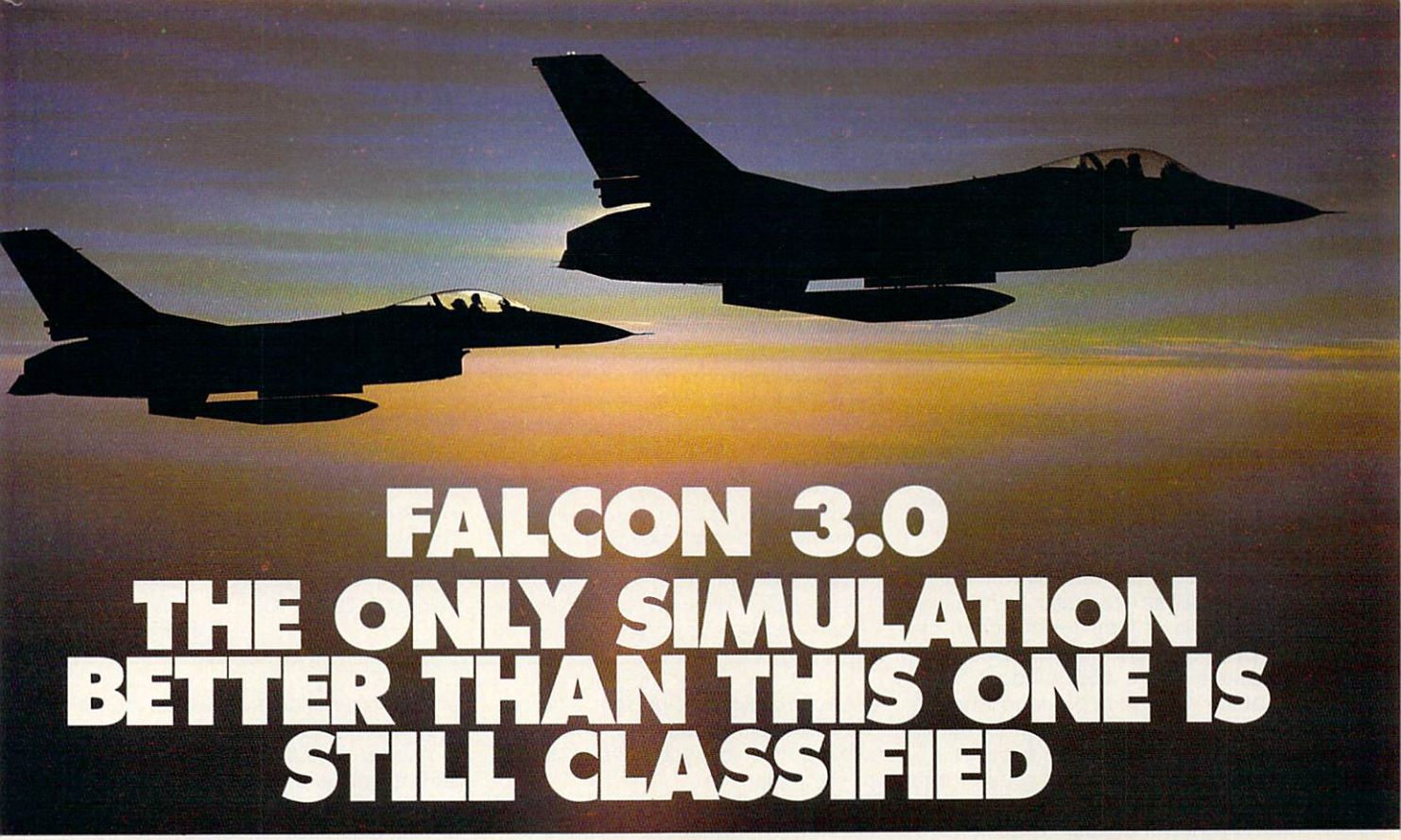
Design an office with ROOMER3.

Before arranging your office, Alvarez suggests analyzing the way you work, the type of equipment you will use, and even your physical characteristics. Are you right- or left-handed? Tall or short? Do you have any physical handicaps?

There are four standard office layouts, according to Alvarez:

- The strip, the most basic office design, is a straight line of office furniture and components. This is the least desirable if you have to accommodate lots of equipment.
- The L-shaped layout is common in home offices because it uses wasted corner space and offers a convenient arm for the printer.
- The galley, which is basically two strips with a chair in between, is a favorite in executive offices. The computer can be set up on one work surface, while the other surface is used for phone calls and handwork.
- The U-shaped layout, says Alvarez, "is like sitting at your own personal control center—everything important is usually within easy reach."

The best thing about designing your own office is that you don't have to stick with some plan dreamed up by the corporate designer. You can find the arrangement that is most comfortable and productive for you.



FALCON 3.0
THE ONLY SIMULATION BETTER THAN THIS ONE IS STILL CLASSIFIED

The bogey came out of nowhere. You see him just off your tail. The adrenalin hits you like a fist. You call your wingman: "Viper One, I've got a bandit on my six. This is not good..."

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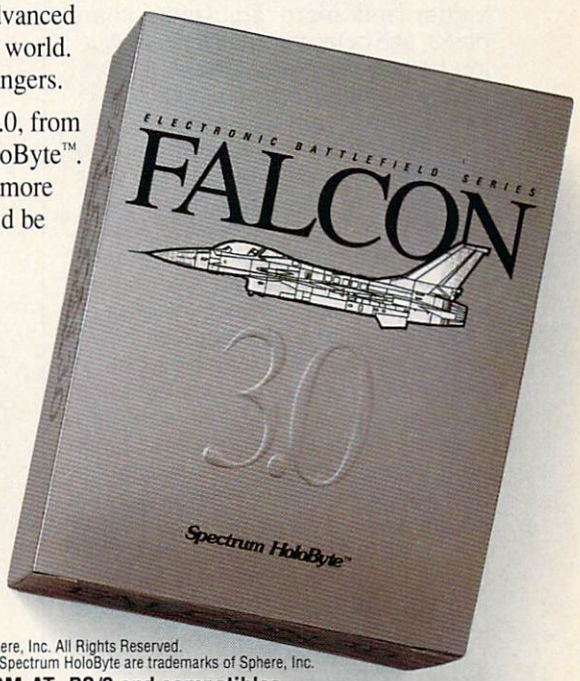

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Circle Reader Service Number 223

Furniture

Today's office is more than a table and a chair. To underscore this fact, consider that an ordinance requiring adjustable furniture in businesses with more than ten employees went into effect in San Francisco in January 1991.

Jeff Larson, marketing communications manager for Krueger International in Green Bay, Wisconsin, says the ordinance illustrates the growing concern about safety in office environments: "Researchers have found you're just as much at risk doing any repetitive motion such as keyboard strokes as you are out on the plant floor."

Larson has been following the San Francisco legislation because Krueger is the eighth largest furniture manufacturer in the United States. The company produces 50 different lines of chairs as well as workstations and DataBord—a line of furniture designed for computer support with slide-away and adjustable-height work surfaces.

Larson says, "People tend to put a lot of money into their computer but go cheap on the items to support it." Which is a mistake. Your comfort and health are even more important than the horsepower of your computer.

The most important piece of furniture in the home office is the chair. "Choosing a chair is like test-driving a car," Larson says. "You have to sit in the product."

Professional designers recommend work surfaces with adjustable height. Alvarez prefers tables, which often are bigger and more adjustable than desks, and notes that the standard writing height of a work surface is 29½ inches. Standard typing height is 26½ inches. The proper typing height is the one that permits your elbows to bend at a 90-degree angle when your hands are on the keyboard.

A desk should be at least 22 inches deep, Alvarez says, considering that a CPU and keyboard can easily consume more than two feet. Also there should be at least 18 inches on either side of the keyboard for workspace.

You can save precious workspace by turning your CPU on its side and standing it beside the desk, then propping your monitor on an articulating arm. Recommended placement of the computer monitor is 16 to 28 inches from your face. Alvarez also suggests setting the monitor below eye level, so that you look down 10 to 20 degrees when you're reading from it.

Access to Power

When you choose the space for your home office, make sure it has several power outlets and phone jacks. If you only have one electrical outlet and three computers, two printers, a fax machine, a scanner, a stereo, and an answering machine, you need to consult an electrician.

Also don't scrimp on surge protectors. You don't want to lose valuable information when the air conditioner kicks on or someone pops popcorn in the microwave. Power hogs like copiers and laser printers should be on separate circuits from the PC.

Alvarez says one of his most popular chapters is the one on lighting. And no wonder: Monitor glare is the computer user's nemesis. It causes eyestrain, headaches, and sore necks (from leaning and squinting at the screen).

To eliminate monitor glare, position

FURNISHED COMFORT

Computer furniture has become as innovative as the computers themselves, providing high-tech comfort through almost infinite adjustability.

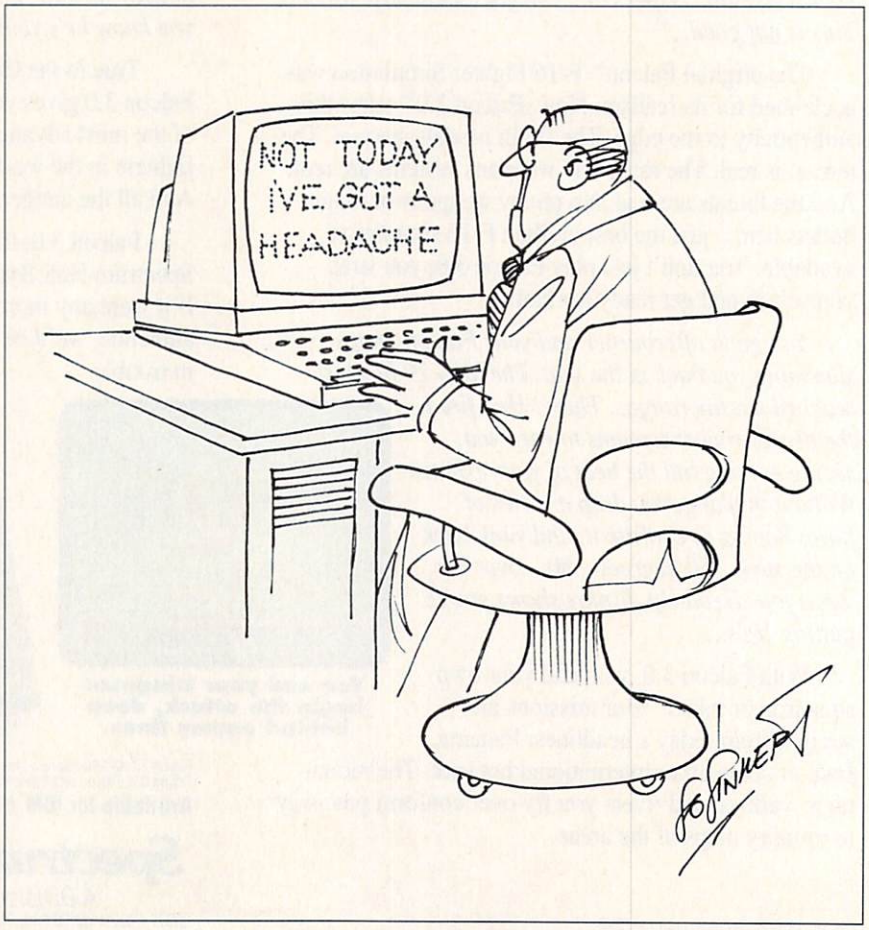
Haworth (P.O. Box 5574, Kalamazoo, Michigan 49003-5574; 800-344-2600) offers an adjustable computer table that allows you to place the keyboard and the monitor at a wide range of completely adjustable levels.

Human Factor Technologies offers a whole range of adjustable furniture, some of which is electrically operated. This company can be reached at 55 Harvey Road, Londonderry, New Hampshire 03053; (603) 432-4495.

If you're among the truly hip, you're into comfort to the maximus. Check out the offerings of Biomechanics Corporation of America (1800 Walt Whitman Road, Melville, New York 11747; 800-248-3746). This company is hard at work developing chair technology. By using hundreds of adjustments through tiny pneumatic tubes shaped like little fingers, its Intelligent Seat conforms to your seat to provide maximum comfort to your glutei.

There's more to furnishing than furniture. You need dozens of small items to make your home office work efficiently, and there is a significant industry built around making an office comfortable, efficient, and attractive. Curtis Manufacturing is a supplier of surge protectors, monitor bases, antiglare screens and sundry items for the office. To assist you in making good decisions, Curtis has released a series of pamphlets titled "Tips to Computing More Comfortably," "Surge Protection and the New UL 1449 Standard," "VDTs and Radiation," and "Design Ideas for Your Home Office." These pamphlets are yours free of charge from Curtis Manufacturing (30 Fitzgerald Drive, Jaffrey, New Hampshire 03452; 603-532-4123).

—ROBERT BIXBY



Circle Reader Service Number 163

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your monitor so that light sources are to the side of the monitor. Don't place the monitor in front of a window so that you are constantly looking into the bright, natural light. Also beware of windows behind you that cause distracting squares of light on your screen.

Shades of the Professional

The colors in your home office are a personal preference, but the professionals have good reasons for recommending off-white or neutral colors. "Neutral wall colors are best because, as far as reflections go, they don't change much under different lighting from morning to afternoon," Alvarez says. "They also hide dust, which is important in some home offices."

If clients will be visiting your home office, color selection may be important in other areas of the house as well. "When you walk into a commercial office, you are getting a prepackaged first impression," Lasater says. "When you walk into someone's home, it is a real summation of that person."

The client of a home-based business is slapped with a full-force dose of the homeowner's personality. Dirty laundry, dying plants, and fleas do not give the impression of professionalism. Remember the client is asking, "Do I want this person to handle my work?"

GETTING IT ON PAPER

You can design your home office on the back of a cocktail napkin, with general graphic design software such as *Micrografx Designer,* or with specific floor plan and interior design software.

ROOMER2 (Hufnagel Software, 501H Main Street, Clarion, Pennsylvania 16214; 814-226-5600; $79) is a special-purpose CAD program that creates floor plans and furniture arrangements for home or small offices in 3-D. Creator Henry M. Hufnagel released *ROOMER3* ($395) in the fall of 1990. A video about the software is available for $10; it's included in the *ROOMER3* product at no extra charge. The chief differences between the products is that *ROOMER2* supports CGA and Hercules and has no mouse support while *ROOMER3* supports the mouse and VGA.

Generic CADD 5.0 (Generic Software, 11911 North Creek Parkway, Bothell, Washington 98011; 206-487-2233; $495) is a full-featured drafting and design program. Available for the PC (a similar product is available from Generic Software for the Mac), this program does more than let you push furniture around on your computer screen. It calculates dimensions, adds notations to renderings, and scales drawings. A special library of images of office furnishings is available.

If you have no interest in floor plans, call Norm Abelson, a Lake Oswego, Oregon, consultant specializing in trade shows and exhibitions. He has developed the Instant Office "to put to use those underutilized areas of the home."

Instant Office comes in three sizes (8 × 12, 12 × 12, and 12 × 16 feet) and includes an Allen wrench to lock the units together. The units come with a videotape to lead you through the assembly, which Abelson says takes about two hours.

The kit, which runs $5,000 to $7,000 depending on the size of the room, has walls, ceilings, fluorescent fixtures, doors, wiring (ready to be hooked up by an electrician), phone jacks, outlets on all four walls, and vinyl-covered paneling in three finishes (light, medium, and dark.)

Does It Work?

After you've designed your office, how do you know if you've got it right? "The tipoff is if your home office gets in the way," Alvarez says. Alvarez, for example, realized after he developed an ear problem that he had his telephone on the wrong side of the desk. Simply moving the phone to the other side made the office work better.

The key to designing your home office is to constantly look at it with a fresh eye. You must build an environment in which you can live and work. ❐

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Circle Reader Service Number 202

ARTS & LETTERS

Robert Bixby

FUTURE IN MY HAND

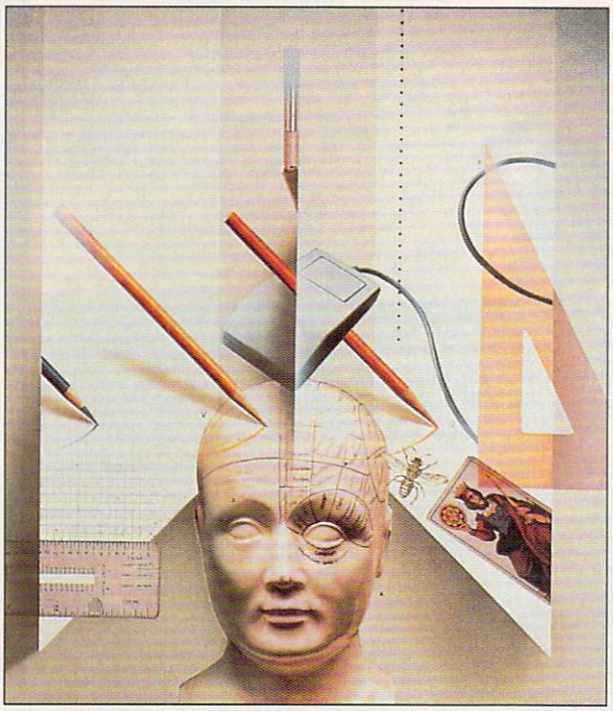
Ever wish you'd been around when Apple got started? Well, I got a glimpse of something that made me feel excited about personal computing all over again.

I wasn't among the cheerleaders when people first started mumbling about pen computing a couple of years ago. Long ago I left legal pads behind in favor of typing. The last thing I wanted to do was give up being able to type—a process that very nearly keeps up with my thoughts—and return to the slow hand.

Writing slowly enough to be legible (even to myself) would mean letting ideas go by and dreading second thoughts that would require rewriting. Pen-based computing might be embraced by people ignorant of the advantages of keyboards, but I knew better.

Momenta's new pentop computer has all the momentum to make pen-based computing the twenty-first century standard.

That was my mindset as I approached the Waldorf-Astoria Hotel in New York one June afternoon for a product demonstration of something new (ho-hum) in pen-based computing. The address of the demonstration and the fact that the call came from the Regis McKenna agency did make me take notice, however.



I was met at the elevator and led to a quietly elegant suite where I saw something that may very well change the way we conceive of the computer for the next generation or two—Momenta's entry into pen-based computing, called pentop computing to distinguish its approach from that of Grid. Momenta's reason for differentiating its machine is that it understands the resistance of people like me and has provided for us a fully functional keyboard to supplement the touchscreen.

The keyboard represents the company's philosophy that the thing pen-based computers do the worst is handwriting recognition, and, ironically, this is the activity that uses the most processing time. It makes more sense to process text through a keyboard and use the touchscreen as a pointer and editing tool.

Regular readers of this column will recall my long search for the mouse killer—some device to eliminate the need for desktop rodents forever. The problems I've encountered so far have been response speed and the fact that most GUIs were designed for mice in the first place, which puts any other device at an instant disadvantage.

Momenta, while built on top of a fairly conventional 386SX DOS-based 4MB system, uses a specially designed GUI (in 1.5MB of ROM) that takes specific advantage of the pen and the motions peculiarly suited to pen input. For example, it can detect when you're trying to create an ellipse or a rectangle on the drawing screen.

When you want to embellish or delete an object, you move the pen in one of six directions from the object's center point—a flick of the wrist, and the object is gone or copied to the clipboard or ready to move, or a menu is called, or a file is opened or closed, and so forth—the commands relate to the current activity. The range of actions is complete. Recognizing pen movement is the province of a special chip, so response is lightning quick, and it takes nothing away from the CPU.

It's clear from the moment you sit down with the wedge-shaped computer that a great deal of thought went into this device before its design was implemented. The wedge shape, for example, fits as naturally on the lap as a sketch pad. The RAM expansion uses standard SIMMs, so you won't have to pay a lot for your memory.

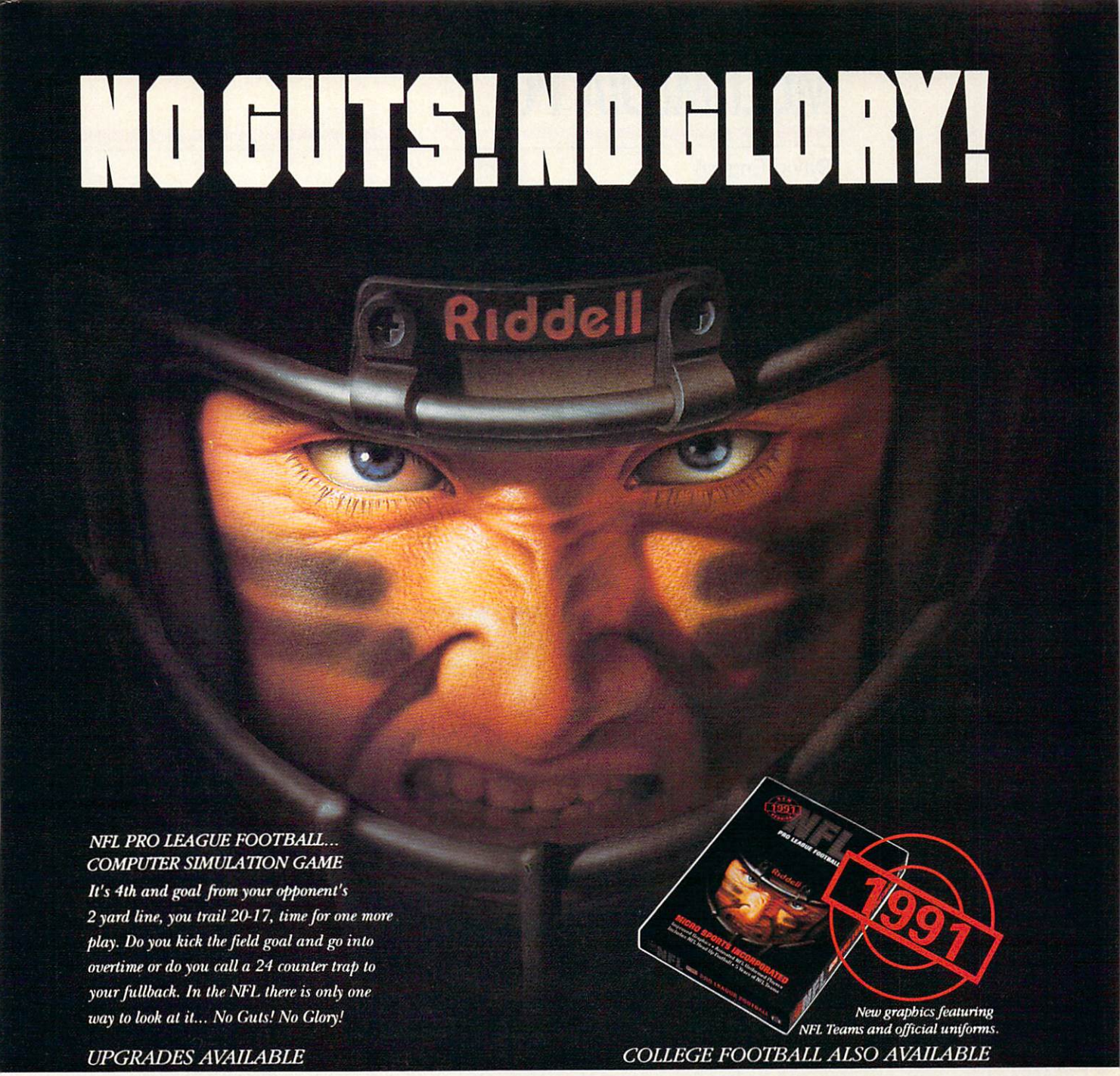
The system is equipped with a cold shutdown, which means that when you aren't actually interacting with the computer, for all intents and purposes, it's turned off with almost no battery drain. The result is about six hours of battery life from its ten standard penlight cells in continuous use.

Since the machine is built on an Intel chip and MS-DOS, you'll be able to run standard DOS software from the machine's 40MB hard drive as well as from the pen-based GUI Momenta will build in.

Although Momenta opted not to attempt raw handwriting recognition, the GUI is capable of deciphering print, so you'll be able to enter text in dialog boxes, for example. It would be prohibitive to enter text this way for word processing, however.

Watch Momenta. It has the future written all over it. ❐

NO GUTS! NO GLORY!



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David English

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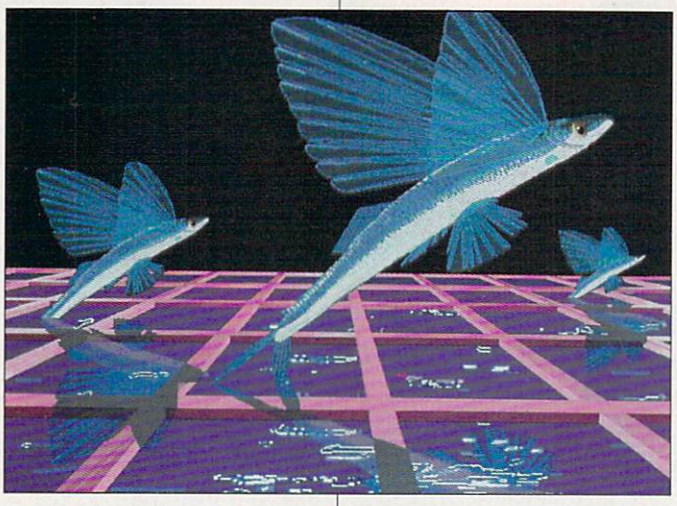
It was hard work for the Disney Studios to string together millions of individual drawings to create an animated movie. Each frame of *Pinocchio* and *Fantasia* was carefully painted by hand and photographed in sequence with a motion picture camera. In the movie theater, the cels were projected 24 times every second to generate fluid motion.



With Autodesk Animator Pro, you can create animation that rivals today's professional animation.

By contrast, much of today's animation is called limited animation—most of the time only the characters' mouths and hands move. It's just too expensive to use Disney's methods. Not even Disney does it the way Disney used to. Costs are kept down by using computers to create some of the backgrounds. A computer can quickly calculate the steps necessary to move an object from point A to point B.

Given the state of today's animation—limited animation on the low end and computer-assisted on the high end—and the graphics capabilities of today's powerful 386- and 486-based PCs, you can create fine computer animation. And there's no better place to start than with the recently released *Autodesk Animator Pro* (Autodesk, 2320 Marinship Way, Sausalito, California 94965; 415-332-2344; $795).

Like *Autodesk Animator* ($295), which was released in 1989, *Autodesk Animator Pro* offers cel animation (where you can create each frame as an individual picture—much like traditional Disney animation), tweening (where you can transform one shape into another by letting the computer draw each in-between shape onto a separate frame), and optical animation (where you can use television-style special effects to add swirling, twirling, spinning, flipping, and squashing motions to a shape or an entire frame). Both programs include text titling and a built-in 256-color paint program.

But while *Animator* restricts your work to a resolution of 320 × 200, *Animator Pro* lets you work in 640 × 480, 800 × 600, and even 1024 × 768. Because the animation backgrounds are stored in GIF format, I downloaded several interesting 640 × 480 photographs and was able to load them directly into *Animator Pro*.

Other improvements in *Animator Pro* include enhanced tweening, better font support, WACOM graphics tablet support, and a new animated cel option that lets you paint one animation over another as though you were painting with a brush.

Although it's a great program, there are limitations. As you advance to higher resolutions, you'll find that your animations slow down. While Autodesk recommends a 286 with 640K of RAM for *Animator,* it recommends a 386 or 486 with 4MB of RAM for *Animator Pro.*

There are some things you can do when using these programs to place less strain on your PC's processor. While you'll probably want to use the full screen for your backgrounds, try to keep the moving objects relatively small. With tweening, color cycling, and the optical animation techniques, you can create dramatic effects without having to move the entire frame. And if you plan to bring your animations over to video, consider purchasing or renting a video recorder with the ability to record single-frame video. Then you can make your animations as complex as you like because you won't have to depend on your PC to move the objects in realtime.

Both *Animator* and *Animator Pro* have an easy-to-use interface that actually makes it fun to try out your ideas. And the *Animator Pro* package includes a generous selection of animation files that illustrate many of its techniques. (You'll need a whopping 11MB of hard drive space to install everything that comes with the package.) By the end of the year, you can expect to see a *Windows*-based animation player, a *Visual Basic* DLL, and support for sound cards within *Windows.* Add it all together, and you have a great way for a future Walt Disney to get started in animation. ❐

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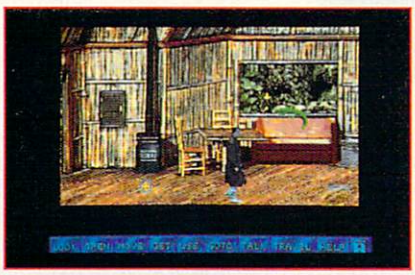

MARTIAN MEMORANDUM

Private eye Tex Murphy is back in a hilarious new interactive movie adventure from Access Software. For the first time, players will be able to interact with full motion video characters on a disk- based product, as they help Tex face murder, romance, deception, and prophecy from present day San Francisco to the year 2039.

WORDTRIS

A new challenge from the TETRIS people at Spectrum HoloByte. The fast action, falling blocks now have letters on them, which players try to form into words. Time is of the essence as you try to maneuver letter tiles to spell words, as they fall from the top of the screen into the well. If you like TETRIS, you'll love WORDTRIS.

FACES...TRIS III

You'll meet some pretty strange characters playing this addicting Soviet mind-teaser from Spectrum Holobyte. Falling block pieces of famous and not-so-famous faces must be stacked in the proper order (mouth to chin, eyes to nose) to form complete faces. Remember there are no points for "double chins" in this game!

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DISCOVERY

COMPUTE CHOICE. Outstanding graphics and sound accompany the bunny's return.

Heidi E. H. Aycock

READER RABBIT 2

Only a few years old and, already, *Reader Rabbit* has gotten a face-lift. Kids are growing up so fast these days.

Seems like only yesterday *Reader Rabbit* was a cleverly designed program with engaging, but not spectacular, graphics. Now, *Reader Rabbit 2* features more than solid educational programming with impressive pictures. This newest addition to the Reader Rabbit series sparkles with the kind of graphics usually reserved for entertainment software. For people with sound cards in their PCs, this new program also brings great music and sound effects to the arena of children's software.

But what's more important? Graphics or educational value? To the Learning Company, responsible for grooming Master Rabbit, education comes first. *Reader Rabbit 2* helps children between five and eight years old hone their reading skills. Following the young rabbit through four fun sections of Wordville, children improve their understanding of spelling, phonics, vocabulary, and sequencing.

To begin, hop on the crosstown train and head for the Word Mine, where you search for special crystals. The crystals display word or letter combinations, and the mining car holds another word or letter combination. As with all of the sections, four levels of difficulty challenge you. First you create compound words by matching a picture and half the word on the mining car with a word on one of the crystals. On the second level, you select the three-letter crystals that complete words started by the two-letter consonant blend on the mine car. On the third level, reverse the skill you practiced on the second level; the three-letter crystals begin words ended by the two-letter blend on the mining car. On level 4, type the appropriate words or letter combinations with no cues from the game. Whether the car holds a compound word or a two-letter blend, this level is very challenging.

The Word Mine flexes at least two reading muscles. As you build words, you expand your vocabulary. Like a game of Scrabble, *Reader Rabbit 2* may send you scrambling for the dictionary. As you work with blends and letter combinations, you develop a stronger friendship with phonics, too.

To try a new section of *Reader Rabbit 2,* just hit the Escape key or click on the train icon, and you're off to the station. At the station, you can choose one of the other exercises.

Vowel Pond, second in the list of choices, tests your understanding of vowel sounds. At the pond, you find Reader Rabbit casting off from a dock, his net and bucket poised for catching fish. When he finds a good spot, our angling hero waits for the fish to swim out of a nearby log. Each fish has a word emblazoned on its scales.

On the easiest level, you catch fish which match the short vowel sound shown at the top of the screen. With a stroke of the Return key, Reader Rabbit dips his net into the water and scoops up the fish. Sometimes the vowel sounds are represented by the same letter combinations—*cup* matches *sun,* for example. Sometimes the matches are tougher, complicated by different letter combinations—*leg* matches *bread,* for example.

Vowel Pond's second level tosses long vowel sounds into the water. Besides being a new concept, long vowel sounds can be made up with even more letter combinations than short vowel sounds—*lane,* for example, matches with *train* and *day,* as well as *vane.* The third level mixes short and long vowel sounds. By the time you reach the

fourth level, Master Rabbit has two pails, one for the short sound of a vowel and one for the long sound. You not only match sounds but also pick which pail should hold each fish that swims by. Fishing is a wonderful way to spend an afternoon, but *Reader Rabbit 2* has two more fun exercises. Flag down the Wordville Train and explore the other areas.

In Match Patch, you play that old standby, concentration, but the matches are much more challenging. The carrots in this garden are labeled with words. In the first level, you match carrots that rhyme. These rhymes are usually represented by similar spellings. On the second level, you match words that sound the same but are spelled differently. Take this opportunity to talk about what these words mean, and you'll add vocabulary skills to this exercise. You can also use this technique on the third level. These carrots are labeled with opposites. The fourth level plants more difficult rhymes in the soil—*night* rhymes with *bite,* for example.

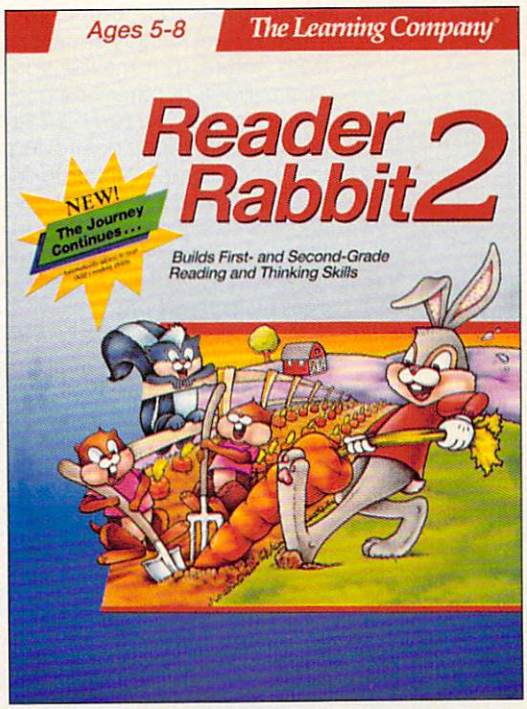
Finally, Alphabet Dance works on sequencing skills. The screen shows four animals tapping their toes. The animals' interesting names—like Cecil and Quala—are printed with the waiting figures. You put the names in alphabetical order so the critters can cut the rug. On the first level, these names are just one letter apart from each other—*Albert, Ben, Cami,* and *David,* for example. On the second level, the names are more spread out in the alphabet—*David, Mary, Robert,* and *Yul,* for example. On the third and fourth levels, some names start with the same letter, so you have to sort them by the first and second letters.

With these four exercises, the Learning Company has, once again, released an excellent educational package. *Reader Rabbit 2* is packed with good lessons and valuable practice. Best of all, this program is not simply an electronic workbook. With its animation and sound, *Reader Rabbit 2* takes full advantage of computer technology. If you've seen the first *Reader Rabbit,* you may be surprised by the description of *Reader Rabbit 2.* Sure, the first program had nice graphics, but they were blocky, simplistic, and nothing overwhelming. This new program is truly exceptional in comparison to what you may have seen in other educational packages.

Each section of Wordville is populated by adorable creatures and interesting visual effects. In the Word Mine, shimmering sparkles highlight the crystal that has been selected. In Vowel Pond, humorous cartoon fish frolic and make faces in Reader Rabbit's bucket. If our heroic hare catches the wrong fish, the scaly scoundrel scowls at the rabbit and leaps back into the water. The Match Patch grows vibrant orange carrots, at least as big as the gophers that push them out of the ground. The poor gophers strain and puff under the weight of these vegetables. Finally, the Alphabet Dance features several different characters who tap their toes and clap their hands to the music. In VGA, the game's images seem to jump out of the screen because their colors are so rich. Added depth to the images lends a three-dimensional quality.

Excellent sound accompanies the sharp graphics. The different themes bounce as energetically as the game itself. Your children will especially appreciate the seven different songs that play during the Alphabet Dance. You'll need a sound card to enjoy the music to its fullest, but the effect that great music can have on youthful learners can't be discounted. Boredom with an oft-repeated game sequence can be averted for many days by simply piping in harmonies. Here's another reason to buy that sound card you've always wanted; your kid's education just might stand to benefit from that purchase.

What you'll see when you boot up *Reader Rabbit 2* is an education program that has been through a cosmetic overhaul. Now learning can be as visually and aurally stunning as the slickest videogame. ❐



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PATHWAYS

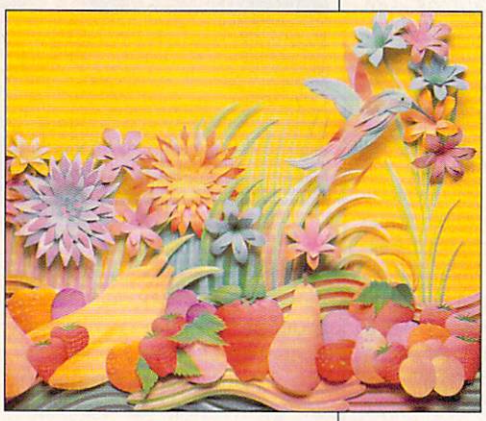
Steven Anzovin

COMPUTING IN THE GREEN

Working at your computer, you may feel smugly separate from nature, but maybe you and millions of other computer users are worsening the greenhouse effect, destroying the ozone layer, pouring toxic chemicals into the air and water, and creating thousands of tons of unrecyclable solid waste. If that thought concerns you, read on.

You may hear claims to the contrary, but the computer industry isn't inherently green. For example, in many plants, circuit boards are still cleaned with chlorofluorocarbons that damage the earth's ozone layer, so buy your computer components from companies that use a water-based process.

Small works reap big results, so get in on the act of green computing—now!



Computer retailers need to clean up their acts, too. If you order by mail, use companies that ship in recycled packaging without foam peanuts and bubble pack. PC Connection is one such company (6 Mill Street, Marlow, New Hampshire 03456; 800-243-8088). Put the squeeze on other vendors to do the same.

Every kilowatt hour of electricity you use adds more than two pounds of carbon dioxide to the atmosphere, according to the American Council for an Energy Efficient Economy. The single best way to save juice and combat the greenhouse effect is to turn off your equipment often. If you can't turn it off every time you leave your desk, at least turn off the monitor and printer. To save even more energy, use low-wattage fluorescent task lighting instead of incandescent.

Instead of buying a whole new computer, save plastic, metal, and packaging by getting your current hardware to do more for you. Enhance your computer's performance with an accelerator board. Buy internal modems, hard drives, and other components instead of external ones because they're composed of less material. Share seldom-used peripherals with another person, or rent them.

One idea I particularly like is file-compression software. Such programs (and optional compression boards) let you squeeze up to double the number of files on your current hard disk so you can put off buying a larger drive. One such program for the PC is *Stacker* from Stac Electronics (5993 Avenida Encinas, Carlsbad, California 92008; 800-522-7822; $149, $229 with a compression board).

Do you really need to print that draft? Flip over some used sheets and print on the backs. Do a lot of faxing? Get a fax modem—it will save paper every time you send or receive a fax. A paper-saving print utility is *DynoPage* from Portfolio Systems (21 East Market Street, Rhinebeck, New York 12572; 914-876-7743; $125), currently available only for Macs. *DynoPage* lets you print reduced multiple pages on one sheet, but best of all, it prints consecutive pages on both sides of the paper, potentially cutting your paper use in half.

Keep a special recycling basket next to the computer to catch ruined print jobs, drafts, and perfories from tractor-fed paper. For fresh stock, use recycled paper when possible. A good-quality recycled paper can actually be better for laser printing since it's more flexible and less likely to warp when exposed to heat and stress. You can buy recycled computer paper at many computer stores. To order a wide assortment of recycled paper by mail, try PaperDirect (205 Chubb Avenue, Lyndhurst, New Jersey 07071; 800-272-7377).

Paper isn't the only consumable you can recycle. Check out the machines that reink printer ribbons and recharge laser toner cartridges. You can save quite a bit of money on printing. Floppies, of course, can be used again and again. When you're ready to upgrade, recycle the entire computer by selling it or donating it to a local school or charity. Most schools are desperate for computers. Most donations are tax-deductible at the computer's depreciated value. (The IRS considers computers to be fully depreciated after five years.)

Consider a used PC for your new machine, too. A slightly used 386SX/20 brand-name PC can cost 40 percent less than the street price. Check with the Boston Computer Exchange (800-262-6399) or the National Computer Exchange (800-359-2468) for the latest prices.

Want to share your personal tips on green computing? Send your ideas to me at Box 2173, Amherst, Massachusetts 01002. If they're green enough, you'll see your name and idea in a future column. ❐

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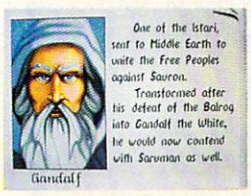

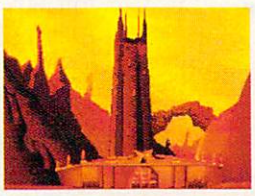

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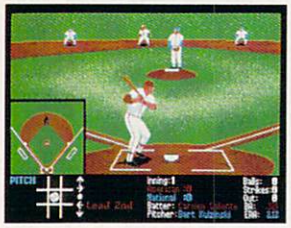

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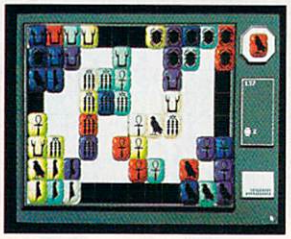

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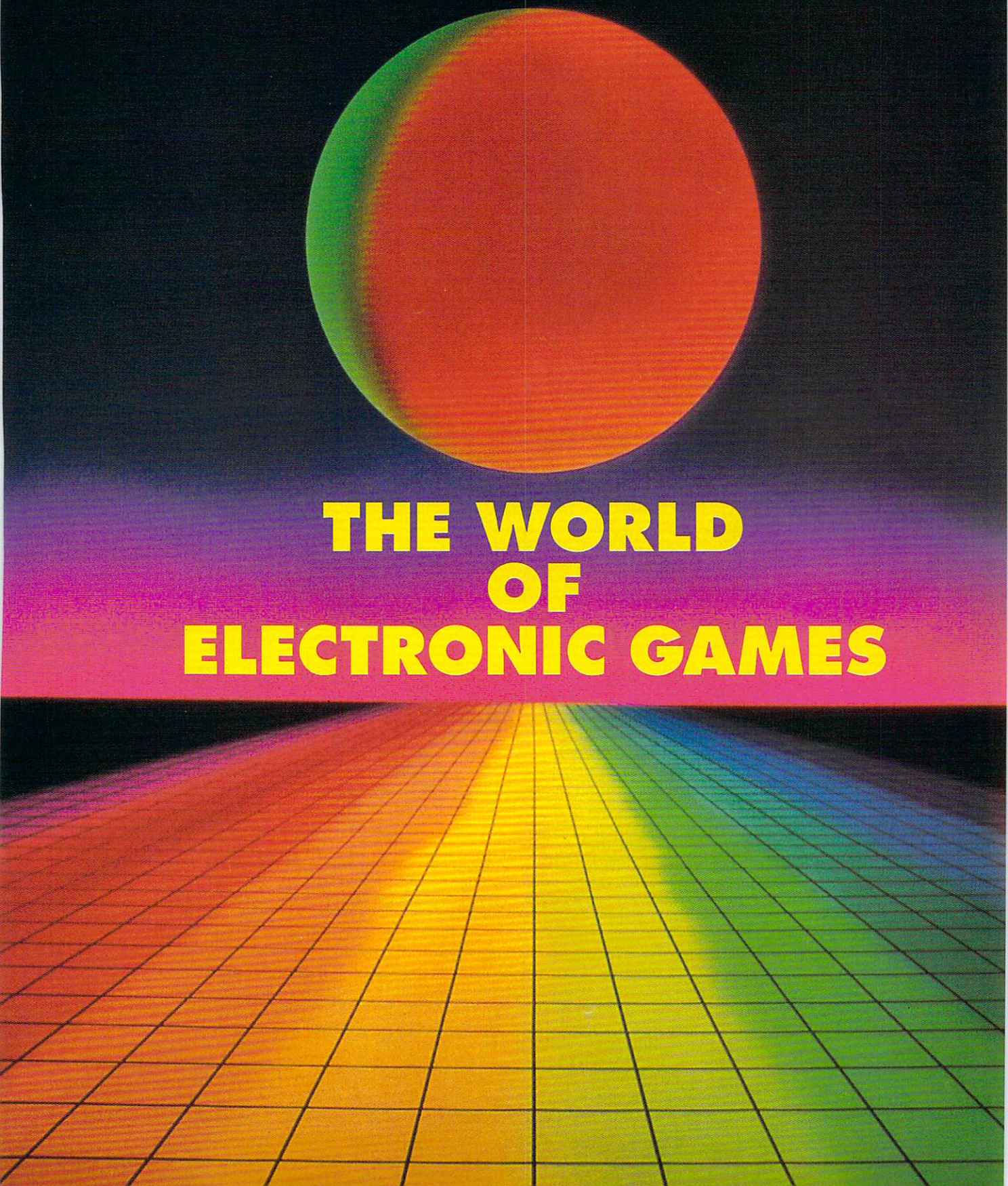

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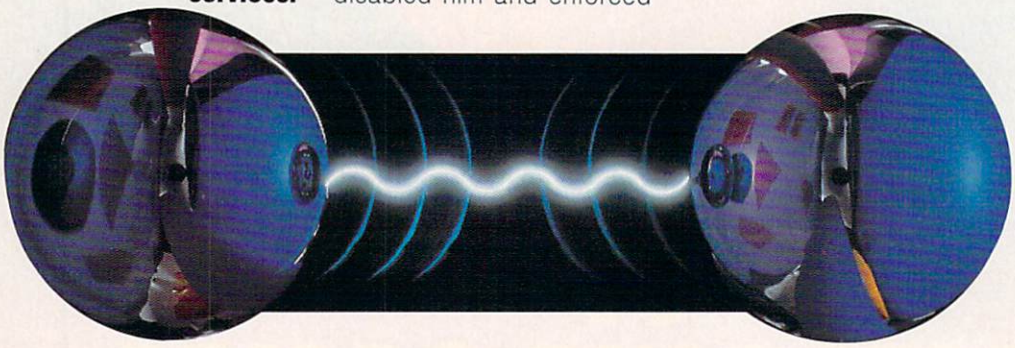

This is a story about the basic facts of life. It's a story about birth and death, love and sex, and cyberspace.

Ralph McAuley is a 57-year-old grandfather from Sarasota. He is no longer the Type A personality who roared across Florida blacktop at over 100 miles per hour. The former owner of a computer software company, McAuley spent 30 intense years dealing with Big Oil, Big Banking, and Big Government. His life changed forever when a heart condition disabled him and enforced inactivity became his bottom line for survival.

"Reading, playing with my computer, and watching TV was all I did. No interaction with people. I felt like a vegetable and would become despondent because I couldn't be mentally active and challenged. Then I discovered Prodigy and *Baseball Manager*. For the first time in five years, I look forward to getting up in the morning. *Baseball Manager* may have saved my life."

McAuley is talking about an interactive, multiplayer, online computer game—one where he competes against other people. Played on Prodigy, the computer network created by Sears and IBM, *Baseball Manager* is one of dozens of games available on major national online services. While both single-player and multiplayer games exist on these networks, the interactive ones enjoy the greatest popularity. These games include most of the traditional types—adventures, fantasy role-playing, interstellar trading and fighting, combat simulators, and the like. In general, they cost anywhere from $2.00 to $12.50 per hour to play, depending on the service, the time of day, and your modem speed. *Baseball Manager* is the exception to the rule. It's a "rotisserie" baseball league. For $119.95, you can purchase a team to play for the season—and that's on top of Prodigy's $11.95 monthly fee. Ralph McAuley bought six teams to start.

"I can afford it," he explains, "but if someone had told me six months ago that I'd be doing this, I wouldn't have believed it. It opens up a whole new world and new friends to me. I meet two or three new people every day, and the interaction is so deep. But because this is fantasy, there is no stress. It's definitely role-playing, but using real events." It is this combination of interaction and role-playing that gives online gaming its greatest appeal.

For many people like McAuley, online gaming and online relationships can be their chief connection to the outside world. Disabled people, people with few friends, the socially inept, people who have difficult times forming relationships because of their appearance or size—all these people can interact equally online.

Ken Williams is the cofounder (along with his wife Roberta) of Sierra On-Line, the publisher of the King's Quest series of computer adventure games, the Leisure Suit Larry series, and other titles. Despite the company name, however, Sierra had nothing to do with online gaming. That changed in May when the country's newest national online service became available. The Sierra Network (TSN) is unique in the field because it ignores all of the other traditional offerings of the online universe, concentrating instead on interactive game playing and chatting. Right now, the games available include backgammon, checkers, chess, bridge, hearts, and cribbage. "I wanted a place for my grandmother to be able to play a bridge game 24 hours a day," said Williams.

As meager as these choices seem, they do fulfill Williams's promise to his grandmother, so much so that this part of TSN is named Constant Companion. TSN plans to make two other familiar game-playing environments available early in 1992—LarryLand and SierraLand. In LarryLand, players will take on roles and interact with each other's alter egos in bars, convenience stores, and other sleazy locations from the Larry games. It could have a pretty adult tone to it. SierraLand will include interactive adventure and combat games like *Red Baron*. "The closer people get to the game-playing experience, the more they'll behave like real people," Williams

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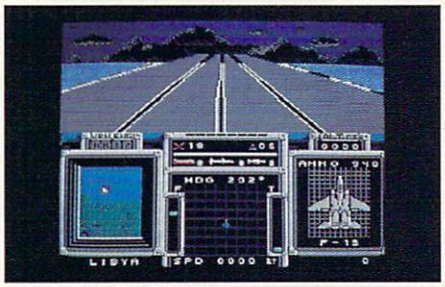

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says. "Role-playing is always fun. Soon we'll be seeing lots of 'virtual reality' worlds online where people can live."

What does Williams mean by "soon"? He predicts that in five years online game playing will be more important and more popular than the games we buy in boxes today. Williams and others see a merger of disk-based and online gaming as inevitable. Some of that is already happening.

In June, America Online introduced *Neverwinter Nights*, a fantasy role-playing game based on SSI's series of Advanced Dungeons & Dragons games. The game looks, plays, and has the same interface as the Forgotten Realms titles, except that the online players can talk to and help each other. SSI worked with America Online in developing the product, leading to unconfirmed speculations that soon there would be software "hooks" in SSI games to allow characters from the boxed games to move to the online game.

This fall, GEnie is introducing *Multiplayer Battletech,* an online version of Activision's box product *Mech Warrior.* GEnie already has a multiplayer version of *Harpoon* available. Along with TSN's promised *Red Baron,* these games just might be the first overlaps toward the predicted merging of the two gaming environments. If that happens and you've never played games online, you'd better be prepared to enter an entirely new world.

Carrie Washburn administers the Multiplayer Games RoundTable on GEnie. She first got involved in online game playing just after her son was born in 1986. "Paul was 14 weeks premature, 13 inches long, and only weighed two pounds, three ounces. In the neonatal intensive care unit, he seemed more wires than baby." During the 2½ months Paul was in the hospital, Carrie and her husband discovered *Island of Kesmai* on CompuServe.

"*Kesmai* became our link back to reality. After a day of work and our time in the hospital with Paul, we would enter a fantasy world in order to forget the real one. The online friends that we met there helped pull us through."

Washburn became addicted to *Kesmai* and stayed with it even after her first marriage ended. She admits to a phone bill of over $2,000 one month and others of over $500. In the fantasy role-playing game, her identity became Lynn De'Leslie—adventuress and tease. "More of a slut, really," she admits.

Ironically, it was there in *Kesmai* that she met the man to whom she's now married. They had a two-year online relationship both in *Kesmai* and the real world before serious romantic involvement.

"One of the great things about meeting people online is that you get to really know them," Washburn enthuses. "The entire relationship is built on talking." Their marriage in May, though, is not unique by online standards. Carrie's assistant at GEnie also met her husband online—she was in Florida, and he lived in Seattle—but they do live together now. TSN had its first marriage less than three months after it was launched. "It's getting to be commonplace," is an often-heard description of this phenomenon. "There are also divorces and bankruptcies," interjects Washburn. "It's just like real life."

What makes online gaming so addictive seems to be not so much the games themselves (which tend to be quite good anyway), but the idea that they are an excuse for interaction among players. Jim Pasqua, game product manager at CompuServe, contends that people like to play games with other people.

"There's a range of emotions with online games that you just don't get with PC games. There, if you win, you feel as if you've just beaten the machine or the game's designer. Online, you beat other people." Ralph McAuley describes his experience as "more than just a computer interchange . . . an interchange of personalities."

Perhaps even more significant, though, is the idea of role-playing. A significant number of people in the online world are not known by their real names. It is customary to take on what is known as a handle, a name that you are known by online, such as Big Bad Mama, Slasher, Scorpia, CyberPunk, or something even more (or less) colorful. Many people spend years online with few ever learning their real names.

Online gaming takes this even farther. Handles become identities, and this makes virtually every major online game an exercise in role-playing. When you start asking questions, it becomes apparent that this just might be the point behind spending several dollars an hour in connect time charges.

Carrie Washburn: "The role-playing is at least as important as the games themselves."

Ken Williams: "People want to vicariously live other lives. The game is irrelevant. The game gets people together and gives them a chance to chat and interact. We tell peo-

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ple on TSN, 'This is a play; you are the actors.'"

Brenda Laurel should know about actors. She holds an M.F.A. and a Ph.D. in theater from Ohio State and has worked in the personal computer business for 15 years. Laurel consults on interactive entertainment for people such as LucasArts and Apple Computer. Here's her take on online role-playing: "A lot of the punch of gaming is empathy—being someone other than yourself. It's a new way to learn . . . a real life what-if."

This what-if often goes well beyond assuming the identity of an adventurer, air ace, or some powerful and mysterious sorceress. Often it ventures into the forbidden realm of what sex we are.

To pursue this matter further, it really helps to try to understand reality as it exists online. If you think about it, there you are chatting and/or playing a game with several folks. You are all together, but where are you all? You're no place physical—that's for sure. But there is no denying the reality of the place. Welcome to cyberspace.

Author Bruce Sterling is one of the founders of the form of science fiction known as cyberpunk, a genre in which people plug their brains directly into electronic networks.

Sterling defines cyberspace as "electronic spaces within which people interact with one another." When you're online, you're in cyberspace, and (if you'd like to) you can think of each individual online service as a different cyberspace. With each a new frontier for you to explore, this diversity of nonspaces encourages you to experiment with new roles for yourself and even allows you to be sexually neutral. Needless to say, these environments are difficult to find anywhere else.

For example, online, a person named COMPUTE has no apparent gender identity and must be related to as a person, as opposed to a male or female person. Opinions and friendships are formed based on what people say and do, and not on how many X chromosomes they possess. Gender roles disappear, and equality of the sexes is theoretically achieved. A meeting in cyberspace can be a true meeting of minds.

It should come as no surprise, then, that when sex is clearly identified online, the old male-female games get played along with the online games. As a result, contends CompuServe's Jim Pasqua, "women get more help playing games than men, and men play less aggressively against women."

So much for equality. The joke may be on the chivalrous, though. Online, it's sometimes impossible to tell the boys from the girls. Gender switching occurs more often than you think.

Rick Mulligan, one of GEnie's game gurus, says such role reversal is quite common there. "Eighty percent of our subscribers are male, but in our games and chat areas . . . if you just look at the names . . . it's closer to 50-50." Spokespersons from CompuServe and America Online both admit that a lot of gender switching goes on, although not to the extent GEnie observes. And while everyone in the online community admits it happens (and often), very few will admit to having experimented with it. One person who gender-switches as part of the job on one of the services ("I check out reports of guys hitting on women.") asked to remain anonymous because of the embarrassment of making the gender switch public. It doesn't stop there. Tell someone that you gender-switch online, and you're likely to be asked if it's the same as being a transvestite. And are you one? It's as if this one particular form of role-playing is somehow dirty, or worse. I took the gender-switch challenge, and I admit that it was quite a kick. The question is, was I a sicko? Or was I looking into a future where being online is merely an excuse to play more significant games?

Brenda Laurel is sure it's the future. "Mutability of gender is more acceptable now, especially to younger people, and in ten years, things will be a whole lot different. Cyberspace will change us; we're only two inches into it now. As we penetrate the landscape, we will change the land, just as it changes us. Later we could change into something new."

She might very well be right. But what would Ken Williams's grandmother think?

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STRANGE NEW WORLDS OF ENTERTAINMENT

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These days, the term *virtual reality* (VR) likely evokes either a blank stare or a cynical smirk. For many who have been exposed to the hype of the last two years, VR may seem to be just another one of those crazy ideas from California—who really thinks a computer could make you believe you're somewhere else? Most of us in the business have squirmed under the glare of press attention, wishing the idea weren't quite so sexy and the implementation weren't quite so tough. The truth is that VR is still an embryonic medium, and most folks would probably find something lacking if they stuck their heads into today's systems. But people are going to start seeing things that impress them in the next couple of years, and within this decade, VR techniques and technologies will be standard features of many entertainment, business, and communications environments.

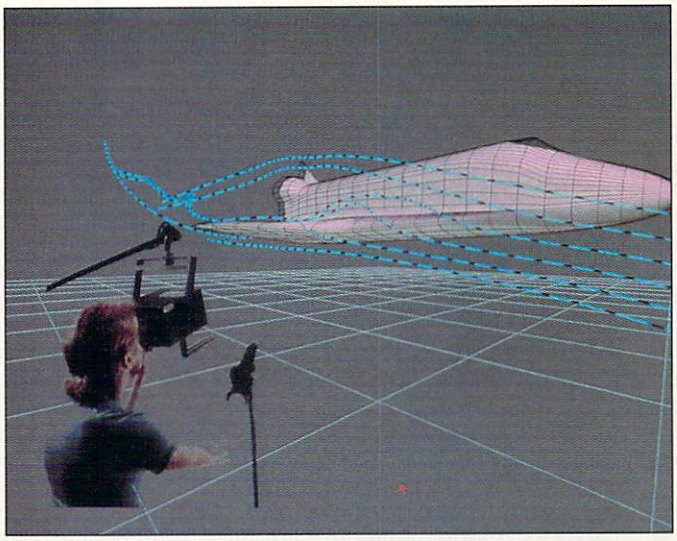
Be There Here

For those of you who have not been exposed to the VR hype, here are some definitions. *Telepresence* is a somewhat more descriptive (and less oxymoronic) term for the popular idea of virtual reality. Telepresence refers to a medium or technology that can give a person the sense of physically being in a different place or time, either real or imagined. One could argue that a good film or a good computer game can create the sense of being in another world, through the forces of empathy and imagination—the "willing suspension of disbelief." But telepresence means something significantly more: It means that you take your body with you into another world; you experience it from the inside. When you watch a good movie or play a good game, you're apt to forget about your body al-

together. In telepresence, your body's right there, experiencing sensory immersion. And through a variety of interface techniques, you are also able to do things with your body in virtual environments like walk, fly, or manipulate virtual objects—all good news for the game player seeking more believable simulations.

A central component of telepresence technology is the ability to track a person's movements, especially head and hands and possibly eyes and other body parts, depending on what you're doing. Head tracking allows the computer to adjust what you see and hear according to where you're looking—the technical term is *viewpoint-dependent imaging*. For instance, as you turn your head toward a virtual window, the window moves into the center of your field of view; as you move toward the window, the sound of the dog barking outside gets louder. Telepresence systems usually include three-dimensional video and audio displays. In certain applications, other senses like touch and smell may enhance the telepresence effect. Although the popular image of virtual reality is a person wearing a funny glove with an alien strapped to his or her face, in fact, many different kinds of interfaces can create a telepresence experience. Researchers are working on a variety of less encumbering interfaces that will allow people to have greater physical freedom and comfort in telepresence environments.

Telepresence enables access to two different kinds of environments: virtual and remote. Virtual environments are computer-generated, usually involving 3-D computer graphics and 3-D sound. *Remote presence* is the term for the ability to experience a



real location that is remote in space and/or time, typically employing video instead of computer graphics. In real-time systems, robots with cameras for eyes stand in for humans in places where they can't or wouldn't want to be—on the surface of the moon or under a few miles of water, for example. Both flavors of telepresence are in development for entertainment applications, and eventually they will be integrated—Roger Rabbit style—in worlds where imagination and reality can intermingle in unprecedented ways. But what about the home computerist? Are you really moving any closer to the days of integrating your entertainment environment with your real one? Both your mind and your body will share the experience of electronic play, finally, through the conduit of your personal computer. Home computers may need some more time to evolve, however, to allow for the speed and flexibility that VR demands.

Taking One Step Beyond

Stand-alone telepresence systems, especially the virtual-environment flavor, are a natural for arcade-type environments. Atari's *Hard Drivin'* is probably their closest ancestor. New VR companies like Division, Ltd. and W Industries in the U.K. are currently selling systems that can be used in superarcade environments. Leading arcade-game companies are also developing advanced systems that feature VR and motion-platform technologies, at prices that routinely top $100,000 per system—an order of magnitude more expensive than the average arcade cabinet in 1989. By the summer of 1992, you can expect to see several examples of systems that incorporate telepresence technology in superarcades in large cities like Tokyo and New York.

At the high end, limited forms of telepresence are finding their way into large-scale amusement parks and mass-audience installations in the U.S., Japan, and Europe. Ancestors are the current crop of motion-platform rides, beginning with Star Tours at Disneyland. More recent attractions, like the Back to the Future ride at Universal Studios in Florida and UCC Spaceport 2045 in Tokyo, feature a bevy of smaller motion-plat-

form-based systems, each carrying a handful of people through a preplanned course of events. Interactivity—personal viewpoint control and significant choice-making ability—is largely absent, but the overwhelming visceral effects produced by video, motion, and sound in such rides provide a strong sense of you-are-there-ness. You can expect to see more flavors of the motion-platform-based rides with continuing improvements in 3-D audio and video (including high-definition), but don't expect any big breakthroughs in interactivity before the spring of 1993—and remember that the degree of interactivity is always going to be inversely related to the number of people that a system has to accommodate, either at one time or in rapid succession (the theme-park jargon is *throughput*).

Somewhere between arcades and amusement parks lies a new class of attractions called location-based entertainment (LBE). LBE systems are typically larger and more expensive than arcades, and they are often networked. *Photon* was an ancestor; *Battletech* in Chicago is a contemporary pioneer. LBEs provide a good solution to several problems: They can command a higher ticket price than arcade games but can survive on a lower throughput requirement than theme-park rides; they can piggyback on permanent public attractions (like urban shopping areas, national monuments, and large museums) or temporary ones (like Olympic Games and world's fairs); and they can help real estate developers turn losses into profits by revitalizing ailing shopping malls (a strategy popularized by Atari founder Nolan Bushnell). Because of the economics involved, the investment climate, and the current players, the most interesting developments in telepresence are likely to take the form of LBEs, at least over the next few years.

Changing Face

Most of the roots of telepresence technology, including viewpoint-dependent imaging and motion-platform technology, lie in military and aerospace applications, so it's no wonder that flight simulation is predominant in today's VR systems—and it's a no-brainer to predict that the trend will continue. But an awareness that some of us have promoted since the early days of computer games is finally dawning on entertainment industry executives: Shoot-'em-ups appeal to an extremely limited demographic.

As people come to see more connections between computer-based entertainment and film, the classical idea of games (with scores, clocks, winners, and losers) is called into question. After all, you can't win a movie. You're more likely to want to be a character in it or to explore its world. The focus of content design in VR is likely to move away from classical game structures and toward dramatically interesting environments and characters. Designers will discover and capitalize on the special powers of telepresence to enhance the relatively simple activity of exploration. In three to five years, intelligent systems utilizing advances in both computer hardware and software techniques will support increasingly complex, dynamic, and responsive virtual worlds.

Getting Personal

If all of this sounds like Las Vegas–scale entertainment, just turn the telescope around and look through the other end. For personal access to cyberspace, the key components are the same as for big systems—3-D video and audio displays, head tracking and some degree of system intelligence. You need low-cost interface peripherals and more processing power for the buck in order to achieve acceptable frame rates on small systems.

Technology is moving in an orderly incremental way toward these goals, and we can expect to see low-cost game systems that approximate telepresence experience within 12 months—possibly sooner. One lesson to be learned from the PowerGlove (a Mattel peripheral for Nintendo systems), however, is that without great implementation and a critical mass of compelling applications, the most sensuous concepts may wither and die. And the notion of cyberspace seems to suggest that a solitary VR experience is not the Holy Grail—rather, it's human-to-human interaction in a computer-augmented matrix that captures our imaginations.

Already, a lot of lowly little PCs and game machines are boring holes into cyberspace. When this army of personal moles breaks through to the underground fiber-optic rivers of Japan, colonization will spread very quickly. Cyberspace is a literally endless frontier, and we all know how much humans enjoy exploring and settling frontiers. The action on the the cyberspace frontier is already being documented. *Habitat*, a graphical networked world developed by Lucasfilm and sold in Japan by Fujitsu, provides excellent examples.

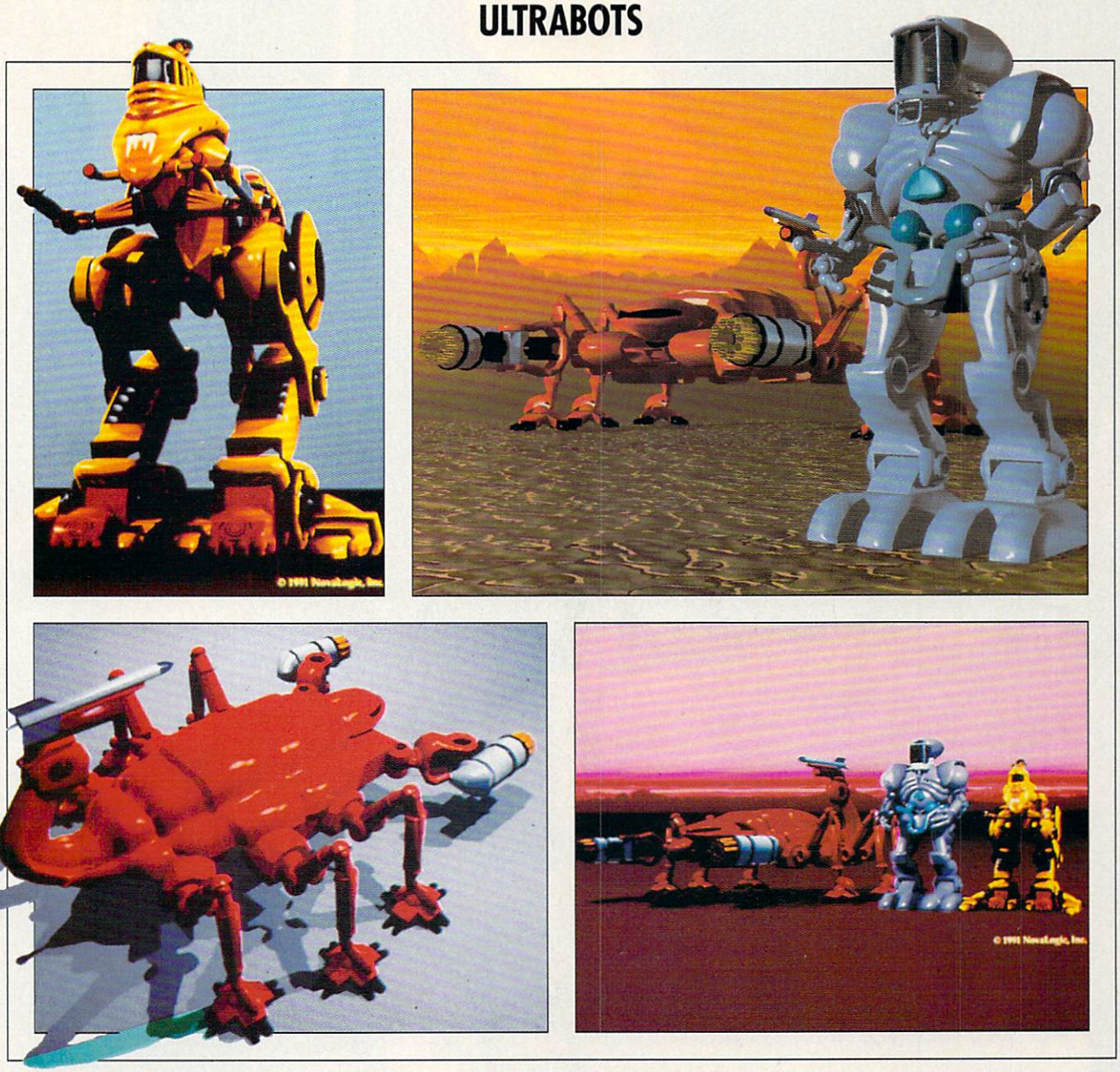
Chip Morningstar and Randy Farmer, *Habitat*'s principal designers, report tales of crime and exploitation, followed by self-organizing and self-governing activities on the net that are strongly reminiscent of the American West. Citizens of text-based cyberspace communities have organized revolts against corporate overlords that would make an East European proud. Cyberspace re-creates the grand adventure of people coming together in new places, deciding what to do and how to live.

Networked telepresence systems introduce a whole new set of issues into the design of interactive entertainment. The medium allows us to move well beyond clothing, makeup, and personal mannerisms in the ways that we represent ourselves to others. We may create self-representations that are radically different from our physical bodies, and we may present different versions of ourselves to different people simultaneously. A central design task will be to invent landscapes in which we may interact with others as well as to provide the means for people to collaboratively shape cyberspace environments and objects for their own purposes.

Through telepresence we are diving into a strange new sea, at the confluence of information, sensation, and communication. No one can predict what new forms, styles, and genres will emerge; the medium is still too young. But after a few more years of obligatory imitations of the past, interesting games are bound to happen.

—BRENDA LAUREL

ULTRABOTS



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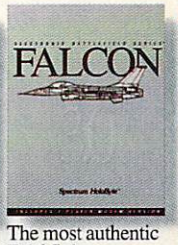

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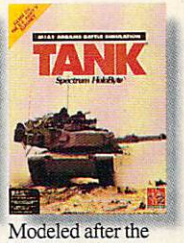

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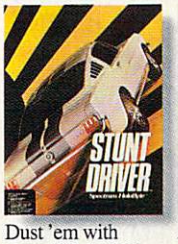

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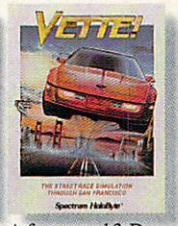

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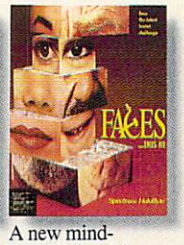

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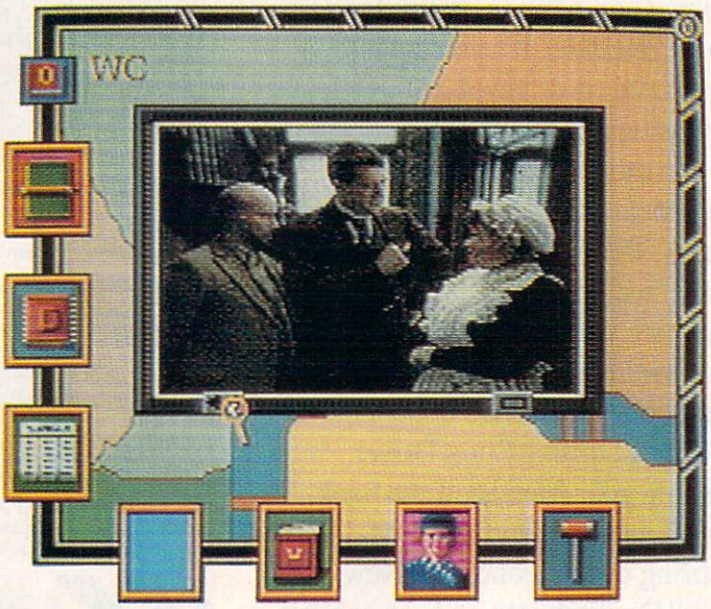
GAME CONSOLES NOUVEAU

After a day at the office with only *Lotus Agenda* and a desktop PC for company, many punchy adults would like to ignite a few beatific explosions. What better venue for relieving this tension than a dedicated game machine? More than rivaling the PC in sound and animation capabilities, these acarde wonders now offer a respectable body of adventures, sports games, and even flight simulators.

Four machines vie for the Christmas shopping season top spot: the NEC TurboGrafx-16, the Sega Genesis, the SNK NEO-GEO, and the Nintendo Super NES. All these machines have their selling points and their fans, but just as the PC was catapulted to "industry standard" by its spreadsheets, the future sales of consoles will be determined by the quality of their cartridge games.



Sherlock Holmes comes to you via CD-ROM and courtesy of the TurboGrafx-16 and TurboGrafx-CD.

16-Bitter Rivals

At the heart of current game consoles beat powerful 16-bit processors—68000-series chips well known for their graphic capabilities. Alongside these pulse a variety of coprocessors for added speed. Joysticks, most in the form of ergonomic pads, come with the machines. Game machines are maturing, and prices are generally low. You can purchase impressive graphics technology at yesterday's prices. No kidding. The problem, however, remains: Which machine should you take home?

TurboGrafx-16

NEC's veteran TurboGrafx-16 still holds its own in most head-to-head comparisons. With its respectable palette of 512 colors and the ability to manipulate up to 64 sprites, the TurboGrafx-16 can pull some surprising video stunts, but when compared to other consoles, the graphics seem just a bit muddy. When it comes to sound, the TurboGrafx-16 falters with its six-channel stereo sound. *Only* six channels? True, that's a veritable chorus when compared to the sound channels available on most home computers, but alongside other consoles, TurboGrafx-16's digitized speech comes up a bit hollow and raspy.

With its humble list price of $99.00, though, this machine's the least expensive of the 16-bit giants and not a bad deal. Pair your TurboGrafx-16 with bracing games such as the demonic pinball simulator *Devil's Crush* or the absurdly engaging *Ninja Spirit*, a story of revenge and swordplay. Typical of the TurboGrafx-16 library, these games do a lot with the hardware and will deliver hours of excitement. Games for the TurboGrafx-16 range from $19.99 to $76.99—not that expensive when compared to the lineups of some of the other consoles.

For under $300, add the TurboGraphx-CD and empower your TurboGrafx-16 to play the sophisticated and expansive *Sherlock Holmes, Consulting Detective*. ICOM Simulations, better known as a PC software developer, brings digitized actors and vocals to this Victorian mystery trilogy and uses the prodigious capacity of the CD to support full motion video.

Consider the current availability of the CD-ROM drive and the third-party interest in software development, and the TurboGrafx-16 emerges as a contender. There's enough juice in this system to warrant a look from jaded PC owners wanting just a bit of cerebral diversion along with their video violence.

Genesis

Third-party interest doesn't stop with the TurboGrafx-16, of course. Electronic Arts turns out a startling number of titles for the Sega Genesis, and high-quality products at that. *Centurion of Rome*, a great game on any platform, takes to the Genesis almost by di-

vine right. Disney's in the 16-bit race with *Fantasia,* featuring the lovable Mickey Mouse. Under Accolade's Ballistix label, you'll find a noteworthy version of *Star Control,* too.

Implementation of PC games for consoles underscores a fundamental problem with the game machines: They don't come with a keyboard attatched. While the Sega controller pad outclasses any other similar interface, it lacks a suitable number of buttons for a solid PC-to-console conversion. Games that have traditionally been thought best left to PCs (and their keyboards) include flight simulators, role-playing adventures, and anything else that uses the keyboard heavily. Coming from a market where most PCs don't have joysticks, that's a considerable challenge for programmers to surmount. When planning for the PC, game designers exploit the keyboard wherever possible. The situation is reversed for console designers who have only the pad. The interface problems seem to be diminishing as programmers work out the kinks and more involved, more playable adventures emerge. For the moment, consoles really shine when they focus on arcade screamers that require few buttons and emphasize the superhuman reflexes common to arcade addicts.

You've probably heard at least some of the hype about Sega's *Sonic the Hedgehog,* the "fastest" game available for any console. *Sonic* not only scrolls more smoothly than any game on console but also is quite possibly the most absorbing game available on any platform, PCs included.

The Genesis can't compete with the NEO-GEO when it comes to sound or number of colors; Sega's 64 colors onscreen at one time

Sega's Sonic the Hedgehog *defines the cutting edge of loveability.*

pale next to the NEO-GEO's 4096. In the category of sound, the Genesis has 10 channels stereo; the NEO-GEO has 15 with 7 dedicated to digitized speech alone—striking superiority. Yet *Sonic the Hedgehog* possesses much more replay value than the NEO-GEO games tested because it pushes the Genesis to the edge. There are times when all 80 sprites seem active, and only rarely does a programming glitch show. Factor in the thoughtfulness behind the levels, and Sega has an instant classic.

The Sega Genesis sells for $149, and games range from $39–$59, with the exception of *Phantasy Star III,* which sells for $79. In all, an economical way to game.

NEO-GEO

At the moment, no console can touch SNK's NEO-GEO in terms of sheer power. This console displays more colors onscreen than any other game machine, handles more sprites (380), and sports the largest palette—65,536 in all.

The responsive NEO-GEO joystick controller (as opposed to the push pad ubiquitous on other machines) encourages you to play through the wee hours of the morning and has well-placed action buttons. For an ego boost, use the memory card to save your high score games at home and then continue play in public—the console game you play at home is identical to the version in stand-alone units you find in arcades and cinemaplex lobbies.

Right out of the box, NEO-GEO's *Magician Lord* will wow your friends and family. With a hard-hitting soundtrack that never grows tiresome and more than a few loathsome monsters, *Magician Lord* casts you as the last hope for a mystic valley. You'll have your fill of fire breathing, spell tossing, and shape changing in this sorcerous slugfest. This superficial description also sums up the feel, if not the specific contents, of most NEO-GEO games. Light on plot and heavy on action, these shoot-and-run fiestas bring the standards of coin-ops to your very own living room.

NEO-GEO cartridges harbor considerably more ROM than any other console cartridges. That equates to larger games, of course, though larger doesn't necessarily mean better. Divide megabits by 8 to yield megabytes, and you have some basis of comparison of console software size to PC software size. Unless you're talking about NEO-GEO games, the PC equivalents run on the huge side. With their relatively vast storage capacity, NEO-GEO carts should compete favorably with PC games and stomp Genesis and TurboGrafx-16 games, right? Actually, the answer depends on what you're looking for in a game. Since we're talking about arcade games here, the more involved PC games don't really invite direct comparison; they have their own, higher-brow merits. But to bring the arcade into your home, we must ask if size makes any difference.

The prodigious 46-megabit motorcycle-racing game *Riding Hero* dwarfs the 12-megabit Genesis version of *Star Control,* currently the largest game available for that platform. After a few hours of play, you realize that the comparatively minuscule Sega game devotes a significant amount of memory to game mechanics. NEO-GEO software, on the other hand, favors the graphic and audio side of entertainment, with lush backgrounds that scroll seemingly to infinity and striking, detailed animations. Here the arcade addicts and the merely devoted gamers will draw their lines. For a thrill a minute but strategically shallow gameplay, NEO-GEO's the titan. With respectable, but slightly less than astonishing graphics, the Sega Genesis library of games outclasses NEO-GEO's in both number and variety.

The last consideration for prospective NEO-GEO purchasers is price. The $649 retail price is more than three times the amount you pay for any other console; games cost around $200 each. On the other hand, NEO-GEO owners can be certain that their machines are the most powerful on the market. This feeling of certain hardware superiority only adds to the satisfaction that playing a handful of roaring, pulse-pounding NEO-GEO games provides. If SNK software developers concentrate more on game-

Magician Lord *invokes mystic warfare on the NEO-GEO.*

play, while maintaining the high standards of current NEO-GEO games, Sega's only advantage will be price.

Whither Super NES?

After overseas success in Japan, the Super NES promises to be the next winner in the 16-bit sweepstakes. The Super NES can display up to 2048 colors onscreen at any given time, control up to 128 sprites, and sound off with eight-channel sound—an interesting mix of characteristics when compared to the other 16-bit game machines. The NEO-GEO tops each category but more than doubles the Nintendo machine's sprite-handling capability with the ability to manipulate a startling 380 sprites. Even the Sega Genesis manages to nudge out the Super NES in at least one category—sound channels. So why all the furor?

Arcade devotees can carry the banner of Nintendo Super NES for one simple reason: animation. The Super NES comes to developers hard-wired for 3-D environments. Since they needn't worry over where the next scroll-and-rotate routine's coming from, game designers can concentrate on orchestrating play instead of coming up with high-speed animation code from scratch.

In *Pilotwings,* you'll see this prebuilt modeling system put to good use. As you try to earn your wings, you must pass a series of tests that involve piloting a biplane, maneuvering an experimental rocket pack, and skydiving. The Super NES rotates the world flawlessly and at a shocking rate but to allow for the smooth scaling this game showcases, a certain amount of detail seems to have been sacrificed. Still, if not for the blocky, 8-bit look of the landscape, you'd feel as if you were in the air.

When considering the Super NES for your holiday festivities, bear in mind that the quality of games for this machine will improve, possibly dramatically. For the moment, though, the $199.95 you spend on the fledgling Super NES could welcome you into the Sega Genesis family with its burgeoning library of over 100 appealing games.

If you don't have the cash to buy into existing software libraries wholesale but instead plan to buy as you go—the tried-and-true method of expansion since the invention of the game cartridge—pay special attention to the game packaged with the machine. In the case of the Nintendo, you'll get *Super Mario World,* another in the long line of Mario games. With the NEO-GEO you'll receive *Magician Lord, Baseball Stars Professional,* or *Nam-1975,* certainly some of the top NEO-GEO games. With the TurboGrafx-16, you'll play yourself silly on *Keith Courage In Alpha Zones* as you struggle to prevail over the forces of B.A.D. (Beastly Alien Dudes). Of course, the Genesis offers you *Sonic the Hedgehog,* an inexhaustible, energizing race full of ramps, springs, and killer machines.

Consoles Triumphant

What should you buy? The best all-around value is the Sega Genesis, with its vast library and vanguard *Sonic the Hedgehog,* sure to set new industry standards. If you've got the money and want all the dazzle you can handle, go for the NEO-GEO. For diversionary action with machine guns, explosions, and frightening noises, no other console comes close. The more thoughtful among us may want to consider the NEC TurboGrafx-16 because of its CD-ROM drive, though that accessory puts it close to the NEO-GEO in price. Still, individual games for the TurboGrafx-16 retail for a fraction of what NEO-GEO games go for, and that gives you a chance to run the gamut of game genres, from solving mysteries to playing ninjas.

No one needs to tell you that all these game engines outpower your PC from a shoot-'em-up perspective; it's their job to look good and throw sprites around, while the PC is a multipurpose computer. If you want the thrills that cost a quarter per ride anywhere else, bring one of these consoles home. In the end you'll save money on sound cards and other PC upgrades, and you can trust the 16-bit game market to grow. That means pyrotechnic new games will be arriving monthly. For the kid in you—and for the kids that live in your house—these powerful but economical game consoles will readily indulge the fiercest appetite for sensational play.

—DAVID SEARS

Super Mario World *brings the little guy back for more.*

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You didn't learn everything you needed to know in kindergarten or sixth grade or even college. Until computer games were invented, where else, for instance, could you learn to slay drug-crazed zombies, pilot death-dealing antigravity fighters, or see truth and justice triumph over greed? Only in the storied world of silicon. Look at the statistics. Since the introduction of computer games, we have had 68 percent fewer wars, 35 percent less brawls at hockey games, and an amazing 28-percent increase in the number of plastic Valentine hearts sold. Why? Because recreational software provides a safe, socially acceptable outlet for repressed hostility while teaching valuable survival skills.

Hit the Streets

Take, for example, Accolade's *Hoverforce*. Equipped with superhuman powers conferred on all test-tube cops in the year 2050, you fly around the city defying gravity, fate, and common sense by blasting heavily armed drug dealers, thugs, and brain-dead drug zombies. Gratuitous violence? Rage inducing antisocial behavior? A monomaniacal lust for power? No way! Simply wise preparations for a weekend visit to Manhattan.

Instead of packing routine big-city tourist items such as Mace and a screech whistle, your arsenal includes laser-guided slide missiles, belly-pumping machine guns, and other devices guaranteed to end unwanted conversations. Granted, Manhattan's not yet ruled by drug-crazed slime-lords, but *Hoverforce* is, after all, a futuristic fantasy. That's somewhat unfortunate, since the Hovercraft's Quick Pulse Cannon would be just dandy to open a path through rush-hour traffic.

Access Software's *Mean Streets* provides additional big-city survival skills. It's 2033 in San Francisco, and you're the death-defying private investigator Tex Murphy. Sylvia Linsky, the beautiful daughter of a very dead college professor, hires you to investigate her father's suspicious demise. As you sort out the convoluted case, you uncover a conspiracy to rule the world. Now, guess what. Right! You single-handedly must save everyone from ruthless domination by bringing to justice an unholy assortment of murderous mutants, cyborg crooks, and titans of industry. The first challenge is for you to distinguish one group from the other.

Mean Streets' realistic digitized graphics and audio add intrigue to Murphy's and Linsky's misadventures. Hopefully, Access combined legal advice with technical wizardry when designing the "look and feel" of Murphy's Lotus-class speeder.

Both *Hoverforce* and *Mean Streets* paint a bleak picture of a future society where technology's advances result in improved drugs and weapons (which indirectly translate into more downtown parking spaces). With the future looking so gloomy, maybe the past is preferable.

Set in Stones

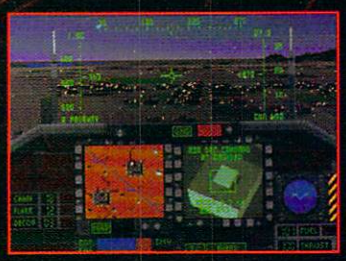
DSD (Dank Smelly Dungeon) computer games provide the chance to safely battle demons drawn from your worst nightmares or best blind dates. Accolade's *Elvira, Mistress of the Dark* elevates silicon sorcery to a black art as you battle nether world ghouls and ghosts from hell accidentally loosed in Elvira's favorite castle. Complete with slashing, hacking, and blood-curdling howls of heart-wrenching agony, this game will prepare any student of politics for a visit to Washington during budget hearings.

While male and female demon destroyers who strive to rid Elvira's DSD of its denizens require both strong stomachs and nose clips, guys in particular will need to exercise self-control. Based on the revealing package photo of Elvira, some men could unconscionably choose to let the demons run amok and happily spend the last of their days fervently guarding Elvira's personal assets.

If Elvira can own a castle, why can't you? After all, computer gaming is a world built of dreams and fantasies. Interplay's recently released *Castles* enables you to build the castle of your dreams. In addition to playing surveyor, architect, and builder, you get to parry paranoia and persecute the peasants (great for relieving boredom).

Castles' action takes place 700 years ago, predating pesky present-day concerns like planning boards and building inspectors. Indeed, if your neighbors objected to your castle, they leveled it, scattered the workers, ripped you to pieces, and ate your horses. When they got really angry, they did even meaner things like making you bathe between rainstorms. Several historians claim these murderous rampages had nothing to do with power, gluttony, and greed but were incited by Stone Age Software's futuristic adventure game, *Saddam in the Eye of the Storm.*

Rule the Desert Skies



Like some sleek, metallic bird of prey, it slices through the thin air of the desert night. Below, the enemy's radar frantically scans, searching for a sign. But the only warning is the deafening roar of ordnance demolishing its target. Before fighters can scramble, this airborne apparition vanishes, like a ghostly dream.

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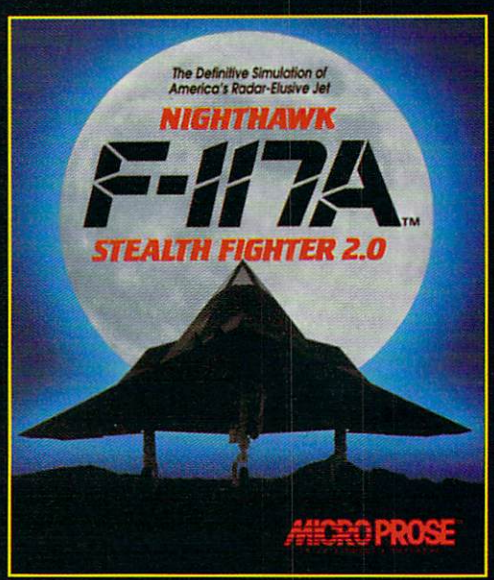

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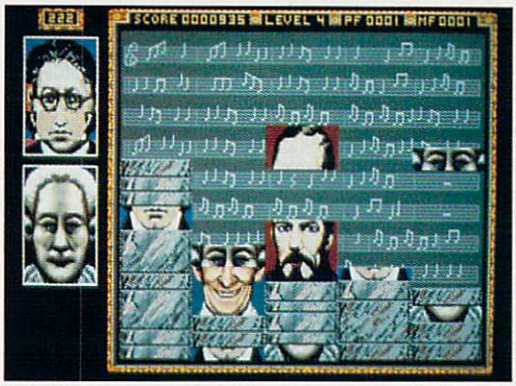
Circle Reader Service Number 225

But Seriously, Folks

Would you rather preserve life than destroy it? No matter how much the vicious drug-dealing, flag-burning, opera-loving thugs deserve annihilation? Computer games resolve that dilemma, too. Software Toolworks' *Life & Death* provides an introduction to do-it-yourself medicine that far surpasses the typically shallow home study course in surgery hawked on matchbook covers. Striving for realism (including vivid graphics of non–gender-specific anatomy), *Life & Death* prepares you for that inevitable midnight call from Smalltown General pleading for you to perform emergency surgery. As one of its first lessons, *Life & Death* explains when you should rush the patient into the operating room (appendicitis) or outside (intestinal gas).

Gamers who successfully complete their software residency face an unparalleled challenge in completing the forthcoming addition to the Life & Death line. Reportedly named *Managing Your Shekels,* the sequel takes realism to the limits and focuses exclusively on learning how to drive a five-speed Jaguar, pilot a Cessna, and lower your golf handicap.



A view from the cockpit in Mean Streets, right, and the mix and match celebraties of Faces, below.

Scientific Breakdowns

Recreational software provides diversions beyond the visceral with games that demand as fast an intellect as a scalpel or trigger finger. Heading this cerebral genre are two programs from Autodesk, *Chaos* and *Cellular Automata Lab.* Both programs masquerade as eye-catching sources of mesmerizing graphics while actually illustrating the mysterious order underlying seemingly random events such as the shape of clouds, raindrop patterns, or the origin of Chicken McNuggets. *Chaos,* as the name promises, concerns itself with finding free-form, forever-changing behavior patterns in an uncharted universe lying beyond the limits of present-day science. Now, finally, you will understand that no matter which line you're in at the toll booth or the supermarket, the other one always moves faster. I recommend *Chaos* as a required survival technique for anyone who works for the military, directs traffic, or books airline flights.

CA Lab, also employing eye-popping graphics, appears better suited for creating computer animations of strictly real world events such as the complex interactions between chemical, thermal, and biological processes. One typical application might be modeling the exotic life forms unearthed by janitors in college dormitories. Aside from its significance to researchers, *CA Lab*'s implied educational value holds considerable appeal to science-minded computerists. Capable of unlimited visualizations, it will reportedly provide the graphics in a upcoming juvenile TV science special, "How to Decode a Frog's DNA Using Your Mom's Blender." Unquestionably, this special promises to be an example of computer-aided learning at its finest.

Get Down, Get Funky

Should you overdose on cerebral software, Sir-Tech offers a superb remedy—*Freakin' Funky Fuzzballs.* Particularly recommended for players who suffer from rampant self-assurance, this if-the-shoe-fits game has you play the part of a dirtball. Strictly for arcade game players, *Freakin' Funky Fuzzballs* will provide valuable field training should you ever need to survive getting sucked through a vacuum cleaner. Possessing this sort of skill, while it's not in great demand, would certain-

ly distinguish you from mainstream America. Boast about it to your friends and the mental health authorities will cheerfully separate you from the rest of society.

You have heard people accused of being two-faced. Well, how about 60-faced? Spectrum HoloByte's *Faces* challenges you to assemble horizontal slices of 60 famous and not so famous faces as they drift (*Tetris*-like) down the screen. If you accidentally create a face that's a hybrid between a plow horse and a beauty queen, remember we all make mistakes (Noah even took mosquitoes on the ark).

PRODUCT LIST

Mean Streets
ACCESS SOFTWARE
545 West 550 S, Ste. 130
Bountiful, UT 84010
(800) 824-2549

Elvira, Mistress of the Dark; Hoverforce
ACCOLADE
500 S. Winchester Blvd., Ste. 200
San Jose, CA 95128
(408) 985-1700

Cellular Automata Lab, Chaos
AUTODESK
2320 Marinship Way
Sausalito, CA 94965
(415) 332-2344

Castles
INTERPLAY PRODUCTIONS
3710 S. Susan
Santa Ana, CA 92704
(714) 545-9001

Leisure Suit Larry
SIERRA ON-LINE
P.O. Box 485
Coarsegold, CA 93614
(800) 326-6654

Freakin' Funky Fuzzballs
SIR-TECH
58 Noble St.
Ogdensburg, NY 13669
(315) 393-6633

Life & Death
SOFTWARE TOOLWORKS
60 Leveroni Ct.
Novata, CA 94949
(415) 883-3000

Faces
SPECTRUM HOLOBYTE
2061 Challenger Dr.
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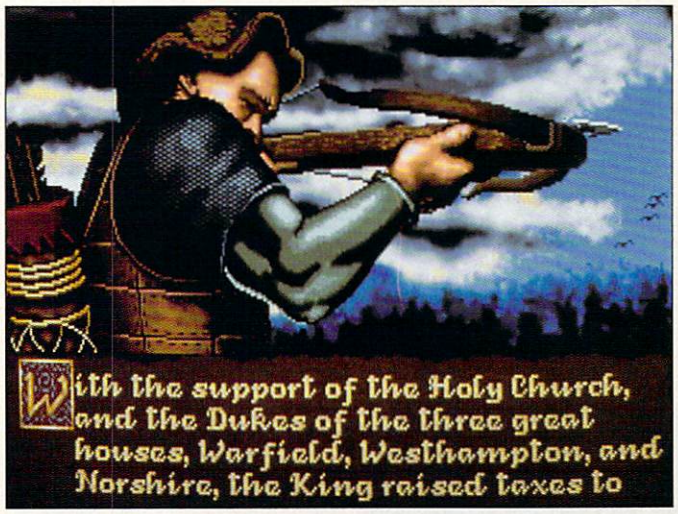
(415) 522-3584



Castles, left, puts you in some difficult political situations, while the hawk in Elvira, below, just wants you dead.

Wrap It Up; I'll Take It

After cleansing city streets of slimelords, ridding dungeons of demons, building castles in the past, and satisfying intellectual curiosity, what's left? SEX! In what truly deserves the designation "fantasy role-playing" software, so-called adult-oriented games range from naughty to lewd. Unlike other simulations that encourage the pursuit of power, truth, or magic crystals, sex-oriented games capitalize on the world's oldest pastime.

One of the best known in this category is Sierra On-Line's Leisure Suit Larry series. Featuring a choose-your-own level of ribald humor, enduring dork Larry Laffer continues to spend eight days a week measuring the appeal of every woman he sees. Alas, Larry never learns. He still wonders why the women he approaches immediately pretend they're comatose. Studying Larry's techniques will provide you with skills in superficial small talk, feigning interest, and controlling drool.

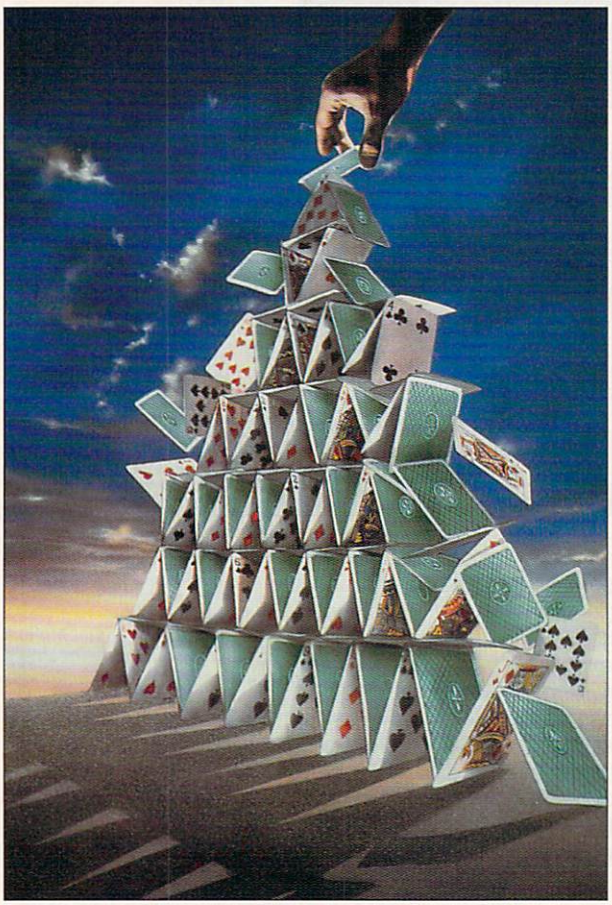
From practicing safe sex to slaying slimelords, dodging demons, or coping with chaos, the endless variety of computer games transport you to

mythical worlds peopled with sorcerers, heroes, nerds, and geniuses. And in these imaginary worlds you can practice exotic skills—skills that you will hopefully never have to use in the real world. Best of all though, these carefully nurtured talents and hard-won abilities will make you more than a match for the next generation of computer games.

—HOWARD MILLMAN

GAMES ADDICTION: THE TROUBLES I'VE SEEN

A reformed hacker and redeemed game fiend makes some dark disclosures.



Hackers and videogames have had an intimate relationship from the early days of computers. As an ex-hacker, I know; I was seduced by the idea that entire worlds could exist just beyond a VDT. My first experience with all-consuming games was with an Atari 2600, a bottom-of-the-line no-nonsense machine. I purchased a cartridge called *Pitfall* and ensured my descent into the life of the hopelessly and altogether too happily addicted.

The basic premise of the game was that a small pixoid hero ran through about 50 screens' worth of jungle. He picked up treasure, avoided snakes, and jumped over large pits. That was it, pretty absurd by today's standards. But I spent every waking hour playing that game.

"Why do you spend so much time on that machine?" my father fumed. I didn't know. It felt good, so I played. But I never had much money, so I couldn't get many more cartridges for my machine. I tired of playing the game and stopped dreaming about dodging logs and snakes in two lackluster dimensions.

I visited the Lawrence Hall of Science at Berkeley and played with an Apple II acting as a terminal to a mainframe. *Eliza* was online. It glibly responded to whatever I typed. Recharged and back on edge, I went to my mother and told her I wanted a computer. Amazingly, I got one.

I learned BASIC first but moved directly from there to copying software. Tons of disks filled my drawers, and I again learned of the power of addiction. I'd moved beyond the lure of console games to the more sophisticated and sensatory world of the home computer. And about this time, for the first time in my life, I noticed girls.

In particular, one girl, but she might as well have been a tag-team wrestler. She and her best friend were never apart, so I couldn't move closer. Then I introduced her friend to my IBM PC and *Zork*. We couldn't get her away from it; she fit the profile of the instant addict. We left her sitting there, oblivious. Hours later, we had to scream at her to provoke a response.

I had encountered a game junkie's nightmare. Another addict had stolen my computer, and I panicked. I almost got violent. I never saw those girls again, and I didn't care. I had my computer back; each breath came easier after the fear of losing my machine left me. Why do we obsess over things like these?

I had a girlfriend dump me over an Ultima game. I think that was the start of my hacking. I spent too much time with my computer, she said. So to save time, I began to look for a way around winning. With a hex editor I changed character files so that I was the most powerful character in the game. Then I went out and skragged everything in sight. I cheated myself. I subverted an urge to win and discovered the strange rush of power that comes from manipulating a game outside of its context. Games grew old quickly then, maybe because I began to grow up. Girls became part of my life, and I slowly pulled myself away from my other addictions. I came out of my shell. Unfortunately, this sort of recovery never happens for a lot of addicts.

I didn't turn out all that badly. I came away with an obsessive tendency to pay attention to any sentence with the words *game* or *computer* in it, but that's about it. I no longer pirate games; I no longer spend sleepless nights cracking machine code so that I can play my favorite games and cheat. I try to set an example so that the human race won't devolve into amorphous blobs of flesh with no more urge to leave their terminals than a beached whale has to swim to sea.

That vision scares me. Sure, I still play videogames, and I love them, but life's about balance. Play the games you love and share them with someone you love. Just don't play them to the exclusion of everything else. Take it from a reformed software junkie: Know and respect the power of games.

—DARREN MCKEEMAN

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GAMEPLAY

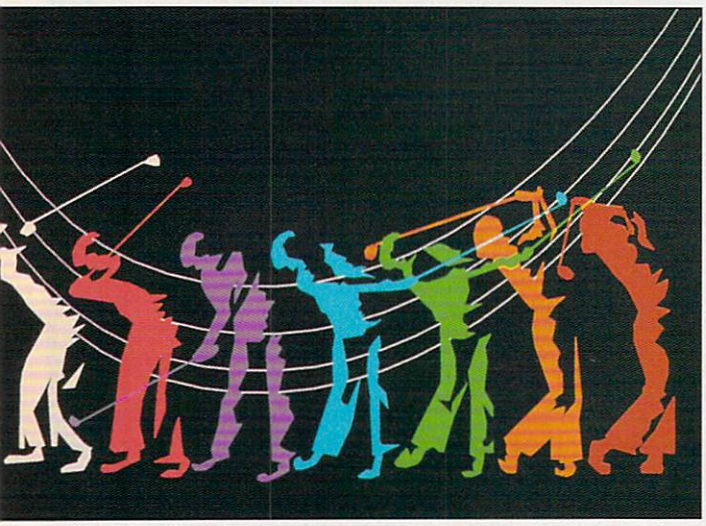
Orson Scott Card

IN THE COURSE OF HUMAN EVENTS

All one-player computer games are like golf. You aren't playing against another player—what he does has no effect on where your ball lies. Instead, you're playing against the course designer. When you face a sand trap or a water hazard, these obstacles were set in place by the person who plotted the course. However, despite the similarities between good golf courses and good computer games, there aren't that many really good golf simulations around. One obvious reason is that there's no way the computer can give you the sun on your back; the wind in your hair; the feel of the club swinging, dragging your arms along; the thwack of the club on the ball; and the sense of public humiliation or exultation when you see how close you have landed to the green.

Links may be the most realistic simulation I've ever seen on a computer. This is the standard for everybody to meet from now on.

The best computer golf simulation right now is *Links,* from Access. From the way *Links* got the built-in IBM speaker to sound like birds chirping and your player-figure to say things to the caddy like "I think that'll play" to the gorgeous real-world golf courses and the lifelike swing of the golfer, the illusion of playing golf is as good as it gets on the computer screen.



Pretty pictures are often offered as a substitute for quality gameplay, but not here. The simulation is excellent, and the computer does all the hard work, leaving the fun decisions and the final hand-eye coordination to you. You get help when you want it, but then, as in the real thing, during the swing itself you have to be focused and hit *now,* with just the right force.

By contrast, even on the Amiga (where I played it), Accolade's *Jack Nicklaus: Greatest 18 Holes of Major Championship Golf* is just not up to the competition. While the Amiga's sound capabilities allow *Nicklaus* to offer real speech, *Links* makes better use of the miserable IBM speaker for speech and everything else. Much more important, while the *Nicklaus* graphics are good and the play of the game is easy to learn, once you've played with *Links,* you'll feel positively crippled going back to the simpler game.

For instance, *Links* handles aiming with a stick that you actually move around the course and lets you switch to a top-down map whenever you want; *Nicklaus* gives you the top-down view only at the beginning of each stroke, and you aim with a little ball along the top of the screen. This makes putting artificially hard because the ball is so far above the hole itself that you can't be sure, as you could on a real course, whether you're lined up properly.

Even the way the two games handle the stroke is telling. Both of them graphically represent the backswing, the forward swing, and the moment of striking the ball—you click to start, click (or release) at the top of the swing, and then try to click again *exactly* when the club reaches the original ball position. Quite a hand-eye feat, but learnable on both. However, where *Nicklaus* uses a vertical bar, on which your stroke rises straight up and comes straight down, *Links* uses a C-shaped graph that gives far more of the illusion of the movement of the head of the club during an actual swing.

Both games offer several excellent courses, and *Nicklaus* allows you to create your own courses, even offering trees and other features as clip art to make course construction easier and more realistic. But even the best of the *Nicklaus* courses pale beside the *Links* courses, which were not only videotaped, but also analyzed by computer so that when you shoot through foliage, the game can tell whether the ball was deflected by a major branch or just slowed in the leaves. Indeed, *Links* may be the most realistic simulation I've ever seen on a computer. This is the standard for everybody to meet from now on.

My son Geoffrey has pointed out that *Nicklaus* is easier to learn and play and win. He is almost always under par in that game, whereas *Links* is still tough after many plays. Maybe, then, you could use *Nicklaus* as an intermediate golf game, for kids who have outgrown Digitek's delightful *Hole in One Miniature Golf,* with its wonderful courses (including the insane Fantasy course). The three games do make a good progression—my daughter likes *Hole in One,* and her big brother likes *Nicklaus,* in large part because they can often beat par. But *Links* gives me everything I want from golf: endless challenge and beautiful scenery, without sunburn, bugs, lost golf balls, or weariness. ❐

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9th RECORD-BREAKING YEAR!

64/128 VIEW

Most software works as advertised, but some programs do their jobs with elegance.

Tom Netsel

Recently, Larry Cotton, in his "Beginner BASIC" column, offered a two-part series on making programs user-friendly. He discussed ways programs could be designed so computer novices could enter data without crashing the program, entering invalid characters, or becoming confused. That's quite a programming challenge.

It reminded me of a program that was the basis of a computer course I took in college in 1985. The course used a newly released integrated PC program that contained a word processor, spreadsheet, and database management system.

The program wasn't bad. It was reasonably priced, the word processor was great, and I still use the spreadsheet. The database, however, was something else entirely. Does the term *user-hostile* ring a bell?

Let's say you have a database called PEOPLE that consists of a list of friends and relatives and their ages. You also have a field called Holiday. This field has a *Y* in it if you send the person a card on holidays and an *N* if you don't send one.

Now, let's say you want to find all the people on your list who get cards and who are older than 20 years old. With this program, you had to go into Edit mode and enter PEOPLE,HOLIDAY='Y' AND AGE>20,NAME.

Any BASIC programmer can see the logic behind this command, but you had to know the syntax. You got no prompts, and the punctuation marks were tricky.

Now let's talk user-friendly. In that same year Brøderbund released *Bank Street Filer* for the 64.

With its prompts, help screens, and menus, this database program is a snap to use. To conduct a test, I created a similar database on my 64. I then requested a report listing all the people who got cards and who were over 20 years old.

Filer walks you through the process using prompts that are in English. To prepare a report, the program starts *Print every record where* and presents your fields: Name, Holiday, Age. I selected Holiday.

The program then asks *Is, Is Not, Is Before, Is After, Starts With, Ends With,* or *Contains?* I selected Is. The next prompt asks *Is What?* I entered Y for Yes.

Filer then asks *Stop, And,* or *Or?* Since I had more conditions, I selected And. The program then listed my fields for further selection. This time I selected Age, which is a number.

The next prompt offers these choices for numbers: *Is Equal To, Is Not Equal To, Is Less Than, Is Greater Than, Is Zero, Is Not Zero.* I selected Is Greater Than and typed 20 at the prompt.

At the top of the screen, my search equation was presented in English: *Print every record where the Holiday field is Y and the Age field is greater than 20.* The program then sorts and prints the report in a variety of possible formats to screen, disk, or printer. It's simple, elegant, and friendly.

When anyone mentions a user-friendly program, I give *Bank Street Filer* a plug. Too bad more programmers haven't copied it. ❐

GAZETTE

64/128 VIEW G-1
Why can't more programs be as user-friendly as *Bank Street Filer?*
By Tom Netsel.

LASER PRINTING ON A BUDGET G-2
Here are some tips on printing *GEOS* documents on a laser printer, even if you don't own one.
By Carlos Amezaga.

REVIEWS G-8
The Untouchables, B.A.T., Metal Gear, and *gateWay 64.*

FEEDBACK G-16
Questions, answers, and comments.

MACHINE LANGUAGE G-19
Working with fixed point numerals in machine language can be simple.
By Jim Butterfield.

GEOS G-20
Even fans find *geoWrite* tough to love, but here are some tips that can help.
By Steve Vander Ark.

D'IVERSIONS G-22
Home movies are out; news is in!
By Fred D'Ignazio.

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POSTSCRIPT

Here are some tips
on how to print GEOS documents
on a laser printer—
without owning a laser printer.

LASER PRINTING ON A BUDGET

BY CARLOS AMEZAGA

Desktop publishing really took off when the laser printer arrived. This advance in printer technology took desktop publishing to new heights, and Macintosh, IBM, and Amiga owners were quick to take full advantage of it. But 64 and 128 owners haven't moved as fast. Many owners of 8-bit Commodores have been slow to embrace laser technology because they are reluctant to spend ten times the price of their computer for a printer. What many of them don't know is that they can take advantage of laser printing without going to the expense of owning a laser printer. This article will explain how.

Setting Standards

To understand what laser printing is all about, you must remember that when these printers first appeared on the market, they didn't follow any standard. This led to the development of a page description language called PostScript. This language instruction set tells the laser printer how your image should be printed, what it should look like, and where it should be on the paper. PostScript soon became the standard for most laser printers.

That was great, especially if you were a Commodore *GEOS* user. When *GEOS* first came out, Berkeley Softworks provided drivers and fonts so you could buy a laser printer, connect it to your 64, and print. Berkeley published *geoLaser* and special fonts with *geoWrite*. It also released *geoPubLaser* and special fonts with *geoPublish*.

Lasers on a Budget

The technology and software are available for 8-bit Commodores, but there's still one main hurdle blocking the path to laser printing. That problem is price. Laser printers are expensive, and the typical 64 owner does not have that kind of money to pay for a printer. But even on a budget, there's still a way to laser printouts.

The solution was provided by Jim Collette, known as GeoRep Jim on QuantumLink, the Commodore-specific online service. Jim has contributed many programs, both public domain and shareware, as well as his own commercial releases. One of his shareware releases is called *PS.Patch* 2.0 and can be found on Q-Link. Rather than being a stand-alone program, this product is a patch, a program that alters another program. It modifies either *geoLaser* or *geoPubLaser* so that instead of sending the required PostScript information to a laser printer, it prints the information to a floppy disk.

Do Me a Favor?

With this information on disk, you no longer need to own a laser printer. If you have a friend who has a PC that's hooked to a PostScript laser printer, all you have to do is transfer the PostScript file from your Commodore disk to an IBM-formatted disk. You can do this with either *Big Blue Reader*, sold commercially by SOGWAP Software, or *Xlink*, which is 128-specific public domain software.

In order to read or write to an IBM-formatted disk, however, you need a 1571 or 1581 disk drive. These are the only two Commodore disk drives that can accomplish such a task. If you don't have either of these drives, there's still a way around this problem. If you have a modem, you can transfer the Commodore file to any other modem-equipped PC.

Check the Yellow Pages

If you're not fortunate enough to have a friend with a laser printer, look in the yellow pages under Desktop Publishing or Printing. In my area there are about four dozen publishers who have IBM equipment at their shops. Some even have a 24-hour bulletin board so you can upload your PostScript file for printing. They do charge a reasonable fee, but it all depends on the number of pages you're printing out.

How to Do It

Now that you know it can be done, it's time I told you how to create a PostScript file with *GEOS*. First, we want to check a couple of applications to make sure they are up-to-date. To do this, select the following files from the Desktop, and then select the INFO option from the FILE entry on the top menu. Now make sure that *geoPublish* and the two laser printing applications, *geoPubLaser* and *geoLaser*, have the following dates stamped in their info boxes. Earlier versions have problems.

geoPublish 1.0 10/4/88
geoPubLaser 1.8 8/22/88
geoLaser 2.1 3/10/88

I haven't heard of any problems with *geoLaser* and different dates, but version 2.1 seems to be the most current.

Laser printers are expensive, but there's still a way 64 owners on a budget can get laser printouts.

If you don't have this latest version of *geoPublish*, you can obtain the most current version of this two-disk program by sending in your disk to Berkeley Softworks, now renamed GeoWorks, and asking for the updated *geoPublish*. You can obtain *geoLaser* or *geoPubLaser*, the 11 laser fonts, and the patch program *PS.Patch* 2.0 from Q-Link's software libraries.

Once you obtain *PS.Patch* 2.0, put it on the same disk as either *geoLaser* or *geoPubLaser*. Execute the patch, and you'll get a menu with the option to modify either of the laser drivers. Select the laser driver you wish to modify, and follow the prompts. Once *Patch* has finished running, you'll find a new version of the selected driver on your disk.

Once you have these files patched, all you have to do is load the proper laser printing application. If you created your document with *geoWrite*, then you should use the patched version of *geoLaser*. If you created your document with *geoPublish*, then you must use the patched version of *geoPubLaser*.

You can use any of the 11 laser fonts within your document. By using these fonts, you'll achieve print comparable to that used in textbooks and magazines. You can also use your regular *GEOS* fonts, but they'll look jagged in most cases. You can, however, have your *GEOS* fonts and graphics smoothed as an option to improve their appearance when printed.

Convert to PostScript

Making the PostScript file takes a few minutes. The longer your document is, the longer it'll take to create the PostScript file. You'll also need plenty of free disk space. PostScript files can be very big, possibly taking up your entire 1571 disk or half your 1581 disk, depending on how complex the document is. Since PostScript is a structured language and has about 250 operators, *geoLaser* and *geoPubLaser* have the task of creating another program with this language that the laser printer will understand.

Once you've created your PostScript file and moved it to a PC or Macintosh (which can read IBM disks) by either disk or modem, it's time to print. Dump this file directly to the printer. Do not—I repeat—do not load your file into a word processor! The PostScript file would be corrupted, and it probably wouldn't fit in memory anyway.

Boot a Terminal Program

If you're using an IBM or PC clone, use a terminal program to send the PostScript file to the printer. This will establish a two-way communication channel in case the laser printer encounters any PostScript command errors. If such errors occur, they'll be printed on the terminal screen.

A terminal program such as *Proterm*, *Comterm*, *Procomm*, or *Freeterm* may be used on any IBM or PC clone. Set your communication parameters as follows: 9600 baud, 8 Bits, 1 Stop, No parity, Half-duplex, and Xon/Xoff activated.

Do not under any circumstances use either of the following commands from DOS:

COPY A:*filename* LPT1

or

COPY A:*filename* COM1

This doesn't establish a two-way environment and is therefore undesirable.

Dump from a Mac

If you have access to a Macintosh that can read IBM-formatted disks, you

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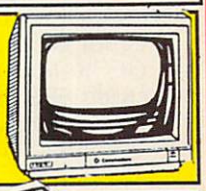

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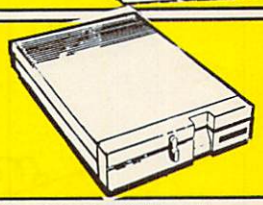

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have the option of dumping the file with a font utility, a program designed to send a PostScript file to a laser printer. There are two that I know of. One is called *SendPS*, and the other is *Font Downloader* from Adobe. *Font Downloader* can be found on font disks that Adobe distributes commercially. *SendPS* is public domain and can be found on GEnie's Desktop Publishing RoundTable. Either of these will do the job for you. You can also use a terminal program on the Mac with the same parameters described earlier. You also have the option of using the Macintosh version of *PageMaker* sold by Aldus.

With an ingenious program by Roger Eller (RogerE5 on Q-Link), we can also load this file into *PageMaker* as an Encapsulated PostScript File (EPF), which is an object oriented graphic file rather than a text file. He discovered that if you add a short list of commands at the beginning of the PostScript file, *PageMaker* will recognize the file as an EPF. By doing so, you can create some stunning effects with commands such as Place, Resize, Condense, and Stretch.

You'll need to play with the PostScript file a bit first. You'll need the *GEOS Text Manager*, a text scrap called EPS Insert Text, and *Wrong Is Write*. *Wrong Is Write* is an application which will turn your PostScript file into a *geoWrite* document and back again. It can be found on Q-Link, and a more advanced version is sold by Storm Systems. EPS Insert Text can also be found in Q-Link's *GEOS* library.

What you do is convert this true ASCII PostScript file to *geoWrite*. Once it's converted, paste the short text scrap at the beginning of the document; then convert the file back to true ASCII using *Wrong Is Write*. You can then load this modified PostScript file into the Mac version of *PageMaker* and create your own effects. You can then print directly from *PageMaker* instead of dumping the PostScript file to a printer.

The world of laser printers is within reach of the average 64 or 128 user. Documents generated with *geoPublish* and *geoWrite* are comparable to those created on high-end systems that use gigabytes of memory. With a little time and effort, we can get high-end results on a low-end budget.

Carlos Amezaga invites your comments or questions. His address is 1330 SW 97th Avenue, Miami, Florida 33174. He can also be reached online. He is The Smee on Quantum-Link, C.Amezaga on GEnie, and Carlos Amezaga 135/10 on Fidonet. ❐

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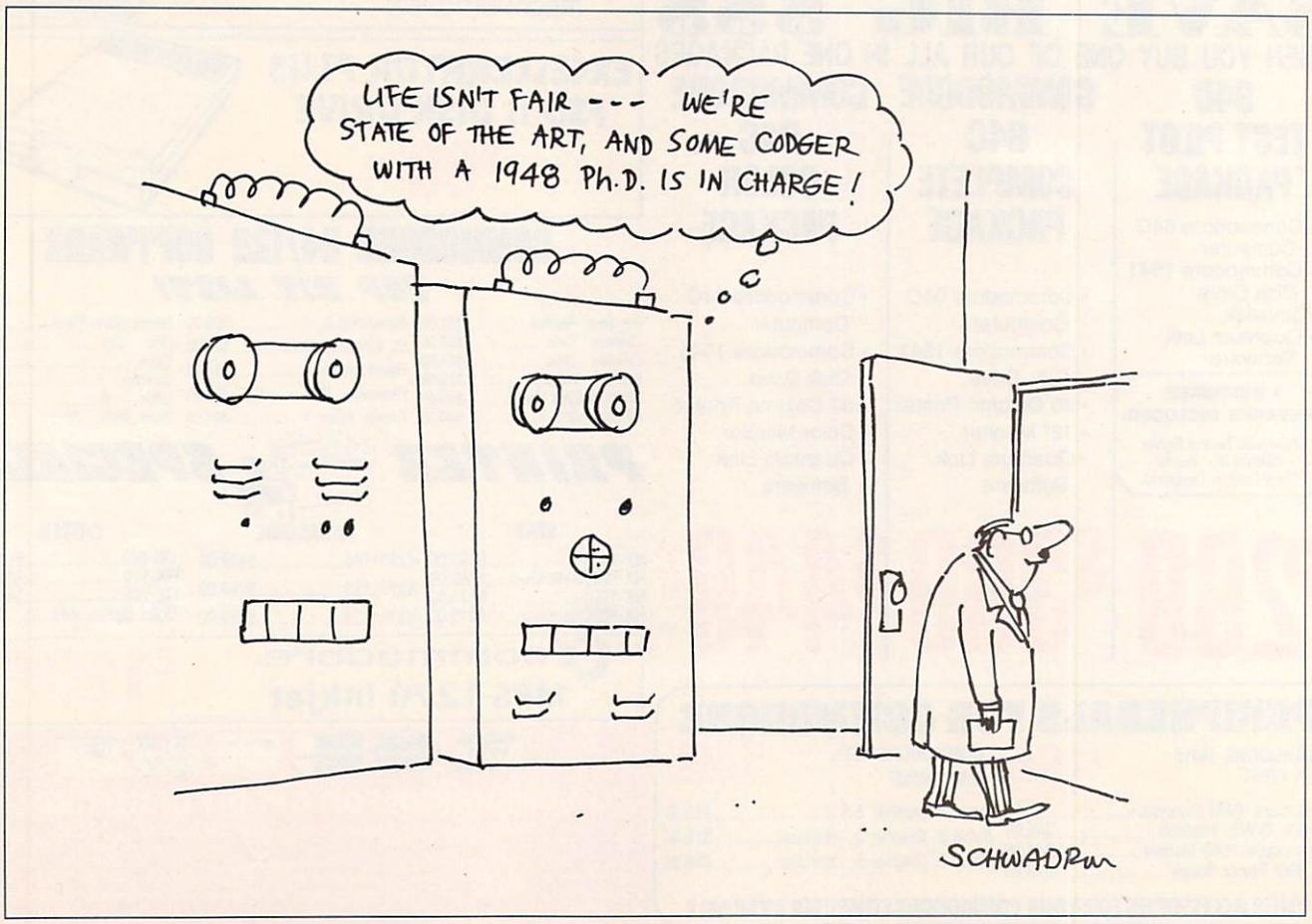

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THE UNTOUCHABLES

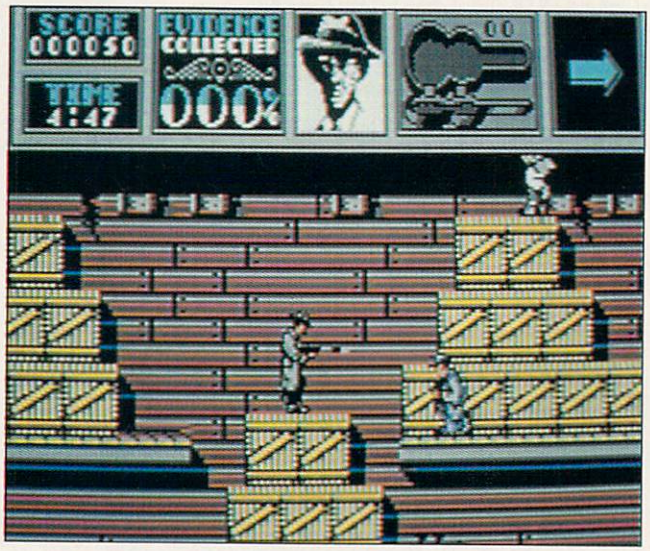
Chicago, 1931. The dark streets of this city are not a safe place to be! Al Capone and the Mob have invaded this area for their own unscrupulous and illegal dealings. It's up to you to free this city from their control.

Ocean of America's *Untouchables* (distributed by Electronic Arts) puts you in control of Elliot Ness and his team of crimebusters. Get plenty of rest now, because you'll need your strength and your mission won't be easy!

Like the popular movie of the same name, this arcade game is full of action and danger. You must complete six very difficult levels to win this game. These levels are called Warehouse, Bridge, Alleys, Train Station, Hostage, and Rooftop. At each level, you must accumulate points and evidence. This is not easy. For example, at the Warehouse level, gangsters are trying to kill you as you search for the Mob's bookkeepers. You want their books, but they're armed and not about to cooperate.

Time is another factor that can affect your success. Each level must be completed in a certain amount of time. Using the Warehouse level once again as an example, once you kill a bookkeeper or make him drop his evidence, you have only a short amount of time to pick it up.

As the game begins, you are at the bottom level of the Warehouse. You must engage in a surprise attack on Al Capone's bootlegging operation to get the necessary damaging evidence from his bookkeepers' ledger pages. An arrow displayed at the top of the screen tells which direction to move to find these bookkeepers with the evidence. But watch out! Gangsters move in quickly to stop you as you chase these fast-moving bookkeepers.



Help Elliot Ness get the goods on Al Capone and his Mob.

You get points for killing gangsters. You can also acquire additional weapons and ammunition or extra energy in some cases. However, cornering the bookkeepers is more important, since you collect a certain percentage of the necessary evidence from each one. If you accumulate 100 percent of the evidence before the time limit expires, you move to the next level, the Bridge.

At the Bridge, Capone's men are attempting to cross the Canadian border to safety and must be stopped. Again, you must kill the gangsters to collect the necessary evidence. At this level, you should probably select a different Untouchable character, since your current one is getting weak.

In the next stage, the Alleys, you must collar Capone's accountant with the evidence before he skips town on a fast train.

The fourth level, the Train Station, has your Untouchable character guiding a runaway baby carriage away from gunfire and dangerous obstacles. If innocent civilians are accidentally shot, your character loses energy.

At the fifth level, only one of Capone's men is left, and he decides to take someone hostage. React quickly, since you only have five seconds to kill the gangster.

The final level is the Rooftop. With all the evidence you have collected against Capone, he has been indicted. However, you must now dispose of Capone's hitman. Manage this, and you'll win the game.

The Untouchables is easy to understand. There's no problem figuring out what moves to make and how to play it. However, I did find it very difficult to get to the higher levels of the game. With practice, my score gradually improved. This game definitely takes a lot of practice to reach the upper levels. Learning the detailed layout of each level can help, but I think the average player will have problems just getting to the second or third level.

The documentation for this game is brief, but it provides you with all the information you need to begin playing. Instructions are straightforward and easy to comprehend. Each level of play is described in enough detail to help you understand what you will be up against. This documentation also includes some useful tips on playing. The game's main idea is not that original; it's simply good guys versus bad guys. However, I liked the challenge involved in defending myself against the gangsters while searching for the evidence, as opposed to just worrying about being shot.

The Untouchables also makes good use of the 64's graphics and sound capabilities. Graphics were displayed on the screen in much detail. The background music was pleasant and set the mood for action.

This game is entertaining, and its level of difficulty only makes it more of a challenge to play. So, if you like a real challenge, this game will give you hours of enjoyment as you visit Al Capone's Chicago of the 1930s.

Chicago, 1991. Sixty years have gone by, and the streets are much safer now. Al Capone's reign of terror is but a distant, unpleasant memory. Unfortunately, Elliot Ness and his brave heroes are also relegated to the past, but with your 64, you can go back to the era of the Untouchables and relive their fight against crime.

CHRIS STAWASZ

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B.A.T.

If you're looking for a science fiction role-playing game that takes the genre to its limits of creativity, originality, and fun, then check out *B.A.T.* I've never played a stranger sci-fi game.

The designers of *B.A.T.* worked hard to produce a game that's unique in every aspect. They succeeded and went beyond this goal to create a game that's as much fun to explore as it is to solve. Although *B.A.T.* takes many hours to finish, it's also fun just to explore the game's more than 1000 locations that vary from bars and offices to apartments and caves. *B.A.T.* comes from UBI Soft in France, and its European feel contributes a great deal to the game's effect on its players.

First of all, *B.A.T.* stands for the Bureau of Astral Troubleshooters, a group of galactic police officers whose job is to investigate problems and maintain order. Just don't make the mistake of pronouncing the acronym *bat*.

Your character is a new agent brought into the B.A.T. organization to capture Vrangor, a dangerous scientist, and his sidekick Merigo. Both of them recently broke out of prison. The two troublemakers have threatened to destroy the large city of Terrapolis on the planet Selenia if their demands are not met. Although you have to work fast to find and neutralize Vrangor and Merigo, the story moves you along so you can perform crucial actions at the right times. There is plenty of time to explore Selenia, and it's important to look for clues and to familiarize yourself with the game.

The first step in *B.A.T.* is to create a character. Your persona can have many characteristics and abilities to accurately represent you in the game. The development of characters in *B.A.T.* is one of the most comprehensive and complete systems in the RPG field. Your character possesses various competencies and aptitudes, some of which are modifiable during character creation.

B.A.T. uses menus and icons for gameplay. You can select the main menu with the cursor to access the necessary commands and also click directly on the screen to gain information about objects, talk with characters, and use exits. The interface is dynamic and combines the menu commands and clickable icons to make gameplay effortless. The manual explains all of the menu commands and subcommands and shows the menu levels in detail. There are only a few main commands, but they cover everything your character does in the game.

Menus and windows in B.A.T. *simplify gameplay and help you explore more than 1000 different locations.*

Six areas of competence which may not be modified are life percentage remaining, level of knowledge, experience, calorie requirements, hydration requirements, and credits (money). The six modifiable characteristics are force, intelligence, charisma, perception, vitality, and reflexes. Various aptitudes include such skills as climbing, vigilance, and psychology. As you can see, a character in *B.A.T.* can be well developed.

There are enough places to visit and enough mini-quests to solve in *B.A.T.* so that all of your character's competences and aptitudes gain real meaning at one time or another. Another nice touch is the chart that visually represents these characteristics and abilities on the character screen.

Two other parts of the interface further confirm the uniqueness of *B.A.T.* These are B.O.B., a biodirectional organic bioputer, and the DRAG, a vehicle you use to travel around Selenia.

B.O.B. is attached to your character's arm, and it performs several important functions. It can list your alter ego's characteristics and physical condition and can modify heart rate. Perhaps more important, B.O.B. can be programmed with a simple command language to perform some functions automatically, such as alerting you when Vrangor or another enemy is near or automatically translating languages of aliens during conversations. B.O.B. is very useful in *B.A.T.* and further develops the game universe.

The DRAG is a simple flying machine that adds 3-D flight simulation to *B.A.T.*'s already complete interface. It's tough to fly, but it does carry some formidable weaponry. You need DRAG to reach certain locations in the game, and it expands your character's mobility.

The graphics in *B.A.T.* are impressive. The locations are detailed and colorful, and you can access most areas of the picture with the menu commands. When you enter small rooms or other locations, *B.A.T.* pops up a window for that location rather than clearing the screen. This windowing trick maintains itself because there are only a few windows on-screen at any time. This feature provides the player with a partial view of previous locations and simplifies visualization of the game world. The 3-D view from the DRAG ship works well on the 64.

Movement is fluid, and the flying machine adds yet another level of fun to this game. *B.A.T.* is one of those gems that you might normally miss because it comes from a small software company and has a strange name and box cover. The game presents science fiction in a way that any fan will devour. The variety of weapons, alien races, locations, and objects populating the game adds the finishing touch of realism to this future world.

B.A.T. lets you move at your own pace to explore the game world and enjoy all that it has to offer. You can continue to enjoy the game

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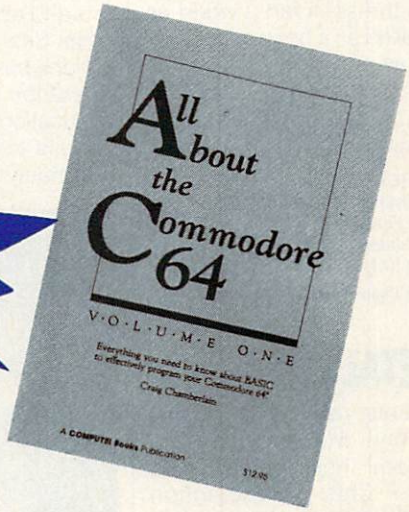

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METAL GEAR

Rockets, rations, handguns, oh my! *Metal Gear* from Konami has all this and more. This arcade/action game tosses you into the heat of combat as a one-man army sent to stop the insane Col. Vermon CaTaffy from taking over the world. Here's a chance to see if you've learned anything from all those Stallone and Schwarzenegger movies.

CaTaffy has set up a vast compound in Outer Heaven, a small nation in Africa that houses his worst creation, the ultimate weapon—Metal Gear. As Solid Snake of the covert unit Fox Hound, you must infiltrate the enemy compound; collect weapons, ammunition, and other useful objects; and then destroy CaTaffy's powerful device.

Metal Gear is an average game that doesn't excel in any particular area, except perhaps fun. For its price, the game is an absolute steal and will keep you occupied for hours.

Metal Gear's main screen has a three-quarter perspective view through which your character moves. If you hit any key other than the space bar, a menu pops up providing you with various choices for the weapons screen, equipment screen, or communications screen.

The first two screens show pictures of all the weapons and objects that you possess. Select one of them or a blank position with a cursor to exit the screen. The communications screen provides access to your transceiver, the means to communicate with home base for helpful hints and messages. The space bar switches between your fist and the current weapon. The gameplay in *Metal Gear* is simple. You move around the buildings and outdoor areas of the compound, trying to find better weapons and special objects that'll get you past obstacles and traps.

You must capture weapons and equipment if you hope to foil Col. Vermon CaTaffy's evil plan to conquer the world.

Konami includes a map of all game screens along with the well-written manual in the package. Although it felt like cheating to use the map, I found it very helpful in some places. Even with the map, *Metal Gear* is still challenging and fun. Your heart will still be pounding by the time you get to the final level of buildings. With well over 100 screens, there's a lot of two-fisted variety in *Metal Gear*.

The graphics are average for a 64 game. You can easily distinguish the objects and floor layout, but the colors on most screens are a drab green-blue. What *Metal Gear* lacks in splashy graphics, however, it more than makes up for in music and sound effects. The music is catchy and fast and continues throughout the entire game. Sound effects are not as impressive, but the explosions and gunfire still get the point across. The music heightens the intensity in the game more than any other feature.

One big problem with *Metal Gear* is disk access. Every two or three screens and every time you go into a room or other enclosure, the screen blanks, and the drive starts spinning. This becomes so annoying that I frequently take a break and leave the game. Other arcade games of the same complexity have tackled this problem in the past.

Metal Gear's method of saving games is also awkward. The save-game feature is very important for a game as large as this one. However, *Metal Gear* saves directly to the program disk, and I often had problems restoring games. In the end, I had to start all over. For this reason, I decided to play *Metal Gear* in one sitting rather than chance losing my place. It's always a bad idea to save games to the program disk.

The variety of neat objects and compound rooms kept my interest in *Metal Gear*. From a bomb blast suit and compass to an oxygen tank and flashlight, you intelligently use objects to conquer the terrain and traps. This element of *Metal Gear* elevates the game above the bevy of military shoot-'em-up clones to a category reserved for better action games.

One hint to keep you awash in ammunition is to take note of all places where you find bullets and such. When you leave the room and reenter, you'll find a fresh supply of ammo in the same place. I don't know if this is a glitch in the program, but it certainly keeps me from running out of both rations and ammo.

If you like games with a lot of action and strategy to boot, *Metal Gear* is worth your money and efforts. The game lasts longer than its monetary equivalent in movies and puts you in charge of all the action.

Now go get CaTaffy before he eliminates what's left of the world! And watch out for those land mines!

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REVIEWS

GATEWAY 64

CMD says *gateWay* represents a "new philosophy with working with *GEOS*." It's not kidding.

Unlike some alternative deskTops, *gateWay* is a full *GEOS* replacement. The first thing you do is create a new boot disk customized to your setup. This includes a device driver for each of your disk drives, your printer, and your input device. Once you've done this, you boot up into a different world.

Fortunately, this world runs by familiar *GEOS* rules. Gadgets on the screen are intuitively designed. Files are listed by name in a resizable window from which they can be selected and maneuvered with a mouse click.

On one side of the filenames is a slider to move quickly through a directory. On the other side a "fuel gauge" shows how much of the disk is filled. If you need to be more exact, a click on the gauge opens a window of disk information. Keyboard shortcuts are pretty much the same as with *GEOS*. *GateWay* operates with exceptional smoothness; the entire directory is in memory at once, which speeds up scrolling.

Basically, these changes are cosmetic, but there are some real improvements that make *gateWay* shine. The program supports three active drives at one time if you have a RAM expansion unit (REU). It also has a trash can system which allows you to toss unwanted files into an alternate menu, but if you change your mind, they can be reinstated. But *gateWay* really jumps ahead of the deskTop and stock *GEOS* when it comes to supporting disk drives. It offers device drivers not only for 1500-series drives, but for CMD hard drives, all REUs (including geoRAM and the 1700), and CMD's new RAMDrive and RAMLink systems.

Also included is a RAM disk driver which takes advantage of any extra memory you may have installed. If you operate *GEOS* with anything more than a floppy drive or two, *gateWay* will finally allow your system to run instead of walk. If you have at least 512K RAM on board, *gateWay* flies. Using a 64K area of RAM, the system offers a task-switching device called the Switcher. Press two keys, and you can jump instantly between two applications. This

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is one of the most exciting features of *gateWay*, but it works only if you have a lot of extra RAM installed.

Features like full three-drive support also require an REU. This program is designed for the user with an expanded system. If that's you, *gateWay* is a must.

The more you have for *gateWay* to play with, the more powerful the system becomes. You can modify your version of *gateWay* with a new file type called a Gateway Document. This is essentially a separate but compatible program which can be integrated into *gateWay* to provide additional options. Several such documents are provided as examples.

You'll find *gateWay* works well with various disk drive combinations. Without extra RAM, however, different models can only communicate for basic file copying.

GateWay cheerfully runs almost any application or desk accessory written for *GEOS*. To ensure compatibility, CMD has provided a driver which configures the REU to emulate the 1541/1571 drive supported by *GEOS* itself. The manual is well written, despite a few errors resulting from last-minute changes in the software.

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FEEDBACK

Questions and answers about plotting equations, computer uses, and more

Plotting Equations

Is it possible to get a hi-res program with a PLOT X,Y function for the 64, which will rapidly plot equations on *x*- and *y*-coordinate axes?

FRANK GORDON
ORONO, ME

Here's a very simple routine in 64 BASIC that will plot a sine function. The program asks for upper and lower bounds which are the amplitude of the sine wave. No matter what amplitude you select, the program will scale the sine wave to fill the screen. For brevity, finer points (such as adding values and tick marks to the axes, providing text on the screen, and error checking for infinities) have been omitted.

When you run the program, it asks for a lower and upper bound. For a demonstration, enter -6 and 6 and then experiment with other values. Press any key when the program finishes. Type RUN for another plot. A machine language routine lets you go to bitmap mode (clearing the bitmap screen as it does so), return to text mode, and clear the bitmapped screen independently of modes.

```
SH 100 AD=49152
CX 110 READ XX:IF XX>=0
       {SPACE}THEN POKE
       {SPACE}AD,XX:AD=A
       D+1:GOTO110
JJ 120 INPUT"WHAT IS THE
        LOWER BOUND";X1
FC 130 INPUT"WHAT IS THE
        UPPER BOUND";X2
CJ 140 PRINT:PRINT"PLEAS
       E WAIT";
DX 150 XX=X1:GOSUB 310:Y
       1=YY:Y2=YY:RX=319
       /(X2-X1)
KF 160 FOR XX=X1 TO X2 S
       TEP 1/RX:PRINT"."
       ;:GOSUB 310
MJ 170 IF YY<Y1 THEN Y1=
       YY
EQ 180 IF YY>Y2 THEN Y2=
       YY
AE 190 NEXT:RY=199/(Y2-Y
       1)
CJ 200 SYS 49152:REM GO
       {SPACE}TO BITMAP
SJ 210 IF X1<0 AND X2>0
       {SPACE}THEN XX=-X
       1*RX:FOR YY=0 TO
       {SPACE}199:GOSUB
       {SPACE}290:NEXT
SC 220 IF Y1<0 AND Y2>0
       {SPACE}THEN YY=-Y
       1*RY:FOR XX=0 TO
       {SPACE}319:GOSUB
       {SPACE}290:NEXT
KF 230 FOR X0=X1 TO X2 S
       TEP 1/RX
BB 240 XX=X0:GOSUB 310:X
       X=(XX-X1)*RX:YY=(
       YY-Y1)*RY:GOSUB29
       0
MB 250 NEXT
KS 260 GET A$:IF A$="" T
       HEN 260
DB 270 SYS 49152+3:REM R
       ECOVER THE TEXT S
       CREEN
MH 280 END
EX 290 Y0=199-YY:AD=8192
       +INT(Y0/8)*320+IN
       T(XX/8)*8+(INT(Y0
       ) AND 7)
PE 300 POKE AD,PEEK(AD)
       {SPACE}OR (2↑(7-(
       INT(XX) AND 7))):
       RETURN
FX 310 YY=SIN(XX):RETURN
XH 320 DATA 76,13,192,76
       ,74,192,76,83,192
       ,6,7
ER 330 DATA 0,0,32,108,1
       92,32,83,192,173,
       9,192
KS 340 DATA 141,32,208,1
       62,4,134,252,162,
       0,134,251
BD 350 DATA 160,0,173,10
       ,192,10,10,10,10,
       13,9
RX 360 DATA 192,145,251,
       200,166,252,224,7
       ,240,9,192
CG 370 DATA 0,208,243,23
       0,252,76,45,192,1
       40,11,192
XQ 380 DATA 174,11,192,2
       24,232,208,228,96
       ,32,139,192
GH 390 DATA 169,147,32,2
       10,255,96,169,0,1
       33,251,169
DJ 400 DATA 32,133,252,1
       69,0,168,145,251,
       200,208,251
HC 410 DATA 230,252,166,
       252,224,64,208,24
       3,96,173,17
QB 420 DATA 208,9,32,9,1
       6,141,17,208,173,
       22,208
XX 430 DATA 24,41,223,14
       1,22,208,173,24,2
       08,24,41
HB 440 DATA 240,9,8,141,
       24,208,96,173,17,
       208,24
GG 450 DATA 41,223,141,1
       7,208,24,173,24,2
       08,24,41
DE 460 DATA 240,9,6,141,
       24,208,24,173,22,
       208,41
AC 470 DATA 239,141,22,2
       08,96,-99
```

Lines 100 and 110 poke the machine code into the RAM window above BASIC. Lines 120 through 190 do scaling calculations based upon the starting and ending values of the functional argument. Line 200 sets the bitmap screen with SYS 49152.

Lines 210 and 220 draw the axes if they're part of the region being examined. Lines 230–250 construct the actual plot. Lines 260–280 wait for a keypress, return to the text screen with a SYS 49152+3, and end the program.

Lines 290 and 300 are a subroutine for setting the pixels pointed to by variables XX and YY. Line 310 is the actual location of the function where YY receives the value of the function when XX is used as the argument.

The remainder is machine code data. If you want to clear the bitmap, type SYS 49152+6. If you want to change the background color, type POKE 49152+9, backcolor. *To change the foreground (plot) color, use POKE 49152+10,* forecolor. Backcolor *and* forecolor *represent the numeric values (0–15) of the 64's 16 colors. Pick the combination you prefer.*

In addition to writing your own code, many programs are available which do graphing as a specialized talent or as an enhancement to BASIC. These can be obtained commercially, from the public domain, and as shareware. Check software stores, mail-order houses, user groups, online networks, and, of course, COMPUTE *magazine.*

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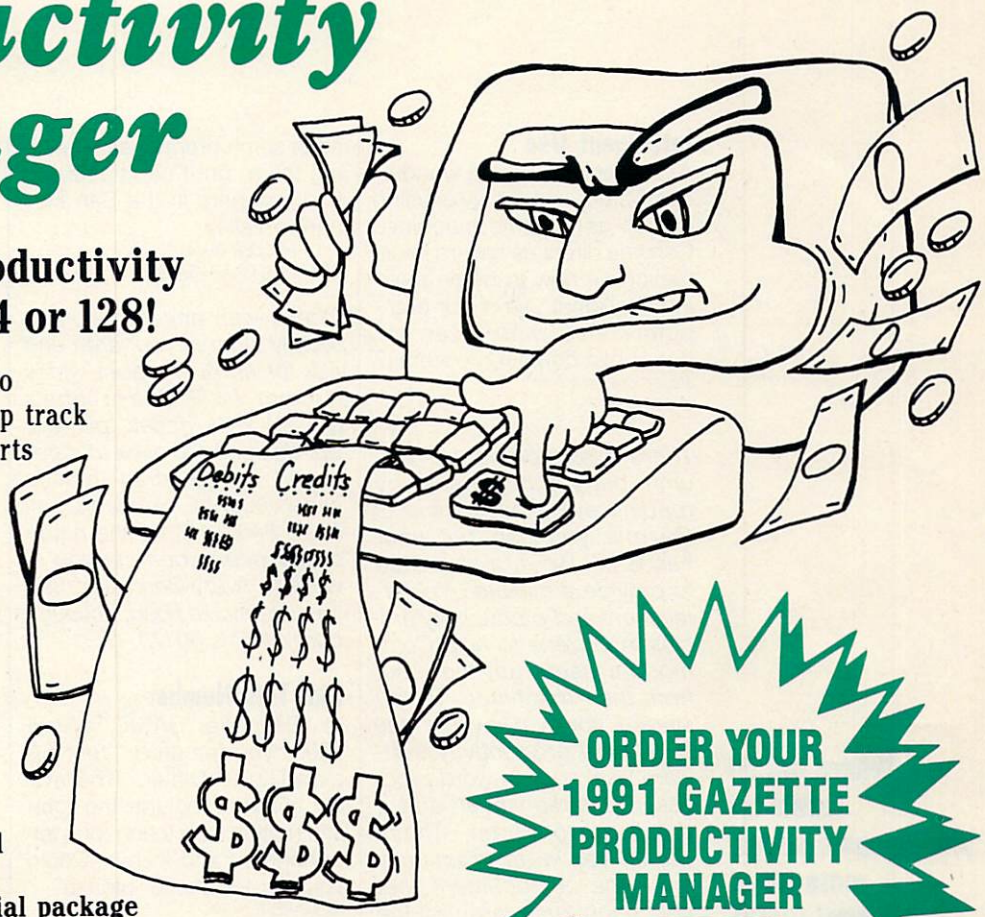

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Where to find labels for photographic slides, more about the Digital Dialer, and thanks from a GEOS user

Intelligent Use

As newcomers to the world of computers, our family is using our 64 as a game machine. Can you direct us toward information on how to begin making intelligent use of our computer? Also, where can we get public domain programs?
JANE TENBRINK
SHELBY, MI

That's a tall order for this column, but you might start by reading every back issue of Gazette you can get your hands on. We've always tried to provide a mixture of entertainment and productivity articles in Gazette to help Commodore users get the most from their machines. To get started, however, invest in the Big Three productivity software packages: a word processor, a spreadsheet, and a database program. These will let you write practically any type of document that you might use around the home or office, keep financial records, and manage other data, such as lists, club memberships, inventories, collections, or what have you.

A modem and terminal program are also good investments as they can enable you to contact other computers in your town or across the world. Electronic bulletin boards are great sources of public domain and shareware programs. You can also find PD software by looking through advertisements in the back of this magazine. There usually are a number of good sources listed. A user group is another excellent source. User group members will be glad to share their knowledge of computers with you and your family.

Transparency Labels

Can anyone tell me where to find some pin-fed label stock for photographic slides? I've seen some programs for printing them, but I can't seem to find any here in the San Fernando Valley.
B. CHANDLER SHAW
GRANADA HILLS, CA

Check with any large office supply store in your area and ask for an Avery label, stock number 7207. These labels are 1½ x ⅜ inches, pin fed, but designed to stick to cardboard rather than plastic slide mounts. You can call (800) 843-2347 for the name of the dealer nearest you or write to Avery-Dennison, 850 East Algonquin Road, Schaumburg, Illinois 60173.

Dial This Number

In "Beginner BASIC" (April 1991) you featured "Your 64 as a Digital Dialer." The article failed to include the tone information for a touch-tone telephone's * and # keys. Could you provide these, please?
RICHARD C. KIRK
NICEVILLE, FL

The telephone dialer program omitted the star (*) and pound (#) signs and the ability to insert a pause during the dialing process. To add these features to Larry Cotton's program, the author suggests the following changes.

Add these lines:

```
25 DIMW(4,12)
291 IFD$(N)="P"THEN FOR-
DE=1TO1000:NEXT
292 IFD$(N)="*"THEN D$="10"
293 IFD$(N)="0"THEN D$="11"
294 IFD$(N)="#"THEN D$="12"
```

Change lines 150–180 to read as follows:

```
150 FORN=10TO12: W(1,N)=77:
  W(2,N)=60: NEXT
160 FORN=1TO10STEP3:
  W(3,N)=121: W(4,N)=77: NEXT
170 FORN=2TO11STEP3:
  W(3,N)=156: W(4,N)=85: NEXT
180 FORN=3TO12STEP3:
  W(3,N)=165: W(4,N)=94: NEXT
```

Delete line 190 in the original program listing.

To test the program, you'll need to increase the length of tones in line 240 and change the first test data item in line 390 to read as follows.

```
240 Z=150
390 DATA JIM, *0#-1P11
```

Be sure to use the capital P to insert a pause. To change pause length, adjust the length of the time-killing FOR-NEXT loop in line 291.

Gee, It's GEOS!

The August issue of *COMPUTE* arrived yesterday, and I just have to write and tell you how much I enjoyed the premiere of the long-awaited *GEOS* column by Steve Vander Ark. I hope that it will become a permanent feature in the Gazette section.

My cup runneth over! There was even a great *GEOS* type-in program for creating an animated mouse pointer. The talent and creativity of your program authors never cease to amaze me.
ROBERT NELLIST
BROCKPORT, NY

In our recent survey, many readers indicated that they wanted more GEOS *information, articles, and programs. In an effort to fill this request, Gazette contacted Robert Nellist, who himself is no* GEOS *novice. (See his review of* GEOS Font Editor.*) Robert recommended Steve Vander Ark. For the past few months now, Steve's "GEOS" column has appeared in Gazette, and we think he's doing an outstanding job. If you have any* GEOS*-related questions or topics you'd like to see him cover, drop Steve a line in care of the magazine. You can also leave E-mail for him on QuantumLink, where his handle is SteveV14.* ❐

MACHINE LANGUAGE

Jim Butterfield

FIXED POINT NUMBERS

We can often handle fractions without the complexity of floating point. Even BASIC sometimes has trouble with floating point. Try entering PRINT 8.13 and see what happens when you press Return.

Fixed point notation uses an assumed decimal point. A value of 12345 might be used to represent an amount of $123.45; a value of 45678 might represent a distance of 45.678 meters or, if you like, 45678 millimeters. Thus, values that we think of as fractions can be held as integer values. This simplifies the arithmetic. Even nonmetric values can be stored this way: 876 ounces represents 54 pounds, 12 ounces (dividing by 16 is easy in binary).

Here's a simple program to keep a monetary value as binary cents. To keep the coding compact, we'll hold the value in two bytes, 16 bits. That limits us to a maximum amount of $655.35; a practical program would use at least three bytes or more. (Three bytes would hold amounts up to $167,772.15).

The program will start with three cents (binary 3) and double this value nine times. Each value will be printed on the screen; you'll see how the decimal point is inserted.

You may load and run the BASIC driver program given below. The full machine language code won't be shown; instead, I'll note highlights.

Our main program is at hex address 2000; it sets up the loop to print the ten values. The loop calls the subroutine at $200B, which, in turn, calls the display value subroutine and then doubles the binary value at $2100 and $2101 with an ASL (Arithmetic Shift Left) and ROL (ROtate Left).

The display routine starts at $2015. Its job is to convert the binary value into decimal so that it can be displayed. To do this, we use a clever procedure involving decimal mode. An area is set aside to hold the decimal value, originally 0. Bits are extracted from the binary number, one at a time. The decimal value is doubled by adding it to itself; the binary bit is added in automatically. When you've handled all the binary bits, the decimal area will contain the decimal value in BCD (Binary Coded Decimal). This coding is worth a look, if you haven't seen it before. Note that the binary number from $2100/1 has been copied to $2102/3.

```
0202C 0E 03 21  ASL $2103
  ;low byte
0202F 2E 02 21  ROL  $2102
  ;high
```

The highest bit of the binary value will have been shifted into the Carry flag. If the Carry flag is set, the add that will take place soon will have an extra value of 1 added in.

```
02032 78  SEI
02033 F8  SED
02034 AD 06  21  LDA  $2106
02037 6D 06  21  ADC  $2106
0203A 8D 06  21  STA  $2106
```

And it goes on, doubling the higher byte values at $2105 and $2104 by adding them to themselves. We'll skip those instructions and just note that we must clear decimal mode. We have locked out the interrupt because some early machines would get muddled on their keyboard scan if decimal mode were set.

```
0204F D8  CLD
02050 58  CLI
```

The above shift-binary, add-decimal is repeated 16 times, once for each bit of the binary number. Now we have the decimal digits, packed two to a byte; all we need to do is to print them, slipping in a decimal point at the right place. I've included zero suppression code; look for it.

Once you understand the principles involved, fixed point decimal seems natural. Use your monitor to snoop through all the code. Then you'll be ready to take on a similar job of your own.

This program will run on most any 8-bit Commodore computer. The code begins at hex address 2000—not the most convenient location, but it's an area of memory that's readily available on most Commodore machines.

Working with fixed point numbers is simple in machine language. All you need to know is where the decimal point should go.

```
100 DATA 162,0,32,11,32,232
110 DATA 224,10,208,248,96
120 DATA 32,21,32,14,1,33
130 DATA 46,0,33,96,173,0
140 DATA 33,141,2,33,173
150 DATA 1,33,141,3,33,160,0
160 DATA 140,4,33,140,5,33
170 DATA 140,6,33,14,3,33,46
180 DATA 2,33,120,248,173,6
190 DATA 33,109,6,33,141,6,33
200 DATA 173,5,33,109,5,33
210 DATA 141,5,33,173,4,33
220 DATA 109,4,33,141,4,33
230 DATA 216,88,200,192,16
240 DATA 208,214,169,48,141
250 DATA 2,33,173,4,33,32
260 DATA 123,32,173,5,33,32
270 DATA 123,32,169,46,141
280 DATA 2,33,32,210,255,173
290 DATA 6,33,32,123,32,169
300 DATA 13,32,210,255,96
310 DATA 72,74,74,74,74,32
320 DATA 136,32,104,32
330 DATA 136,32,96,41,15,9
340 DATA 48,205,2,33,240,5
350 DATA 206,2,33,16,2,169
360 DATA 32,32,210,255,96
400 FOR J=8192 TO 8347
410 READ X:T=T+X
420 POKE J,X
430 NEXT J
440 IF T<>12136 THEN STOP
500 REM Need to poke the
  initial value of three cents
510 POKE 8448,0:POKE 8449,3
520 SYS 8192
```

❐

GEOS

Steve Vander Ark

GEOWRITING MADE EASY (ALMOST)

Even its fans find geoWrite tough to love, but here are ways to make it almost a pleasure to use.

I'm a fan of *geoWrite.* The other day a guy I know called it *geoWrong* and proceeded to bombard me with a rather daunting list of evidence to back up his contention. I didn't listen; I figured that attack was caused by something disagreeable he ate for breakfast or the fact his wife had seen the bill he ran up last month on Q-Link. I think *geoWrite* is wonderful.

Oh, I know—you don't read this column just to hear me gush, but I have a real affection for proportional fonts and WYSIWYG (What You See Is What You Get). Since my first printer (a used Okimate 10) and my first *GEOS* package (1.3) arrived at pretty much the same time, *geoWrite* was really the first word processor I ever used. Now, I'm used to the program, and many of us like what we're used to.

To be fair, my friend's objections to *geoWrite* do have merit. It is a bit slow, and it's prone to dropping characters here and there if you really get cooking at the keyboard. When it redraws the screen—which is quite often—it's certain to miss a few keystrokes. In 40 columns, the side-to-side flipping as you cross the page can frustrate even a confirmed geoNut like me.

There are no global settings available, so if you decide to change fonts or margins on a multipage document, you're in for a rather monotonous process. You make the changes, watch the whole thing reformat itself, and then try to find the bits of text that slipped through at the page breaks with the old formatting. When that's finished, you're forced to print using *GEOS* fonts, whether or not they're appropriate for the document in question, or use the NLQ setting but forgo any style changes such as boldface or italic.

All this might convince you to try a more conventional program and avoid the hassles, but there are some big advantages to a word processor like *geoWrite.* For one thing, you can see what you're doing. The text appears on the screen in all the places and in all the styles that will print on your finished document. This makes formatting a breeze, and since you can preview your text onscreen, it saves a good deal of printer time and paper as well.

You really appreciate this if you ever need to create a page with some unusual spacing and formatting. With a conventional word processor you might spend the entire evening trying to get the right combination of cryptic codes in the right places to make the whole document look like you want. But with *geoWrite,* it happens right there on the monitor's screen as you type, indentations and all. You hardly need to print anything until you are certain that it's what you want and perfect.

The fonts you can use are another benefit of *geoWrite.* They range from businesslike to fun—and they're proportional, as well. As I mentioned in last month's column, you can even overcome the blocky curves and angles inherent to bitmapped fonts with the right printer driver.

Screen redraws will still make *geoWrite* stumble. You can overcome most drawbacks by using only one font for typing the entire document, adding special effects and other fonts only after the document's in shape and ready for the printer. The built-in font, BSW, works fine for this, but I like to use a 10- or 12-point font such as LeConte or University because it's easier to read on my screen. But keep to a smaller point size; the screen redraws only when it's filled with text, after all.

Side flipping can be eliminated by setting the margin to screen width for typing (about 5.2 inches) and then changing it back to full-page width for final printout. This is sometimes a trick in itself, as I mentioned above, but fortunately there's a program available called *Toolkit* which makes global commands a reality for *geoWrite* documents.

From the *Toolkit* menu screen you can set the margins for an entire *geoWrite* document as well as change the font and style of all the text at once. You have to create a text scrap containing the desired ruler settings and/or font. This can be a little tricky at first, but once you get that down, you'll find *Toolkit* to be invaluable and easy to use. If you need to combine several *geoWrite* files into one longer document, you can use *Combiner,* a utility which very neatly does just that.

There's even an answer to the NLQ problems. A desk accessory called *Text Print* will print out a *geoWrite* document using the built-in NLQ font of your printer with all the italic, underlining, and boldface you could want. A companion program, *Custom Print,* must be used to customize a copy of *Text Print* to your printer's specific control codes.

One other feature which *geoWrite* lacks is a word counter. With *geoSpell* you find out at the very end how many words you have, but there's no way to find that information without first going through the entire spelling-checker process. There are several utilities available to provide a word count with the click of the mouse. In the January 1988 issue of *COM-*

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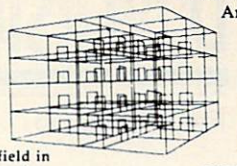

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PUTE!'s Gazette, there was a type-in program called *Word Count* by Shawn Smith which will fit the bill. Back issues and disks are still available from COMPUTE Publications at the Greensboro, North Carolina, office.

Several writing analyzers are available as public domain or shareware. *Blue Pencil*, one of the fine utilities from Student Software, will keep track of the number of words you've used of different lengths, as well as how many words you average per paragraph or sentence. Another, called *Copy Editor*, even makes a judgment as to the difficulty (grade level) of your prose. This helps you tailor your writing to your audience. Look for these on Q-Link or BBS Post, (616) 531-1346.

All this aside, there is something delightful about just watching all those great *GEOS* fonts trip across the screen in *geoWrite*. Let's face it, I think most people will agree that fonts are one of the best things about *GEOS*. It takes a graphics-based, WYSIWYG word processor like *geoWrite* to do them justice. In turn, they can make your routine word processing into full-fledged desktop publishing!

In the last column I mentioned several printer drivers which do a good job of smoothing out the jaggies that plague printouts of bitmapped images. Susan Lamb, a graphic artist whose efforts with *GEOS* will be featured in next month's column, put me onto a great driver for those of you have 24-pin printers and, like me, are disappointed in the haphazard way *GEOS* supports them. It's called *EPSON24pin90dpi*. It's available on QuantumLink and on BBS Post. It creates a somewhat shortened printout in *geoPublish*, but the quality is astonishing. If you have an Epson-compatible 24-pin printer, this file is a must! ❐

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D'IVERSIONS

Fred D'Ignazio

LIVE, REALITY TELEVISION

I woke up this morning, wandered into the kitchen, and found a poppyseed muffin. After I had popped the muffin into the microwave, I clicked on the tea kettle and switched on the TV. Suddenly I was watching three astronauts floating live around the Atlantis space shuttle, going 20,000 miles per hour in zero gravity, hundreds of miles above the surface of the earth.

Smile, America! Home movies are out; video news is in.

One male astronaut was stripped to the waist and wired up like a cardiac patient. He was reading a book and taking swigs of salt water from a plastic bottle. Another man floated around sideways, in shorts and white socks, eating a tortilla. And the third, a tired-looking female, was operating the shuttle's on-board camcorder that was taking these live TV pictures. The female astronaut was only inches in front of the camcorder lens. I felt as if she and her shuttle companions were with me in my kitchen. It seemed almost rude not to offer her a bite of my poppyseed muffin.

Welcome to live, reality TV!

More than 15 million Americans have camcorders, and more than 70 million have VCRs. TV cameras, VCRs, and TV screens showing electronic live and prerecorded images are everywhere: in department stores, in boutiques, inside bank teller machines, and hanging from tree branches on our state and federal roads and highways.

In Michigan, where I live, we motorists have become more cautious in recent weeks about our driving. That is because the state police have installed strings of video robocops in trees and bushes along several of the state's highways. Each high-tech robot policeman is composed of a video camera, computer, radio, and radar. When a speeding motorist zooms by, the hidden robot cameraman snaps a picture of the motorist's license plate, records the motorist's speed, and transmits the information to a central computer that mails the motorist a speeding ticket along with a snapshot that shows him whizzing by.

Several states are considering installing similar video-monitoring systems in people's homes to keep track of alcohol consumption by motorists who have been convicted of driving while intoxicated. The system is used during the period the person is on parole for his conviction. It is overseen by a central computer in a local police station.

The computer calls the person at random intervals via the local telephone system. The person walks up to the alcohol sensor and breathes into it, while the computer monitors the person's movements on a video camera. The computer instantly analyzes the person's movements and his or her breath. If alcohol is detected in the person's breath or his movements are especially erratic, the computer places a call to a police officer who races to the person's home and puts the offender under arrest.

Have you watched TV news lately? Have you noticed that the shots are filled with drama, real-life grit, glory, and gore? But they're also a tad jiggly, fuzzy, and abrupt, as if shot by a news cameraman who's got the heebie-jeebies.

The video footage you are watching has been shot by amateurs, like you and me. It's now an in thing even for network news programs and CNN to show amateur video on the air, especially if it captures a sensational news story as it's happening.

So you can forget videotaping birthday parties, family vacations, and holidays. Home movies are out; video news is in. Now you can become a combination sleuth, CIA agent, and high-tech snoop, all by keeping your eyes open and carrying your trusty video camera at your side. And you can make money, too.

Thousands of your friends and neighbors are doing likewise, and when they get video footage that seems hot, they bypass the local law enforcement officials and send it right to their local TV stations or even to New York, Washington, or Atlanta, to get it on national TV. Police watch TV more carefully these days. They know they might learn about a crime for the first time by seeing it on TV.

We are entering a video goldfish bowl. Camcorders are shrinking, getting more powerful zoom lenses, and dropping in price. Soon they'll be as ubiquitous as the Kodak Brownie or Instamatic. People will carry them wherever they go, aiming them at everything and everyone.

Life will be a video arena with everyone grabbing video slices of everyone else's life, in the hope that they can sell them for a few dollars to the evening news or programs patterned after the phenomenally successful "America's Funniest Home Videos."

You'd better watch out. The next time you slip down the porch stairs in front of your home or yell at your kids or drive above the speed limit, someone might capture that act on videotape and send you a ticket. Or maybe you'll see yourself on the evening news or a national comedy show. Your misfortunes could gladden the hearts of millions of viewers. It may feel like video martyrdom to you, but it's just live, reality TV! ❐

BEGINNER BASIC

Larry Cotton

MY FAVORITE BASIC KEYWORD

I don't ordinarily go around unabashedly touting a particular BASIC keyword, but RND is one I get excited about.

RND creates unpredictable havoc out of order—that's why I like it! Let's see if you can share some of my enthusiasm for this very useful function.

RND creates a virtually random number for use in games, music, graphics, and so forth. However, to generate the first random number, the function depends on a nonrandom seed, or starting number, that is automatically loaded into certain memory registers when the 64 is turned on.

To make the seed as random as possible, use the computer's internal clock (TI) as the argument and convert it to a negative value. The argument is a number inside the parentheses following RND. The best way to see RND in action is by example.

```
10 X=RND(-TI)
20 FORT=1TO5:PRINTRND(1):
   NEXT
```

After you run it, you should see five nonrepeating numbers between 0 and 1. Any positive number can be substituted for the 1, with similar results. Now enter and run this:

```
10 X=RND(-TI)
20 FORT=1TO5:PRINT2*RND
   (1):NEXT
```

You will now see five numbers between 0 and 2. We can truncate these numbers by adding the INT function.

```
10 X=RND(-TI)
20 FORT=1TO5:PRINTINT(2*
   RND(1)):NEXT
```

Be sure to use two opening and two closing parentheses.

How about random choices of two things, such as *Yes* and *No* for a Ouija board? Here's a way to do just that, using BASIC's ON and GOTO.

```
10 X=RND(-TI)
20 X=INT(2*RND(1))
30 ONX+1GOTO100,110
100 PRINT"YES":END
110 PRINT"NO":END
```

Run this program a few times and observe the results. Recall that ON and GOTO can control the flow of a BASIC program, so if X=0, then X+1=1, and control goes to line 100. If X=1, then X+1=2, and control jumps to line 110. To add a third alternative:

```
10 X=RND(-TI)
20 X=INT(3*RND(1))
30 ONX+1GOTO100,110,120
100 PRINT"YES":END
110 PRINT"NO":END
120 PRINT"MAYBE":END
```

To increase the range, change 3 to another number.

Again, using ON and GOTO, you can create a higher percentage of a particular response, thereby tilting the odds one way or another.

```
10 X=RND(-TI)
20 PRINTCHR$(147):POKE214,
   10:PRINT
30 X=INT(5*RND(1))+1
40 ONXGOTO50,50,50,60,60
50 PRINT"ODD":GOTO70
60 PRINT"EVEN"
70 GETA$:IFA$=""THEN70
80 GOTO20
```

Run this program; then touch any key to run it again. In line 30 we add 1 to the randomly generated number to yield numbers from 1 to 5, inclusive. If X is 1, 2, or 3, then line 50 will be the target GOTO line. If X is 4 or 5, line 60 will be chosen. The computer will seem randomly to choose between odd and even yet will pick, on average, three odds for every two evens. Shades of Las Vegas!

Speaking of Las Vegas, here's a short program to simulate rolling one die:

```
10 X=RND(-TI)
20 PRINTCHR$(147)
30 X=INT(6*RND(1))+1
40 PRINTX
50 GETA$:IFA$=""THEN50
60 GOTO30
```

A random number from 1 to 6 will be generated. Press any key to see another, or hold a key down to see a string of rolls. Now, what else can be done with this function?

RND can also produce interesting, if not beautiful, music. Enter this short program:

```
10 X=RND(-TI)
20 FORT=54272TO54295:
   POKET,0:NEXT
30 POKE54296,15
40 POKE54278,255
50 POKE54276,33
60 FORT=1TO500:NEXT
70 POKE54273,INT(100*RND
   (1))+10
80 FORT=1TO100:NEXT
90 GOTO70
```

RND seemingly sets the precise world of computing awry, creating unpredictable havoc out of order.

Line 20 clears the sound chip, line 30 turns up the volume, and line 40 sets sustain and release to maximum (attack and decay default to 0). Line 50 turns on the sawtooth waveform, and line 60 creates a short pause.

Line 70 pokes a random frequency from 10 through 100 into voice 1's main frequency register. Line 80 allows the selected tone to sound a moment; then line 90 returns control to line 70, which generates another (probably different) random frequency and pokes it to the frequency register again. Press the Run/Stop key to halt the program.

Now experiment. Change lines 60 and 70 so that tone lengths and pitches, respectively, are also random. ❐

PROGRAMMER'S PAGE

Randy Thompson

HOW OLD ROMS THWART FLOODS

As flood waters threaten to engulf you, this short program for the 64 is your only hope for survival.

An empty screen is all I saw when I first ran *Flood,* the game with the surprisingly short listing located at the end of this page. After 20 seconds of blank blue, however, I decided something was wrong with this submission.

Trusting that author Geza Lucz of La Jolla, California, wouldn't send me a game with no visible graphics, I hit Run/Stop and typed LIST to diagnose the problem. It turns out the problem was simple, and one I've dealt with before.

You see, I have a very old 64. I bought this machine back when a blank bright blue computer-generated screen seemed impressive. Anyway, if you own one of these elderly computers, then you know that the ROMs housed within it handle screen color memory differently from 128s and late model 64s.

By default, color memory on an old 64 is set to the text's background color instead of its foreground color. This means that if you poke a character into screen memory, it won't appear unless you also poke a nonbackground color into the corresponding color memory location. So all the characters that *Flood* was laboriously poking across my screen might as well have been spaces, since they adopted the same color as the rest of the screen.

The most obvious solution to this problem is to add a POKE to color memory for every POKE to screen memory. This would slow down the game, however. A better solution is to do as the new 64 ROMs do—preset all of color memory to the foreground color so that any POKE to screen memory produces visible results. This can be achieved with the loop FOR I=55296 TO 56295: POKE I, *color*: NEXT strategically placed at the beginning of the program.

But there's an even easier way—one that takes advantage of the way old 64s fill screen memory with the current background color whenever the screen is cleared. Take a look at this.

```
POKE 53281,14:PRINT
CHR$(147):POKE 53281,6
```

The first POKE sets the screen's background color to the color that we want our game's characters to appear in. Next, the PRINT CHR$(147) clears the screen, forcing the computer to fill color memory with the current background color (which, unbeknownst to the computer, is actually our desired foreground color). Finally, the last POKE sets the screen's background color back to normal. Now a POKE to screen memory results in a visible character, no matter how young or how old your 64. You can see this code added to line 100 of the *Flood* program described below.

With the game graphics working, I found *Flood* to be quite entertaining. It's also a good example of what you can do with standard Commodore characters and direct access to screen memory.

The object of the game is to contain a spreading body of water (represented by a growing group of asterisks) by building flood walls. Your score is determined by how quickly and effectively you accomplish this task.

Your onscreen persona appears as a square checkerboard that moves about the screen via the cursor keys. To build a flood wall where you stand, hit Return. Be careful that you don't wall yourself in, since nothing—not even your stylish square body—can scale the sturdy walls. So have fun and good luck.

Send your programming tips and tricks to Programmer's Page, COMPUTE's Gazette, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. We pay $25–$50 for each tip we use. ❐

RAMDRIVE 64

By Hong Pham

How would you like to have another disk drive that lets you access programs and files almost instantly? That's what you get with *Ramdrive 64.*

This program adds a virtual RAM drive to your 64. With information stored in memory, it doesn't have to access a mechanical disk drive. Programs load and save extremely fast. A 70-block program can load in less than four seconds.

What's more, *Ramdrive* does not use any BASIC memory. Instead, it uses the RAM under BASIC and Kernal ROM ($A000–$BFFF and $D000–$FFFF) to store files. That's about 80 blocks: 77 blocks to store data and 3 for the block availability map and directory.

Getting Started

Ramdrive is written entirely in machine language. To enter the program, use *MLX,* our machine language entry program. When *MLX* prompts you, respond with the following values.

Starting address: 7D00
Ending address: 86CF

When you have finished typing in *Ramdrive,* be sure to save it to a work disk under the name RAMDRIVE.OBJ because *Relocator,* a companion program mentioned below, searches for that name. To use *Ramdrive,* load it with LOAD "RAMDRIVE.OBJ",8,1 and then type SYS 32000, or whatever address you may have relocated it to.

Different Device

Ramdrive acts like any other storage device, such as a 1541 disk drive. That means you can load and save to it as if you were using an external disk drive. Like any device, *Ramdrive* has its own device number. The default device number is 7.

To save to the RAM drive, use the standard SAVE command. For example, SAVE "*filename*",7 with *filename* being the name of your file. A maximum of 77 blocks or a total of 30 files can be saved to the RAM drive. To load from the RAM drive, use LOAD "*filename*",7. Wildcard scans are allowed in a load operation. An asterisk (*) will either load the first file on the directory or the first file with the matching character pattern preceding the asterisk. A question mark (?) can be used to replace an unknown character. Remember that information saved to a RAM drive is not permanent. It's lost once the computer is turned off. So be sure to save any alterations you may have made and want to keep to a disk before you turn off your computer.

RAM Drive Commands

Any device without a good BASIC interface would be clumsy and awkward to use. *Ramdrive 64* adds eight new BASIC commands to make accessing data and programs easier.

BLOAD "*filename*", *device number, starting address*

Load a binary file from a device and put it at a specified location in memory. Unlike the standard LOAD command, BLOAD does not corrupt BASIC pointers and reruns any BASIC program already in memory.

BSAVE "*filename*", *device number, starting address, ending address*

Save a binary file to a device from a specified memory location.

RDIR

Display the RAM drive directory with RDIR. Unlike in the disk directory display, the file length and the free RAM space are displayed in bytes. LOAD "$",7 has the same effect as RDIR.

ERASE "*filename*"

Use this command to erase a file from the RAM drive. As with the LOAD command, wildcard scans are allowed in ERASE. To erase all the files in the directory, use ERASE "*".

DEVICE *0–255*

Change the RAM drive device number with this command. Any number between 0 and 255 can be used, but the default RAM drive device number is 7. If you forget what number you assign to the device, enter DEVICE without an argument, and *Ramdrive* will display the current RAM drive device number.

INIT

This command will initialize the RAM drive. Unlike ERASE "*", INIT clears everything: both the block availability map and the directory. On activation, *Ramdrive* initializes itself. If you accidentally disable the program and don't want to initialize the RAM drive itself, use SYS 32003 or SYS whatever address you choose, and add 3 to it.

VALIDATE

Validate the RAM drive. Although *Ramdrive* validates after every unsuccessful SAVE, use VALIDATE to fix the directory if you have problems.

DISABLE

Use this command to disable *Ramdrive.* SYS 65418 normally restores vectors, but it will not disable *Ramdrive,* nor will Run/Stop–Restore because the load and save vectors are fixed whenever a BASIC command is used. The previous load, save, and BASIC system vectors are restored when *Ramdrive* is disabled.

Although these next two features were originally debugging tools, I thought them too good to leave out. To warm reset the system, hit the space bar and Restore key simultaneously. The Run/Stop key is disabled. To reset the system to the power-up state, press the Back Arrow and Restore keys simultaneously. This routine is a handy debugging tool if you don't have a reset switch and your computer is too corrupt to warm start.

Relocate

Because there is no definite safe memory location in the 64, a conflict for the same memory could result between *Ramdrive* and another program. Where *Ramdrive* is situated, it is safe from programs such as *Metabasic, Bassem,* and *Micromon,* but lengthy BASIC programs or strings could overwrite *Ramdrive.*

Relocator solves this potential problem by relocating *Ramdrive* to another location anywhere in memory. Once

again, enter this program with *MLX* with the following prompts and be sure to save a copy.

Starting address: 0801
Ending address: 0FB8

Relocator loads and runs like a BASIC program. Once the file has been loaded, type RUN. When *Relocator* prompts for the new starting address for *Ramdrive*, enter the address in hexadecimal. If you don't have a good scientific calculator handy to convert decimal to hexadecimal, the following program may help.

```
PE 10 H$ = "0123456789ABCDEF": B = 16:
   B1 = 2↑B
FP 20 INPUT "ENTER DECIMAL VALUE";N: IF
   ABS(N)>B1-1 THEN 20
PP 30 N$ = "": IFN<0 THEN N = B1+N
FF 40 FOR I = 1 TO B/4:T = N-(INT(N/16)*16):
   N$ = MID$(H$,T+1,1)+N$:N = N/16
CG 50 NEXT: PRINTN$
```

After *Relocator* relocates *Ramdrive*, insert a work disk to save the relocated version of *Ramdrive*. If the save is successful, you may exit to BASIC or relocate another copy of *Ramdrive*. Be sure to remember your new starting address and to add 3 to it when you want to run it.

RAMDRIVE 64

```
7D00:20 F5 81 20 AE 84 20 DF 62
7D08:84 A9 81 A2 7D 8D FA FF 22
7D10:8E FB FF 20 44 E5 20 6B B8
7D18:84 A2 08 20 62 84 A9 A6 20
7D20:A0 85 20 1E AB A9 BF A0 D6
7D28:85 20 1E AB A2 06 20 62 3C
7D30:84 4C 34 85 48 8A 48 98 F4
7D38:48 AD 01 DC C9 EF F0 09 A9
7D40:C9 FD F0 1D 20 ED F6 D0 07
7D48:15 20 12 85 20 81 FF 20 97
7D50:8A FF 20 F3 84 20 84 FF 81
7D58:EA EA EA 6C 02 A0 4C 9F 72
7D60:7D A2 FF 78 9A D8 E8 8A DE
7D68:95 02 E8 D0 FB 20 A3 FD 7E
7D70:A2 00 A0 A0 20 8C FD 20 2A
7D78:15 FD 20 5B FF 58 6C 00 71
7D80:A0 48 8E 95 7D 20 EF 81 D6
7D88:78 A9 99 A2 7D 8D 5F 7D E5
7D90:8E 60 7D 68 A2 FF 4C 34 03
7D98:7D 20 12 85 20 E4 81 68 F4
7DA0:A8 68 AA 68 40 20 73 00 4F
7DA8:20 D4 E1 A6 2D A4 2E A9 91
7DB0:2B 20 D8 FF B0 03 4C 3B C9
7DB8:7E 08 48 AD 46 85 C5 BA 67
7DC0:F0 05 68 28 4C F9 E0 68 79
7DC8:28 6C 00 03 A5 7A A6 7B 03
7DD0:8D 62 85 8E 63 85 A9 00 49
7DD8:8D 61 85 20 F3 84 A9 64 0F
7DE0:A2 85 85 29 86 2A 20 73 62
7DE8:00 C9 94 F0 B8 20 1D 85 FD
7DF0:A0 00 B1 29 F0 29 20 73 E4
7DF8:00 D1 29 D0 03 C8 D0 F2 6A
7E00:20 1D 85 EE 61 85 EE 61 54
7E08:85 AD 61 85 C9 12 B0 25 D4
7E10:A0 00 20 97 82 B1 29 D0 D8
7E18:F9 20 97 82 4C ED 7D 20 6A
7E20:73 00 AE 61 85 BD 94 85 94
7E28:8D 33 7E E8 BD 94 85 8D EF
7E30:34 7E 4C FF FF 20 1D 85 B0
7E38:4C 3D 7E C6 7A 4C FF FF EB
7E40:20 57 E2 20 BD FF 20 F1 A1
7E48:B7 A9 0F A0 00 20 BA FF 6D
7E50:20 28 85 84 C3 85 C4 A9 C7
7E58:00 20 A2 F4 08 A5 BA CD 1B
7E60:46 85 F0 04 28 4C 3B 7E A7
7E68:28 B0 02 90 CE 6C 00 03 1A
7E70:20 57 E2 20 BD FF AE 46 43
7E78:85 20 F1 B7 A9 0F A0 08 CC
7E80:20 BA FF 20 28 85 84 C1 60
7E88:85 C2 20 28 85 84 AE 85 A0
7E90:AF 20 EA F5 4C 5C 7E 20 1B
7E98:10 83 4C 3B 7E 20 F5 81 9D
7EA0:A9 66 A0 86 20 1E AB 4C A5
7EA8:3B 7E 20 57 E2 86 22 84 56
7EB0:23 A8 D0 05 A2 08 6C 00 E1
7EB8:03 98 A6 22 A4 23 20 BD 04
7EC0:FF AD 46 85 85 BA 20 BA 5C
7EC8:FF 20 70 84 4C 3B 7E 20 90
7ED0:E4 81 20 D2 82 20 EF 81 C7
7ED8:4C 3B 7E 20 79 00 F0 0A 54
7EE0:C9 3A F0 06 20 F4 B7 8E A2
7EE8:46 85 20 31 85 4C 3B 7E D3
7EF0:A9 47 A2 FE 8D 18 03 8E 3A
7EF8:19 03 AD 7A 7F AE 7B 7F CD
7F00:8D 30 03 8E 31 03 AD 48 54
7F08:80 AE 49 80 8D 32 03 8E ED
7F10:33 03 AD 3E 7E AE 3F 7E AE
7F18:8D 08 03 8E 09 03 AD 46 1F
7F20:7F AE 47 7F 8D 00 03 8E 6C
7F28:01 03 A9 7E A0 86 20 1E 03
7F30:AB 4C 3B 7E 38 E0 41 F0 20
7F38:0F E0 42 F0 11 E0 43 F0 D1
7F40:13 E0 44 F0 15 4C FF FF 72
7F48:A9 93 A0 86 B0 10 A9 9F 36
7F50:A0 86 B0 0A A9 AE A0 86 C7
7F58:B0 04 A9 BC A0 86 48 20 81
7F60:6B 84 A9 3F 20 D2 FF 68 14
7F68:20 1E AB 4C 65 A4 85 93 95
7F70:A5 BA CD 46 85 F0 05 A5 AE
7F78:93 4C FF FF A5 93 D0 F7 69
7F80:20 AF F5 A5 B7 10 04 38 D2
7F88:A2 08 60 A0 00 B1 BB C9 F8
7F90:24 D0 09 20 D2 F5 20 6B 13
7F98:84 4C 10 83 20 E4 81 20 DE
7FA0:3B 82 20 EF 81 90 03 A2 D7
7FA8:04 60 20 D2 F5 20 E4 81 6E
7FB0:20 3B 82 8D C7 82 A9 00 53
7FB8:85 90 8D C6 82 AA 20 C5 81
7FC0:82 8D F0 7F E8 A8 D0 07 0D
7FC8:20 C5 82 8D 05 80 E8 A5 14
7FD0:B9 F0 11 20 C5 82 8D 47 A7
7FD8:85 E8 20 C5 82 98 AE 47 50
7FE0:85 4C E8 7F A6 C3 A4 C4 1D
7FE8:86 29 84 2A A2 03 A8 A9 C4
7FF0:FF D0 1F E8 8E C6 82 AA D5
7FF8:EE 05 80 20 C5 82 91 29 47
8000:20 97 82 E8 E0 FF 90 F3 F1
8008:20 EF 81 18 98 A6 29 A4 1D
8010:2A 60 8D 21 80 20 C5 82 94
8018:91 29 20 97 82 E8 D0 F5 F8
8020:A9 FF 8D C7 82 8E C6 82 82
8028:20 C5 82 F0 06 8D 21 80 33
8030:E8 D0 E2 E8 20 C5 82 8D 6F
8038:05 80 EE 05 80 E8 D0 BB 0F
8040:A5 BA CD 46 85 F0 03 4C 23
8048:FF FF 20 8F F6 A5 B7 D0 D4
8050:04 38 A2 08 60 20 E4 81 05
8058:20 3B 82 B0 05 A2 41 4C 15
8060:A5 82 20 C9 82 A0 11 A2 D0
8068:00 B1 27 F0 0F 30 0D 20 3D
8070:80 82 E8 E0 1E D0 F2 A2 3A
8078:42 4C A5 82 A0 00 B1 BB AE
8080:C9 2A F0 08 C9 A0 F0 04 46
8088:C9 3F D0 05 A2 44 4C A5 0D
8090:82 91 27 C8 C4 B7 90 E6 B5
8098:A9 A0 C0 10 B0 05 91 27 93
80A0:C8 D0 F7 20 8C 82 90 03 CD
80A8:4C A3 82 48 A9 01 9D 50 6A
80B0:FD 68 8D 60 85 A0 10 91 E2
80B8:27 C8 A9 80 91 27 A5 AE DF
80C0:E5 C1 8D 5E 85 A0 12 91 21
80C8:27 A5 AF E5 C2 8D 5F 85 AB
80D0:A0 13 91 27 AD 60 85 85 0B
80D8:2A A0 00 84 29 AD 5F 85 A3
80E0:D0 3F AD 5E 85 C9 FC B0 B3
80E8:38 A9 00 91 29 20 97 82 05
80F0:AD 5E 85 91 29 20 97 82 A5
80F8:A5 C1 91 29 20 97 82 A5 0C
8100:C2 91 29 20 97 82 AE 5E 72
8108:85 E8 B1 C1 91 29 C8 CA E7
8110:D0 F8 A0 11 A9 01 91 27 7A
8118:18 20 EF 81 A6 AE A4 AF 2E
8120:60 A5 C1 A6 C2 8D B4 82 97
8128:8E B5 82 20 8C 82 90 03 C4
8130:4C A3 82 A0 00 91 29 20 55
8138:97 82 A5 C1 91 29 20 97 81
8140:82 A5 C2 91 29 20 97 82 DA
8148:20 B3 82 91 29 C8 C0 FD 9D
8150:D0 F6 20 B7 82 20 8C 82 29
8158:85 2A A0 00 84 29 A9 01 D9
8160:9D 50 FD 38 AD 5E 85 E9 65
8168:FD 8D 5E 85 AD 5F 85 E9 D1
8170:00 8D 5F 85 AD 5F 85 D0 E1
8178:2F AD 5E 85 C9 FE B0 28 76
8180:A9 00 91 29 20 97 82 AE 30
8188:5E 85 E8 E8 8A 91 29 20 D4
8190:97 82 EE 5E 85 A2 00 20 9A
8198:B3 82 91 29 C8 CC 5E 85 96
81A0:D0 F5 20 B7 82 4C 12 81 F3
81A8:20 8C 82 90 03 4C A3 82 4B
81B0:91 29 20 97 82 20 B3 82 C2
81B8:91 29 C8 C0 FF D0 F6 20 45
81C0:B7 82 20 8C 82 85 2A A0 2C
81C8:00 84 29 A9 01 9D 50 FD C9
81D0:38 AD 5E 85 E9 FF 8D 5E 48
81D8:85 AD 5F 85 E9 00 8D 5F 18
81E0:85 4C 74 81 78 A5 01 8D 4A
81E8:F0 81 A9 F4 85 01 60 A9 E3
81F0:37 85 01 58 60 A2 00 8A AE
81F8:9D A0 FD 9D 00 FE 9D F2 B6
8200:FE E8 D0 F4 A2 00 8A 9D EF
8208:50 FD E8 E0 4F D0 F8 60 EF
8210:C9 A0 90 18 C9 C0 B0 06 6E
8218:38 E9 A0 AA 18 60 C9 D0 19
8220:90 0A C9 FD B0 06 38 E9 01
8228:B0 4C 1B 82 38 60 18 E0 78
8230:20 B0 04 8A 69 A0 60 8A B3
```

```
8238:69 AF 60 20 C9 82 A2 00 89
8240:A0 00 B1 BB C9 2A F0 24 84
8248:C9 3F F0 04 D1 27 D0 0F 3C
8250:C8 C4 B7 90 ED C0 10 F0 6E
8258:13 B1 27 C9 A0 F0 0D E8 A0
8260:E0 1F F0 06 20 80 82 4C 70
8268:40 82 38 60 A0 11 B1 27 0F
8270:F0 ED 30 EB 18 88 B1 27 9B
8278:48 A0 12 B1 27 A8 68 60 34
8280:18 A5 27 69 14 85 27 90 0C
8288:02 E6 28 60 A2 4C BD 50 65
8290:FD F0 0B CA 10 F8 38 E6 9A
8298:29 D0 02 E6 2A 60 20 2E 56
82A0:82 18 60 A2 43 8E 48 85 8D
82A8:20 D2 82 AE 48 85 38 20 96
82B0:EF 81 60 B9 FF FF 60 18 8E
82B8:98 6D B4 82 8D B4 82 90 F8
82C0:03 EE B5 82 60 BD FF FF DB
82C8:60 A9 A0 A2 FD 85 27 86 81
82D0:28 60 20 C9 82 20 04 82 C1
82D8:A2 00 8E 47 85 A0 11 B1 F7
82E0:27 F0 22 30 20 88 B1 27 AA
82E8:8D FC 82 48 A9 00 8D FB 2D
82F0:82 68 20 10 82 A9 01 9D B0
82F8:50 FD AD FF FF 8D FC 82 0E
8300:F0 03 4C F2 82 EE 47 85 DC
8308:AD 47 85 C9 1E D0 CE 60 37
8310:20 6B 84 A2 03 20 62 84 9E
8318:A9 04 A0 86 20 1E AB 20 62
8320:6B 84 A9 12 20 D2 FF A2 43
8328:04 20 62 84 A9 43 A0 86 EF
8330:20 1E AB A2 09 20 62 84 80
8338:A9 4C A0 86 20 1E AB A2 17
8340:04 20 62 84 20 6B 84 20 BD
8348:E4 81 20 C9 82 A9 00 8D 0B
8350:48 85 8D 61 85 A0 00 B1 05
8358:27 99 49 85 C8 C0 14 D0 1D
8360:F6 A0 11 B9 49 85 F0 35 40
8368:30 33 20 EF 81 EE 61 85 67
8370:A2 00 BD 49 85 20 D2 FF 67
8378:E8 E0 10 D0 F5 A9 20 20 F1
8380:D2 FF AD 5B 85 AE 5C 85 81
8388:20 FA 83 A9 1C A0 86 20 F9
8390:1E AB 20 6B 84 20 E1 FF B4
8398:F0 13 20 E4 81 20 80 82 3F
83A0:EE 48 85 AD 48 85 C9 1E C6
83A8:F0 03 4C 55 83 20 EF 81 C5
83B0:20 6B 84 A9 20 20 D2 FF F4
83B8:AE 61 85 A9 00 20 CD BD 94
83C0:A9 2B A0 86 20 1E AB 20 D4
83C8:E4 81 A9 00 8D 61 85 A2 77
83D0:4C BD 50 FD D0 03 EE 61 29
83D8:85 CA 10 F5 20 EF 81 A9 24
83E0:20 20 D2 FF AD 61 85 A2 FA
83E8:00 20 CD BD A9 1C A0 86 13
83F0:20 1E AB A9 23 A0 86 4C 94
83F8:1E AB 8D 57 85 8E 58 85 BD
8400:A9 00 8D 59 85 8D 5A 85 C1
8408:8D 5B 85 8D 5C 85 A2 0F 85
8410:0E 57 85 2E 58 85 78 F8 4C
8418:AD 59 85 6D 59 85 8D 59 2B
8420:85 AD 5A 85 6D 5A 85 8D 68
8428:5A 85 AD 5B 85 6D 5B 85 49
8430:8D 5B 85 D8 58 CA 10 D8 FB
8438:A2 02 BD 59 85 48 4A 4A 8C
8440:4A 4A 20 4F 84 68 29 0F 21
8448:20 4F 84 CA 10 EC 60 CD 35
8450:5C 85 D0 04 A9 20 D0 07 B9
8458:09 30 A0 FF 8C 5C 85 4C 33
8460:D2 FF A9 20 20 D2 FF CA 21
8468:D0 FA 60 A9 0D 4C D2 FF 7E
8470:20 E4 81 A9 00 8D 47 85 D7
8478:8D 48 85 20 3B 82 B0 09 5B
8480:A0 11 A9 00 91 27 EE 48 A2
8488:85 20 80 82 EE 47 85 AD E1
8490:47 85 C9 1E D0 E5 20 D2 EA
8498:82 20 EF 81 20 6B 84 A9 62
84A0:00 AE 48 85 20 CD BD A9 14
84A8:51 A0 86 4C 1E AB AD 30 43
84B0:03 AE 31 03 8D 7A 7F 8E 21
84B8:7B 7F AD 32 03 AE 33 03 74
84C0:8D 48 80 8E 49 80 AD 08 4B
84C8:03 AE 09 03 8D 3E 7E 8E 41
84D0:3F 7E AD 00 03 AE 01 03 A6
84D8:8D 46 7F 8E 47 7F 60 A9 B5
84E0:CC A2 7D 8D 08 03 8E 09 F3
84E8:03 A9 34 A2 7F 8D 00 03 C3
84F0:8E 01 03 A9 34 A2 7D 8D 31
84F8:18 03 8E 19 03 A9 6E A2 70
8500:7F 8D 30 03 8E 31 03 A9 4D
8508:40 A2 80 8D 32 03 8E 33 B2
8510:03 60 A9 9F A2 7D 8D 5F 69
8518:7D 8E 60 7D 60 AD 62 85 6D
8520:85 7A AD 63 85 85 7B 60 12
8528:20 0E E2 20 8A AD 4C F7 C0
8530:B7 20 6B 84 A9 E9 A0 85 90
8538:20 1E AB A9 00 AE 46 85 B7
8540:20 CD BD 4C 6B 84 07 00 C6
8548:00 00 00 00 00 00 00 00 53
8550:00 00 00 00 00 00 00 00 5B
8558:00 00 00 00 00 00 00 00 63
8560:00 00 00 00 42 93 00 42 0E
8568:94 00 52 44 49 52 00 52 32
8570:D6 00 49 4E 49 54 00 45 D5
8578:52 41 53 45 00 C5 49 44 A9
8580:41 54 45 00 44 49 53 41 19
8588:42 4C 45 00 44 45 56 49 9D
8590:43 45 00 00 40 7E 70 7E E9
8598:97 7E 97 7E 9D 7E AA 7E A4
85A0:CF 7E F0 7E DB 7E 43 36 CE
85A8:34 20 52 41 4D 2D 44 52 2E
85B0:49 56 45 20 49 4E 53 54 1F
85B8:41 4C 4C 45 44 0D 00 0D B8
85C0:20 20 43 4F 50 59 52 49 17
85C8:47 48 54 20 31 39 39 31 28
85D0:20 42 59 20 48 4F 4E 47 0D
85D8:20 50 48 41 4D 20 2F 56 C4
85E0:39 31 30 37 31 32 0D 0D C7
85E8:00 52 41 4D 44 52 49 56 D9
85F0:45 20 44 45 56 49 43 45 27
85F8:20 4E 55 4D 42 45 52 20 13
8600:49 53 20 00 43 36 34 20 06
8608:52 41 4D 44 52 49 56 45 26
8610:20 44 49 52 45 43 54 4F BB
8618:52 59 0D 00 20 42 59 54 57
8620:45 53 00 20 46 52 45 45 F1
8628:2E 0D 00 20 46 49 4C 45 C6
8630:28 53 29 20 49 4E 20 44 55
8638:49 52 45 43 54 4F 52 59 39
8640:2E 0D 00 46 49 4C 45 4E 60
8648:41 4D 45 00 53 49 5A 45 AB
8650:00 20 46 49 4C 45 53 28 09
8658:53 29 20 53 43 52 41 54 CC
8660:43 48 45 44 2E 00 0D 52 EB
8668:41 4D 44 52 49 56 45 20 65
8670:49 4E 49 54 49 41 4C 49 55
8678:5A 45 44 2E 0D 00 0D 52 44
8680:41 4D 44 52 49 56 45 20 7D
8688:44 49 53 41 42 4C 45 44 9A
8690:2E 0D 00 46 49 4C 45 20 82
8698:45 58 49 53 54 53 00 44 F0
86A0:49 52 45 43 54 4F 52 59 A1
86A8:20 46 55 4C 4C 00 52 41 0F
86B0:4D 44 52 49 56 45 20 46 A2
86B8:55 4C 4C 00 49 4C 4C 45 66
86C0:47 41 4C 20 46 49 4C 45 82
86C8:4E 41 4D 45 00 00 00 00 4B
```

RELOCATOR

```
0801:0E 08 C7 07 9E 20 28 32 7B
0809:30 36 34 29 00 00 00 78 50
0811:A2 FF 9A 20 A3 FD 20 15 32
0819:FD 20 5B FF 58 A9 05 20 2F
0821:D2 FF A9 93 20 D2 FF A9 FE
0829:00 20 90 FF A9 06 8D 20 F3
0831:D0 8D 21 D0 A2 02 A0 0A A6
0839:18 20 F0 FF A9 0F 8D 86 A6
0841:02 A9 AF 20 0D 0D A2 8A 21
0849:A0 0E 20 20 0D 20 15 0D 53
0851:A9 0B 8D 86 02 A9 B7 20 59
0859:0D 0D 18 A0 02 A2 06 20 07
0861:F0 FF A2 A4 A0 0E 20 20 26
0869:0D 18 A0 00 A2 09 20 F0 84
0871:FF AD 69 0E F0 03 4C DF 07
0879:08 A2 C9 A0 0E 20 20 0D B7
0881:A0 04 A2 0A 18 20 F0 FF FA
0889:A2 F3 A0 0E 20 20 0D 20 98
0891:34 0D 20 34 0D 20 E4 FF F8
0899:F0 FB A2 13 A0 0F 20 20 48
08A1:0D A9 05 A6 BA A0 FF 20 26
08A9:BA FF A9 10 A2 6A A0 0E 5B
08B1:20 BD FF A9 00 20 D5 FF 08
08B9:20 B7 FF 29 0F F0 1F A2 77
08C1:21 A0 0F 20 20 0D A2 39 22
08C9:A0 0F 20 20 0D 20 E4 FF A6
08D1:C9 59 F0 07 C9 4E D0 F5 CA
08D9:6C FC FF 4C 10 08 A9 01 19
08E1:8D 69 0E A2 4A A0 0F 20 12
08E9:20 0D A9 00 8D A2 0D 85 19
08F1:CC A9 01 8D 86 02 20 E4 2D
08F9:FF F0 FB C9 0D F0 21 C9 9A
0901:14 F0 0D A2 0F DD 7A 0E 18
0909:F0 20 CA 10 F8 4C F7 08 E6
0911:AD A2 0D F0 E1 A9 14 20 51
0919:D2 FF CE A2 0D 4C F7 08 2A
0921:AD A2 0D C9 04 90 CF 4C 3F
0929:4C 09 AE A2 0D 9D A3 0D D6
0931:20 D2 FF EE A2 0D AD A2 3E
0939:0D C9 04 D0 B9 20 E4 FF E9
0941:C9 14 F0 CC C9 0D F0 D8 65
0949:4C 3E 09 A9 01 85 CC A9 2E
0951:20 20 D2 FF AE A3 0D AC A0
0959:A4 0D 20 39 0D 8D 99 0D 77
0961:AE A5 0D AC A6 0D 20 39 83
0969:0D 8D 98 0D 20 34 0D A2 D7
0971:61 A0 0F 20 20 0D 20 97 4D
0979:0A A2 71 A0 0F 20 20 0D B7
0981:A9 00 85 CC 8D A2 0D 20 17
0989:E4 FF C9 0D F0 26 C9 14 DF
0991:F0 2A C9 20 90 F1 C9 80 42
0999:B0 03 4C A2 09 C9 A0 90 B9
09A1:E6 AE A2 0D E0 10 F0 DF 01
09A9:20 D2 FF 9D A3 0F EE A2 34
09B1:0D 4C 88 09 AD A2 0D F0 02
09B9:CE 4C D2 09 AE A2 0D F0 3C
09C1:C6 A9 14 20 D2 FF A9 00 10
09C9:9D A3 0F CE A2 0D 4C 88 CC
```

```
09D1:09 A9 01 85 CC A9 20 20 B8
09D9:D2 FF 20 34 0D A2 85 A0 3B
09E1:0F 20 20 0D AE A2 0D A0 13
09E9:00 B9 9F 0F 9D A3 0F EE D7
09F1:A2 0D E8 C8 C0 04 D0 F1 EB
09F9:18 AD 9A 0D 6D 9E 0D 8D 35
0A01:A9 0D AD 9B 0D 6D 9F 0D 07
0A09:8D AA 0D AD 9E 0D AE 9F 31
0A11:0D 85 FD 86 FE AD A2 0D 36
0A19:A2 A3 A0 0F 20 BD FF A9 0E
0A21:05 A6 BA A0 05 20 BA FF E0
0A29:20 C0 FF 20 B7 FF 29 0F 9E
0A31:F0 03 4C 6C 0D A2 05 20 EB
0A39:C9 FF AD 98 0D 20 D2 FF FF
0A41:AD 99 0D 20 D2 FF A0 00 0E
0A49:B1 FD 20 D2 FF 20 B7 FF D6
0A51:29 0F F0 03 4C 6C 0D E6 21
0A59:FD D0 02 E6 FE 38 AD A9 2D
0A61:0D E5 FD 8D A8 0D AD AA 8D
0A69:0D E5 FE 0D A8 0D B0 D8 E1
0A71:A9 05 20 C3 FF 20 CC FF F5
0A79:20 34 0D 20 34 0D A2 91 FA
0A81:A0 0F 20 20 0D 20 E4 FF 62
0A89:C9 59 D0 03 4C 10 08 C9 9F
0A91:4E D0 F2 6C FC FF 20 8E DC
0A99:0C AD 9E 0D AE 9F 0D 8D 5F
0AA1:BC 0A 8E BD 0A AD 96 0D 85
0AA9:AE 97 0D 8D B9 0A 8E BA 43
0AB1:0A A2 00 AC 9B 0D C8 BD 9E
0AB9:FF FF 9D FE FF E8 D0 F7 AE
0AC1:EE BA 0A EE BD 0A 88 D0 24
0AC9:EE 20 D3 0A 20 08 0C 4C FD
0AD1:2C 0C 18 AD 96 0D 6D 9C 3D
0AD9:0D 8D A0 0D AD 97 0D 6D 10
0AE1:9D 0D 8D A1 0D AE 01 40 39
0AE9:A0 00 A2 00 B1 FD DD 36 1A
0AF1:0E F0 2B E8 E0 30 D0 F6 9D
0AF9:A2 00 DD F3 0D F0 10 E8 8F
0B01:E0 4F D0 F6 91 FB 20 50 F1
0B09:0C 20 64 0C 4C E9 0A 91 2A
0B11:FB 20 50 0C B1 FD 91 FB 9C
0B19:20 50 0C 4C 0A 0B 91 FB 35
0B21:20 50 0C B1 FD 8D A2 0D 70
0B29:20 56 0C B1 FD 8D A3 0D FB
0B31:20 56 0C 38 AD A0 0D ED E9
0B39:A2 0D 8D A4 0D AD A1 0D 4F
0B41:ED A3 0D 0D A4 0D 90 50 74
0B49:38 AD 96 0D ED A2 0D 8D 2C
0B51:A4 0D AD 97 0D ED A3 0D A0
0B59:0D A4 0D B0 3B 38 AD A2 84
0B61:0D ED 96 0D 8D A4 0D AD E3
0B69:A3 0D ED 97 0D 8D A5 0D C2
0B71:18 AD 98 0D 6D A4 0D 8D 88
0B79:A6 0D AD 99 0D 6D A5 0D EB
0B81:8D A7 0D A0 00 AD A6 0D 05
0B89:91 FB 20 5D 0C AD A7 0D B4
0B91:91 FB 20 5D 0C 4C 0A 0B F9
0B99:A0 00 AD A2 0D 91 FB 20 A6
0BA1:5D 0C AD A3 0D 91 FB 20 20
0BA9:5D 0C 4C 0A 0B A0 00 B1 28
0BB1:FD 8D A2 0D C8 B1 FD 8D E5
0BB9:A4 0D C8 B1 FD 8D A3 0D 14
0BC1:C8 B1 FD 8D A5 0D 38 AD C0
0BC9:A4 0D ED 96 0D 8D A4 0D 91
0BD1:AD A5 0D ED 97 0D 8D A5 5A
0BD9:0D 18 AD A4 0D 6D 98 0D D8
0BE1:8D A4 0D AD A5 0D 6D 99 3A
0BE9:0D 8D A5 0D A0 00 AD A2 72
0BF1:0D 91 FB C8 AD A4 0D 91 AA
0BF9:FB C8 AD A3 0D 91 FB C8 9F
0C01:AD A5 0D 91 FB C8 60 20 F7
0C09:8E 0C A9 34 8D AC 0D AE CB
0C11:AC 0D BD AC 0D A8 BD AB 77
0C19:0D 20 A3 0C 20 AE 0B CE 95
0C21:AC 0D CE AC 0D AE AC 0D 01
0C29:D0 E5 60 20 8E 0C A9 12 3B
0C31:8D AC 0D AE AC 0D BD E0 BD
0C39:0D A8 BD DF 0D 20 A3 0C F3
0C41:20 CC 0C CE AC 0D CE AC EE
0C49:0D AE AC 0D D0 E5 60 20 F8
0C51:56 0C 4C 5D 0C E6 FD D0 BF
0C59:02 E6 FE 60 E6 FB D0 02 DC
0C61:E6 FC 60 38 A5 FB ED 9E 53
0C69:0D 8D A2 0D A5 FC ED 9F 2D
0C71:0D 8D A3 0D 38 AD A2 0D 83
0C79:ED 9A 0D 8D A4 0D AD A3 02
0C81:0D ED 9B 0D 0D A4 0D B0 A5
0C89:01 60 68 68 60 AD 96 0D C1
0C91:AE 97 0D 85 FD 86 FE AD 96
0C99:9E 0D AE 9F 0D 85 FB 86 11
0CA1:FC 60 8D A2 0D 8C A3 0D 1B
0CA9:18 AD 9E 0D 6D A2 0D 85 73
0CB1:FB AD 9F 0D 6D A3 0D 85 91
0CB9:FC 18 AD 96 0D 6D A2 0D E5
0CC1:85 FD AD 97 0D 6D A3 0D BD
0CC9:85 FE 60 A0 00 B1 FD 8D CA
0CD1:A4 0D C8 B1 FD 8D A5 0D 32
0CD9:38 AD A4 0D ED 96 0D 8D 50
0CE1:A6 0D AD A5 0D ED 97 0D FC
0CE9:8D A7 0D 18 AD A6 0D 6D 65
0CF1:98 0D 8D A6 0D AD A7 0D 31
0CF9:6D 99 0D 8D A7 0D A0 00 5C
0D01:AD A6 0D 91 FB C8 AD A7 5C
0D09:0D 91 FB 60 A2 14 20 D2 0C
0D11:FF CA D0 FA 38 20 F0 FF CB
0D19:E8 A0 0A 18 4C F0 FF 8E 47
0D21:29 0D 8C 2A 0D A2 00 BD F7
0D29:FF FF F0 06 20 D2 FF E8 F6
0D31:D0 F5 60 A9 0D 4C D2 FF 17
0D39:8E A9 0D 8C AA 0D A0 00 3A
0D41:AD A9 0D D9 7A 0E F0 03 CC
0D49:C8 D0 F8 98 0A 0A 0A 0A 3B
0D51:8D A8 0D A2 00 AD AA 0D 41
0D59:DD 7A 0E F0 03 E8 D0 F8 28
0D61:8A 0D A8 0D 8D A8 0D AD C0
0D69:A8 0D 60 A9 05 20 C3 FF F1
0D71:20 CC FF 20 34 0D A2 21 0D
0D79:A0 0F 20 20 0D A2 39 A0 B3
0D81:0F 20 20 0D 20 E4 FF C9 5E
0D89:59 F0 07 C9 4E D0 F5 4C F7
0D91:10 08 4C F9 09 00 7D 00 22
0D99:40 CD 09 A8 08 00 40 00 B3
0DA1:00 00 00 00 00 00 00 00 BB
0DA9:00 00 00 00 00 09 00 1E 00 48
0DB1:25 00 89 00 DE 00 A0 01 C8
0DB9:2A 02 48 02 4E 02 54 02 B7
0DC1:5A 02 18 06 2C 06 38 06 DC
0DC9:8B 06 C0 06 EC 06 F3 06 11
0DD1:A7 07 DF 07 E9 07 F3 07 48
0DD9:FD 07 07 08 12 08 34 08 37
0DE1:94 08 96 08 98 08 9A 08 BD
0DE9:9C 08 9E 08 A0 08 A2 08 1B
0DF1:A4 08 A9 A2 A0 A5 B5 A1 68
0DF9:B1 A4 B4 A6 B6 B0 F0 90 02
0E01:C9 C5 D5 C1 D1 D0 A6 B6 20
0E09:85 95 81 91 84 94 86 96 B0
0E11:C6 D6 E6 F6 C0 C4 CC E0 26
0E19:E4 EC E9 E5 F5 E1 F1 69 03
0E21:65 75 61 71 30 10 29 25 C9
0E29:35 21 31 09 05 15 01 11 6E
0E31:49 45 55 41 51 AD BD B9 78
0E39:AC BC 20 CD DD D9 AE BE 2E
0E41:4C 6C 8D 9D 99 8C 8E CE 15
0E49:DE EE FE CC EC ED FD F9 52
0E51:6D 7D 79 2D 3D 39 0D 1D 8B
0E59:19 4D 5D 59 2C 2E 3E 6E 9B
0E61:7E 4E 5E 0E 1E A9 A2 A0 7A
0E69:00 52 41 4D 44 52 49 56 6B
0E71:45 2E 4F 42 4A 2A 20 20 25
0E79:20 30 31 32 33 34 35 36 06
0E81:37 38 39 41 42 43 44 45 6F
0E89:46 8E 08 12 98 20 52 41 B9
0E91:4D 44 52 49 56 45 20 52 9E
0E99:45 4C 4F 43 41 54 4F 52 D5
0EA1:20 92 00 9A 43 4F 50 59 6D
0EA9:52 49 47 48 54 20 31 39 6D
0EB1:39 31 20 43 4F 4D 50 55 94
0EB9:54 45 20 50 55 42 4C 49 EF
0EC1:43 41 54 49 4F 4E 53 00 49
0EC9:05 49 4E 53 45 52 54 20 F5
0ED1:57 4F 52 4B 20 44 49 53 64
0ED9:4B 20 43 4F 4E 54 41 49 90
0EE1:4E 49 4E 47 20 52 41 4D CF
0EE9:44 52 49 56 45 2E 4F 42 0F
0EF1:4A 00 54 48 45 4E 20 50 36
0EF9:52 45 53 53 20 41 20 4B C1
0F01:45 59 20 54 4F 20 43 4F 32
0F09:4E 54 49 4E 55 45 2E 2E BB
0F11:2E 00 9F 4C 4F 41 44 49 50
0F19:4E 47 2E 2E 2E 2E 0D 00 1D
0F21:0D 9E 2D 2D 2D 2D 20 44 88
0F29:49 53 4B 20 45 52 52 4F 93
0F31:52 20 2D 2D 2D 2D 0D 00 31
0F39:54 52 59 20 41 47 41 49 36
0F41:4E 20 28 59 2F 4E 29 3F 6D
0F49:00 0D 9A 52 45 4C 4F 43 60
0F51:41 54 45 20 41 44 44 52 C5
0F59:45 53 53 20 3A 20 24 00 F5
0F61:9F 52 45 4C 4F 43 41 54 AF
0F69:49 4E 47 2E 2E 2E 0D 00 CF
0F71:0D 9A 53 41 56 45 20 46 89
0F79:49 4C 45 20 4E 41 4D 45 51
0F81:3A 20 05 00 9F 53 41 56 88
0F89:49 4E 47 2E 2E 2E 2E 00 32
0F91:41 4E 4F 54 48 45 52 20 2F
0F99:28 59 2F 4E 29 00 2C 50 DE
0FA1:2C 57 00 00 00 00 00 00 AB
0FA9:00 00 00 00 00 00 00 00 C7
0FB1:00 00 00 00 00 00 00 00 CF
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1-3-5-7

By Randy Thompson

Can computers learn? It's a thought-provoking question. In a sense, you teach your computer something every time you type in a new program, but is that really learning?

With these questions in mind, I set out to write a program that not only teaches the computer a new trick (to play a game) but also improves its perform-

ance by letting it learn from its mistakes. This program plays a simple game that I call *1-3-5-7* because of the way the game's 16 pieces are arranged—in four rows with one piece in the first row, three pieces in the second row, five pieces in the third row, and seven pieces in the fourth row. The more games of *1-3-5-7* you play against the computer, the better the computer gets at winning.

Getting Started

The program is written entirely in BASIC. Type it in using *The Automatic Proofreader;* see "Typing Aids" elsewhere in this section. When you've finished typing, be sure to save a copy of the program before running it.

When you play for the first time, your computer is a terrible opponent. It knows nothing about what is a good or bad move; it simply strives to make legal moves. At the end of each game, however, the computer reviews the moves both you and it made and attempts to learn from the loser's mistakes and the winner's good strategy. After a number of games, the computer's talent at remembering past events makes it a formidable adversary.

How to Play

The game is easy to learn. Players take turns removing pieces from the board. Remove as many as you like as long as those pieces are taken from one row only. You may remove pieces from any row, and you must take at least one piece. The player who removes the last piece loses the game.

When you run *1-3-5-7,* the computer asks you if you want to load any previous game experience. This is a file that you can create after playing a few games and then exiting *1-3-5-7.*

The game operates from a menu containing six options: Human Moves First, Computer Moves First, Human vs. Human, Computer vs. Computer, Auto-Learn Mode, and Quit.

In the first two options, you play against the computer. If you have not loaded a knowledge file, the computer selects legal moves totally at random (it doesn't know any better). Against a reasonably aware opponent, the computer nearly always loses. It *can* win, but it rarely does.

Beating the computer is not the idea, however. It's your job to improve the computer's game through example. The computer considers any move that you make during a winning game to be a good one. Conversely, all moves made by the losing player are seen as bad moves. If you play a game perfectly, only to make a foolish move at the end, the computer will remember all your moves as being undesirable, and your teaching task will become much more difficult. If you wish to bring your computer up to speed as soon as possible, you must show no mercy and always play your best.

To make a move, you first select a row by pressing the A, B, C, or D key (the rows are labeled this way on the screen). Next, select the number of pieces you want to remove using the computer's number keys. When you've made your selections, press Return to accept the move; press any other key to start over and reenter your move. When the game is over, the computer announces the winner and returns you to the game's main menu.

Other Options

Option 3, Human vs. Human, allows you to play against another carbon-based opponent, such as your best friend. The computer still observes the game while you play this mode, so its expertise improves even though it's not an active participant.

Computer vs. Computer pits the computer against itself. It's a good option to choose when you want to check for weak spots in your computer's game strategy. By watching the computer play, you might learn a few tricks yourself. In Auto-Learn mode, the computer and a spurious opponent named Mr. Random take turns going first and continue playing until they are told to stop. To halt Auto-Learn mode, press the Back Arrow key. This is an excellent mode to select when you want to start building an experience file. Keep in mind that, while Mr. Random is a tireless player, he is hardly a good role model for your computer. Therefore, even after several hours of competition with Mr. Random, your computer will still need some careful tutoring to become a really good player.

When you select the Quit option, the computer asks you if you want to save the current game experience to disk. If you answer *Yes,* you are asked to enter a filename. By using distinct filenames, you can create different experience files for various levels of play.

How It Works

The program keeps track of the current board position in the string variable BD$. Each time a player moves, BD$ is updated. The board position is stored as four characters. The first character reflects the number of pieces in row A, the second character reflects the number of pieces in row B, and so on. Thus, the initial board position is represented as 1357. If you removed three pieces from row B as your first move, 1057 would be the resulting board position. The four board positions 1000, 0100, 0010, and 0001 signify the end of the game.

In order for the computer to learn from a game, it must keep track of the game's moves. Each move is stored in the string array GM$(). The first move of the game is stored in GM$(1), the second move in GM$(2), and so on. The current move number is kept in the variable MV, so the current move is referenced with the statement GM$(MV).

The game's moves are stored in a seven-character format. The first four characters represent the board position in exactly the same way board positions are represented by BD$. The fifth character is always a space. The sixth character represents the row, and the seventh and last character specifies the number of pieces removed from that row. If you remove four pieces from row C as the first move in the game, for example, the string 1357 C4 would be loaded into GM$(MV).

How It Learns

This program learns from experience: Good behavior (winning) is rewarded, and bad behavior (losing) is punished. In order for the program to remember what is good and bad behavior, I had to supply the program with a memory or brain. The brain of *1-3-5-7* is the string array WM$(). Winning moves are moved into the array, while losing moves are shoved out. At the start of the program, this array is empty.

Think of each array element in WM$() as a brain cell, where one

brain cell stores the possible winning moves for one particular board position. Accessing a brain cell is relatively easy. For example, the winning moves (or at least what the computer thinks are winning moves) for board position 1345 are stored in WM$(1345). So, at any time during the game, WM$(VAL(BD$)) returns the winning moves (if any) for the current board position. (Note of interest: With 383 possible board positions and 1357 brain cells, only about 3 percent of the program's brain cells are actually ever used. Remind you of anyone?)

Winning moves are stored in WM$() in the same format as game moves are stored in the last two characters of the GM$() array. Several moves may be stored in one WM$() brain cell. For example, the board position indicated by WM$(1536) may contain C3B1A1C1B2 as its winning moves. This example offers the five moves C3, B1, A1, C1, and B2. It's possible that there will be just one winning move (or none) stored for any one board position.

Brain cells organize moves in order of preference; superior moves appear ahead of inferior moves. Using the previous example, we see that the *1-3-5-7* program prefers the move C3 over B1, B1 over A1, and so on. Hoping to make the best move possible, this program always uses the first move found in a brain cell.

After each game, *1-3-5-7* updates its brain cells in response to the outcome. Each move made by the winning player is placed into the brain cell corresponding to the board position in which the move was made. Consider the case when the player removes one piece from row A in the following board position:

A) I
B) II
C) III
D)

The string A1 is placed into WM$(1230). If WM$(1230) already contains the move A1, then the A1 is bumped up by one move in the list. If the move A1 is already the first move in the list, no change is made. If A1 is not already in the list, then A1 is placed as the first move in the list.

Each move made by the losing player is demoted in the brain cell corresponding to the board position in which the move was made. For example, let's say that the losing player removes two pieces from row C in the following board position:

A) I
B) III
C) III
D) IIIII

The string C2 is moved to the right or removed from WM$(1335). If WM$(1335) contains the move C2, then the move is bumped down a notch. If C2 is the last move in the list, it is removed from the list. If C2 is not in the list, no change is made.

Through this positive and negative reinforcement, the computer modifies its playing style, improves its performance, and—in its own cybernetic way—learns. Try to be a good teacher.

1-3-5-7

```
AS 0 CLR
CS 50 REM COPYRIGHT 1991 - COM
      PUTE PUBLICATIONS INTL L
      TD - ALL RIGHTS RESERVED
JP 100 GOSUB1750:GOSUB1210
KA 110 GOSUB1530:GOSUB300
RP 120 PRINT PL$(OP,PL);"'S MO
      VE":PRINT
EJ 130 ON (OP*2)+PL GOSUB420,5
      90,590,420,420,420,590,
      590,590,690
HJ 140 GM$(MV)=BD$+" "+CHR$(R+
      64)+CHR$(N+48)
SR 150 MV=MV+1:PL=ABS(PL-3)
CD 160 GOSUB860:GOSUB300
BK 170 IF EG=0 THEN120
JF 180 NM=MV-1
GG 190 REM
EJ 200 REM ANNOUNCE WINNER
DG 210 REM
BA 220 PRINT "AND THE WINNER I
      S..."
RE 230 PRINT:PRINT PL$(OP,ABS(
      PL-3))
SD 240 GOSUB940
PG 250 GET K$:IF OP=4 AND K$<>
      "<" THEN110
PP 260 OP=0
EQ 270 PRINT "{9 DOWN}
      {6 SPACES}= PRESS RETUR
      N TO CONTINUE =";
AF 280 GET K$:IF K$<>CHR$(13)
      {SPACE}THEN280
BD 290 GOTO110
JP 300 REM
HG 310 REM DISPLAY BOARD
AR 320 REM
FD 330 PRINT CHR$(147)
PF 340 PRINT:PRINT
CQ 350 FOR I=1 TO 4
AM 360 N=VAL(MID$(BD$,I,1))
AM 370 PRINT CHR$(I+64);") ";L
      EFT$("--------",N)
RA 380 PRINT
PX 390 NEXT I
MA 400 PRINT
EX 410 RETURN
QD 420 REM
XR 430 REM GET HUMAN'S MOVE
EF 440 REM
DM 450 PRINT "ROW: ";
FG 460 GET K$:IF K$<"A" OR K$>
      "D" THEN460
AG 470 R=ASC(K$)-64
HR 480 X=VAL(MID$(BD$,R,1))
MM 490 IF VAL(BD$)=INT(10↑(4-R
      )*X) THEN X=X-1
SP 500 IF X=0 THEN460
MB 510 PRINT K$:R=ASC(K$)-64
PR 520 PRINT "NUMBER TO REMOVE
      : ";
KE 530 GET K$:IF K$<"1" OR K$>
      CHR$(X+48) THEN530
CQ 540 PRINT K$:N=VAL(K$)
MQ 550 PRINT "{8 DOWN}
      {7 SPACES}= PRESS RETUR
      N TO ACCEPT =";
HK 560 GET K$:IF K$="" THEN560
SC 570 IF K$<>CHR$(13) THEN GO
      SUB300:PRINT PL$(OP,PL)
      ;"'S MOVE":PRINT:GOTO42
      0
QP 580 RETURN
DX 590 REM
JM 600 REM GET COMPUTER'S MOVE
SX 610 REM
XJ 620 BD=VAL(BD$):MV$=WM$(BD)
SX 630 IF MV$="" THEN690
JB 640 R=ASC(MID$(MV$,1,1))-64
      :N=VAL(MID$(MV$,2,1))
EG 650 PRINT "ROW:";CHR$(64+R)
HB 660 PRINT "NUMBER TO REMOVE
      :";N
KS 670 IF OP<>4 THEN FOR I=1 T
      O 1000:NEXT I
JA 680 RETURN
BF 690 REM
DP 700 REM GET RANDOM MOVE
GF 710 REM
GB 720 A$=""
EE 730 FOR I=1 TO 4
XF 740 R$=MID$(BD$,I,1)
JD 750 IF R$<>"0" THEN A$=A$+C
      HR$(I+48)
RG 760 NEXT I
QE 770 IF LEN(A$)=1 THEN R=VAL
      (A$):GOTO790
CP 780 R=VAL(MID$(A$,INT(RND(1
      )*LEN(A$))+1,1))
JB 790 X=VAL(MID$(BD$,R,1))
BJ 800 IF VAL(BD$)=INT(10↑(4-R
      )*X) THEN X=X-1
GS 810 N=INT(RND(1)*X)+1
```

```
SK 820 PRINT "ROW:";CHR$(64+R)
SH 830 PRINT "NUMBER TO REMOVE
       :";N
QK 840 IF OP<>4 THEN FOR I=1 T
       O 1000:NEXT I
SM 850 RETURN
HX 860 REM
SK 870 REM EXECUTE MOVE AND CH
       ECK FOR WIN
SB 880 REM
GE 890 CN=VAL(MID$(BD$,R,1))
CJ 900 CN=CN-N
RJ 910 BD$=MID$(BD$,1,R-1)+CHR
       $(CN+48)+MID$(BD$,R+1,4
       )
HS 920 IF BD$="1000" OR BD$="0
       100" OR BD$="0010" OR B
       D$="0001" THEN EG=1
MB 930 RETURN
FE 940 REM
FQ 950 REM LEARN FROM GAME
RG 960 REM
FC 970 REM{4 SPACES}REWARD WIN
       NING MOVES
DB 980 MV=MV-1:IF MV=0 THEN RE
       TURN
CK 990 BD=VAL(LEFT$(GM$(MV),4)
       )
EH 1000 MV$=RIGHT$(GM$(MV),2)
SC 1010 F=0:A$=WM$(BD):IF A$="
       " THEN A$=MV$:GOTO1080
GK 1020 FOR I=1 TO LEN(A$) STE
       P 2
PA 1030 IF MID$(A$,I,2)=MV$ TH
       EN F=I
MM 1040 NEXT I
XK 1050 IF F=0 THEN A$=MV$+A$:
       GOTO1080
PF 1060 IF F=1 THEN1080
DC 1070 A$=LEFT$(A$,F-3)+MV$+M
       ID$(A$,F-2,2)+MID$(A$,
       F+2)
GR 1080 WM$(BD)=A$
EG 1090 REM{4 SPACES}PUNISH LO
       SING MOVES
GD 1100 MV=MV-1:IF MV=0 THEN R
       ETURN
FR 1110 BD=VAL(LEFT$(GM$(MV),4
       ))
EX 1120 MV$=RIGHT$(GM$(MV),2)
JK 1130 F=0:A$=WM$(BD):IF A$="
       " THEN970
HB 1140 FOR I=1 TO LEN(A$) STE
       P 2
PJ 1150 IF MID$(A$,I,2)=MV$ TH
       EN F=I
PC 1160 NEXT I
AC 1170 IF F=0 THEN970
XD 1180 IF F+1=LEN(A$) THEN WM
       $(BD)=LEFT$(WM$(BD),F-
       1):GOTO970
FQ 1190 WM$(BD)=LEFT$(A$,F-1)+
       MID$(A$,F+2,2)+MV$+MID
       $(A$,F+4)
KR 1200 GOTO970
SX 1210 REM
AR 1220 REM LOAD EXPERINCE
DA 1230 REM
KQ 1240 PRINT CHR$(147)
KD 1250 PRINT "LOAD PREVIOUS G
       AME EXPERIENCE? ";
EX 1260 GET K$:IF K$<>"Y" AND
       {SPACE}K$<>"N" THEN126
       0
PD 1270 IF K$="N" THEN PRINT "
       NO":FOR I=1 TO 500:NEX
       T I:GOTO1350
DJ 1280 PRINT "YES":PRINT:INPU
       T "FILENAME";A$:IF A$=
       "" THEN1350
DA 1290 OPEN 15,8,15
AG 1300 OPEN 1,8,2,A$+".AI,S,R
       "
DH 1310 INPUT#15,E,E$
MD 1320 IF E THENPRINT"* ";E$;
       " *":FOR I=1TO2500:NEX
       T I:CLOSE1:CLOSE15:GOT
       O1210
MP 1330 INPUT#1,BD:INPUT#1,MV$
       :WM$(BD)=MV$:IF ST=0 T
       HEN1330
HG 1340 CLOSE 1:CLOSE 15
DE 1350 RETURN
AK 1360 REM
KD 1370 REM SAVE EXPERIENCE
MP 1380 REM
FM 1390 PRINT CHR$(147)
MD 1400 PRINT "SAVE GAME EXPER
       IENCE? ";
DR 1410 GET K$:IF K$<>"Y" AND
       {SPACE}K$<>"N" THEN141
       0
KA 1420 IF K$="N" THEN PRINT "
       NO":GOTO1520
XC 1430 PRINT "YES":PRINT:INPU
       T "FILENAME";A$:IF A$=
       "" THEN1520
ME 1440 OPEN 15,8,15,"S0:"+A$+
       ".AI"
FA 1450 OPEN 1,8,2,A$+".AI,S,W
       "
QR 1460 INPUT#15,E,E$
BJ 1470 IF E THENPRINT"* ";E$;
       " *":FOR I=1TO2500:NEX
       T I:CLOSE1:CLOSE15:GOT
       O1360
SK 1480 FOR I=1 TO 1357
RB 1490 IF WM$(I)<>"" THEN PRI
       NT#1,I:PRINT#1,WM$(I)
GK 1500 NEXT I
MQ 1510 CLOSE 1:CLOSE 15
SS 1520 RETURN
QE 1530 REM
BC 1540 REM PREPARE FOR NEW GA
       ME
GF 1550 REM
BF 1560 BD$="1357"
AJ 1570 FOR I=1 TO NM:GM$(I)="
       ":NEXT I
KS 1580 MV=1
EG 1590 EG=0
PS 1600 IF OP=4 THEN WF=ABS(WF
       -3):PL=WF:GOTO1740
PQ 1610 PL=1
XR 1620 WF=1
XP 1630 PRINT CHR$(147);"{WHT}
       {7 SPACES}1-3-5-7
       {6 SPACES}"
DF 1640 PRINT
JS 1650 PRINT:PRINT "
       {2 SPACES}1) HUMAN MOV
       ES FIRST"
SH 1660 PRINT:PRINT "
       {2 SPACES}2) COMPUTER
       {SPACE}MOVES FIRST"
BC 1670 PRINT:PRINT "
       {2 SPACES}3) HUMAN VS
       {SPACE}HUMAN"
AA 1680 PRINT:PRINT "
       {2 SPACES}4) COMPUTER
       {SPACE}VS COMPUTER"
CF 1690 PRINT:PRINT "
       {2 SPACES}5) AUTO-LEAR
       N MODE"
KA 1700 PRINT:PRINT "
       {2 SPACES}6) QUIT"
EX 1710 GET K$:IF K$<"1" OR K$
       >"6" THEN1710
QG 1720 IF K$="6" THEN GOSUB13
       60:PRINT:PRINT "THANKS
        FOR PLAYING":END
GS 1730 OP=VAL(K$)-1
HX 1740 RETURN
KC 1750 REM
DJ 1760 REM INITIALIZE PROGRAM
XE 1770 REM
FP 1780 X=RND(-TI)
JG 1790 DIM WM$(1357)
PH 1800 DIM GM$(15)
GG 1810 DIM PL$(4,2)
JD 1820 RESTORE
HA 1830 FOR OP=0 TO 4:FOR PL=1
        TO 2:READ PL$(OP,PL):
       NEXT PL:NEXT OP
AF 1840 RETURN
QG 1850 DATA THE HUMAN,THE COM
       PUTER
GH 1860 DATA THE COMPUTER,THE
       {SPACE}HUMAN
HQ 1870 DATA HUMAN1,HUMAN2
RR 1880 DATA COMPUTER1,COMPUTE
       R2
HC 1890 DATA THE COMPUTER,MR.
       {SPACE}RANDOM
```

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SPORT CARD COLLECTOR

By Kevin Scott Davis

Sport card collecting is a fun and profitable hobby enjoyed by millions of Americans. One of the least enjoyable parts of card collecting, however, is cataloging that collection. The usual method is to keep the inventory and prices on paper, but that can be a headache. The problem comes when it is time to make

changes. It can be a messy and time-consuming task.

Sport Card Collector was designed to eliminate these problems. It becomes much easier to alter card inventory and prices when the 64 lends a hand. *Collector* also can evaluate the value of your collection based on the prices you enter, and it can print out an orderly inventory. The program tracks card names, the number of cards and their condition, and price.

Getting Started

Sport Card Collector is written entirely in BASIC. To type it in, use *The Automatic Proofreader;* see "Typing Aids" elsewhere in this section. Be sure to save a copy of the program when you've finished typing.

Options

When you run the program, you are presented with the main menu. Option 1 on the menu allows you to load a new data file. If the memory is not empty, you will be prompted to erase it. You'll be asked for the set year and name (see option 3 for more details), and then the program will load. A counter will show you how many records (number of cards) exist in the set and which record is being read. (If you enter a filename that does not exist, you'll have to reload the program.)

Option 2 is Edit File. You'll first be asked if you want to start a new file. Again, you won't be able to do this if a file is still in memory. If your answer is *Yes,* you'll be asked how many records exist in the set. The counter will indicate the numbers as the file is created.

The next option is to edit entire file or prices only. The Entire File option is used to edit all seven fields of the record: Card Name, Number of Cards in Mint Condition, Number in Near Mint, Number in Excellent/Good, Number in Fair/Poor, Low Price, and High Price.

If you have not differentiated the conditions of your cards, enter the total number in the Mint field and ignore the others (a 0 is automatically registered). You must use Entire File when entering data on a new file or changing the number of cards. If you're merely making changes, it's not necessary to reenter all the previouly entered data.

When you enter the card number to edit, you'll be shown the existing data in that record. Hitting Return at any prompt will keep the data currently shown. In the Prices Only mode, you only edit the low and high prices in each record. This is much faster than editing the entire file. In either edit mode, enter a 0 at the Card to Edit prompt to return to the main menu.

Option 3 allows you to save your file. It will ask for the set year and name. The year can be any length, but usually two digits will suffice. The set name is limited to five characters. A total of seven characters is enough to identify a file, though. My 1990–91 Sky Box file, for example, is called 91SKYBX. (For a convenience to disk subscribers, this 45-block file has been included on this month's *Gazette Disk.*) If the program senses a file with the same name on the disk drive, the older one will be scratched. As the file is saved, the counter shows you the record being saved at any moment.

Option 4 prints out the file in memory. You'll be asked for a data line to be printed at the bottom of the printout. This is ideal for identifying the set year/name, date of prices, and so on. If there's no file in memory, the option will not work from the main menu.

When you're ready to print, you'll be offered two choices of printouts. One is for separate card conditions, which prints different columns for mint, near mint, and so on. The second adds the four card fields and prints the total number of cards. Make sure the printer is on and set to device 4 before hitting Return after entering your choice. The printer can print approximately 65 records per page. At the end of the listing, the set value will be calculated and printed, as explained in option 5.

Option 5 evaluates the set's worth. This calculation will depend on the values you've entered for each card. This program was designed around the standards of the *Beckett* card magazines, the industry benchmark. Of course, you can use any price values you care to assign as long as they include high and low values.

Just as with the *Beckett* prices, the figure given by this option is merely a guide to your collection's value. You may not be able to sell your set for these prices. This option works by taking the number of cards you have in each category, multiplying the number to obtain a high value and low value, and then multiplying by percentage allowances for card conditions.

The allowances are 100 percent of price for mint cards, 75 percent for near mint, 60 percent for excellent/good, and 10 percent for fair/poor. While these are not exactly *Beckett* standards, incorporating all eight card conditions would take too much memory to be efficient. There is also too much overlap in the percentages in the eight fields to be included. If you use different percentages for card grading (such as the higher percentages for older cards), change the values in lines 2000 and 2020. While the values are being calculated, a counter shows you the progress of the program. The prices are shown; then press any key to return to the program's menu.

Option 6 allows you to view the records of the file in memory. You'll be asked for the card number to view. You'll be shown the seven fields of the record for which you prompt. You can then request another record or enter 0 to return to the menu.

Option 7 erases any data in memory. You will be asked to confirm this option. Once the data is erased, there is no way to retrieve it, so be careful!

64 and 128 Modes

Sport Card Collector will run in both the 64 and the native 128 modes. In the 128 mode, you have access to the keypad. As 80 percent of all data entry is entered by number, I find the keypad makes data entry easier and faster.

The main advantage of the 128 is its larger memory. It can handle approximately 1800 cards. I would not recommend more than 750 cards per file in 64 mode. (I break up the few sets with more than 750 cards into two files, such as 89TOPP1 and 89TOPP2). *Collector* may occasionally appear to lock up with the counter stuck on card number 1. Be patient, though; in less than ten seconds the program will continue.

I use this program to hold my own basketball card records. The longest task when using this program is entering the data for the first time. Then be prepared to spend several hours at the computer the first time you edit a file.

Of course, you can save an incomplete file to disk and then reload it later and finish the job of entering data.

Once a file is set up, changing prices from month to month is quick and easy. Each month *Beckett* prints its list of prices with up and down arrows to indicate changes from the previous month. Once you have the hang of it, an entire file can be updated quickly.

Older sets are not as volatile; therefore, they may not need their value updated every month. Just as with collecting itself, you can get as much out of this program as you are willing to put into it. I've found it easy to carry my inventory printout to card stores and sport card conventions. My friends and other collectors find the printout easy to read, and it shows them which cards have duplicates that I might be willing to put up for trade.

SPORT CARD COLLECTOR

```
AS 0 CLR
KP 5 REM COPYRIGHT 1991 - COMP
     UTE PUBLICATIONS INTL LTD
     - ALL RIGHTS RESERVED
CC 10 YL=0
KG 20 POKE 53280,0:POKE53281,0
AQ 30 PRINT(CHR$(147))
JE 40 PRINT"{3 DOWN}
     {10 SPACES}{8}UDDDDDDDDD
     DDDDDDDDDDI"
KM 50 PRINT"{10 SPACES}{8}G
     {5 SPACES}{RVS} {P}
     {OFF} {RVS}{V}{P}{C}
     {OFF} {RVS}{V}{P}{C}
     {OFF} {8}{3 SPACES}H"
RC 60 PRINT"{10 SPACES}G
     {5 SPACES}{RVS} {OFF}
     {2 O} {RVS} {OFF}
     {3 SPACES}{RVS} {OFF}
     {6 SPACES}H"
AE 70 PRINT"{10 SPACES}G
     {5 SPACES}{I}{P}{RVS}
     {OFF} {RVS}{F}{Y}{D}
     {OFF} {RVS}{F}{Y}{D}
     {OFF}{4 SPACES}H"
SA 80 PRINT"{10 SPACES}GEEEEEE
     EEEEEEEEEEEEEEH"
DH 90 PRINT"{10 SPACES}GSPORT
     {SPACE}CARD COLLECTORH"
QS 100 PRINT"{10 SPACES}{Q}DDD
     DDDDDDDDDDDDDDDD{W}"
CX 110 PRINT"{10 SPACES}G{RVS}
     [1] LOAD FILE{7 SPACES}
     {OFF}H"
BS 120 PRINT"{10 SPACES}G{RVS}
     [2] EDIT FILE{7 SPACES}
     {OFF}H"
KX 130 PRINT"{10 SPACES}G{RVS}
     [3] SAVE FILE{7 SPACES}
     {OFF}H"
BA 140 PRINT"{10 SPACES}G{RVS}
     [4] PRINT FILE
     {6 SPACES}{OFF}H"
KC 150 PRINT"{10 SPACES}G{RVS}
     [5] EVAL. SET PRICE
     {OFF}H"
HD 160 PRINT"{10 SPACES}G{RVS}
     [6] VIEW FILE{7 SPACES}
     {OFF}H"
DF 170 PRINT"{10 SPACES}G{RVS}
     [7] ERASE MEMORY
     {4 SPACES}{OFF}H"
JB 180 PRINT"{10 SPACES}JFFFFF
     FFFFFFFFFFFFFK"
BF 190 IF F$="" THEN XW$="**NO
     NE**"
SK 200 PRINT"{9 SPACES}FILE IN
      MEMORY: "XW$
MB 210 PRINT:PRINT"{13 SPACES}
     CHOOSE: [1 TO 7]"
HK 220 GET X$:IF X$="" THEN 22
     0
BK 230 X=VAL(X$):IF X<1 OR X>7
      THEN 20
SX 240 ON X GOTO 250,560,1120,
     1380,1880,2200,2150
QD 250 REM LOAD FILE
MG 260 PRINT"{CLR}{15 SPACES}L
     OAD FILE":PRINT
DF 270 PRINT"ENTER SET YEAR
     {WHT}"
HD 280 POKE19,65:INPUT SY$:PRI
     NT:PRINT"{8}ENTER SET N
     AME [MAX 5 CHARS.]{WHT}
     "
HC 290 POKE19,65:INPUT SN$
QC 300 IF XW$<>"**NONE**" THEN
      PRINT:PRINT"{8}MUST ER
     ASE MEMORY FIRST!"
KE 310 IF XW$<>"**NONE**" THEN
      PRINT"PRESS ANY KEY TO
      GO TO MAIN MENU"
AE 320 IF XW$<>"**NONE**" THEN
      GET HY$
HB 330 IF XW$<>"**NONE**" AND
     {SPACE}HY$="" THEN 320
DE 340 IF XW$<>"**NONE**" THEN
      20
QX 350 PRINT:PRINT:PRINT"{8}IN
     SERT DISK AND PRESS A K
     EY/'N' ABORTS"
AM 360 GET K$:IF K$="" THEN 36
     0
MK 370 IF K$="N" THEN 20
CC 380 F$=SY$+SN$:OPEN8,8,8,F$
     +",S,R"
MR 390 INPUT#8,YT:INPUT#8,GC
GB 400 GOSUB 2360
SA 410 PRINT"{CLR}":PRINT"{8}T
     OTAL RECORDS IN THE SET
     :"YT
HF 420 RN=1
AF 430 PRINT"ON RECORD NUMBER:
     {WHT} 1"
DJ 440 FOR TM=1 TO YT
RS 450 INPUT#8,CM$(TM):INPUT#8
     ,MT$(TM):INPUT#8,NM$(TM
     ):INPUT#8,GD$(TM)
DP 460 INPUT#8,FP$(TM):INPUT#8
     ,LO$(TM):INPUT#8,HI$(TM
     )
CH 470 PRINT"{WHT}{HOME}
     {2 DOWN}{17 RIGHT}"TM
KF 480 NEXT TM
MS 490 CLOSE8
SB 500 OPEN15,8,15:INPUT#15,EN
     ,EM$,ET,ES
FS 510 PRINT:PRINT:PRINT:PRINT
     "{8}DRIVE STATUS:":PRIN
     TEN;EM$;ET;ES
MC 520 CLOSE15:PRINT:PRINT"PRE
     SS ANY KEY TO CONTINUE"
KG 530 GET WO$:IF WO$="" THEN
     {SPACE}530
XF 540 XW$=F$
AF 550 GOTO 20
DM 560 REM EDIT FILE
AD 570 PRINT"{CLR}"
SH 580 PRINT"{8}START BRAND NE
     W FILE?? [Y/N]"
CH 590 GET YN$:IF YN$="" THEN
     {SPACE}590
FK 600 IF YN$="Y" AND XW$<>"**
     NONE**" THEN PRINT"ERAS
     E MEMORY FIRST! [HIT AN
     Y KEY]"
RP 610 IF YN$="Y" AND XW$<>"**
     NONE**" THEN GOTO 2570
KS 620 IF YN$="Y" THEN INPUT"
     {8}HOW MANY CARDS?{WHT}
     ";YT:F$="WORK":XW$="WOR
     K":GOSUB2360
XM 630 IF YN$="Y" THEN GOSUB 2
     490
FP 640 PRINT"{8}EDIT [1] ENTIR
     E FILE{2 SPACES}[2] PRI
     CES ONLY{WHT}{2 SPACES}
     "
JB 650 POKE19,65:INPUT TE$:TE=
     VAL(TE$):IF TE=2 THEN 9
     70
MK 660 PRINT:PRINT"{8}CARD NUM
     BER TO EDIT [0 TO EXIT]
     "
EH 670 PRINT"THERE ARE"YT"CARD
     S IN THE SET.{WHT}"
DB 680 POKE19,65:INPUT CE$:CE=
     VAL(CE$)
HP 690 IF CE=0 THEN 20
EB 700 IF CE>YT OR CE<0 THEN 6
     60
SA 710 PRINT"{CLR}{8}CARD NUMB
     ER: "CE:PRINT CM$(CE):P
     RINT"# IN MINT:
     {6 SPACES}"MT$(CE)
XF 720 PRINT"# IN NRMT:
     {6 SPACES}"NM$(CE)
FD 730 PRINT"# IN GOOD:
     {6 SPACES}"GD$(CE):PRIN
     T"# IN FAIR/POOR: "FP$(
     CE)
EP 740 PRINT"LOW PRICE:
     {6 SPACES}"LO$(CE):PRIN
     T"HIGH PRICE:{5 SPACES}
     "HI$(CE)
```

```
QX 750 PRINT:PRINT"CARD NUMBER
       ";CE
GE 760 PRINT"NAME [LESS THAN 2
       0 CHARACTERS]{WHT}":POK
       E19,65
AQ 770 INPUT CM$(CE):IF LEN(CM
       $(CE))>20 THEN 760
RH 780 PRINT:PRINT"{8}NUMBER O
       F CARDS IN MINT{WHT}"
KS 790 INPUT MT$(CE)
SJ 800 IF MT$(CE)="" THEN MT$(
       CE)="0"
ME 810 PRINT:PRINT"{8}NUMBER O
       F CARDS IN NEARMINT
       {WHT}"
RP 820 INPUT NM$(CE)
JA 830 IF NM$(CE)="" THEN NM$(
       CE)="0"
CF 840 PRINT:PRINT"{8}NUMBER O
       F CARDS IN EXC./GD.
       {WHT}"
JA 850 INPUT GD$(CE)
EP 860 IF GD$(CE)="" THEN GD$(
       CE)="0"
PP 870 PRINT:PRINT"{8}NUMBER O
       F CARDS IN FAIR/PR.
       {WHT}"
PK 880 INPUT FP$(CE)
EE 890 IF FP$(CE)="" THEN FP$(
       CE)="0"
DE 900 PRINT:PRINT"{8}LOW VALU
       E{WHT}"
JR 910 INPUT LO$(CE)
FR 920 IF LO$(CE)="" THEN LO$(
       CE)="0"
SP 930 PRINT:PRINT"{8}HIGH VAL
       UE{WHT}"
QK 940 INPUT HI$(CE)
GP 950 IF HI$(CE)="" THEN HI$(
       CE)="0"
CC 960 GOTO 660
DQ 970 REM EDIT PRICES ONLY
DR 980 PRINT"{CLR}"
PB 990 PRINT"{8}CARD NUMBER TO
        EDIT [0 TO EXIT]"
PX 1000 PRINT"THERE ARE"YT"CAR
        DS IN THE SET.{WHT}":P
        OKE19,65:INPUT CE
RP 1010 IF CE=0 THEN 20
SD 1020 PRINT"{8}CURRENT: "
GP 1030 PRINT"PLAYER NAME: "CM
        $(CE)
XH 1040 PRINT"LOW PRICE:
        {3 SPACES}"LO$(CE)
FJ 1050 PRINT"HIGH PRICE:
        {2 SPACES}"HI$(CE)
HR 1060 PRINT:PRINT"INPUT NEW
        {SPACE}PRICES":PRINT
QR 1070 PRINT"LOW VALUE{WHT}"
JF 1080 POKE19,65:INPUT LO$(CE
        )
HP 1090 PRINT"{8}HIGH VALUE
        {WHT}"
KA 1100 INPUT HI$(CE)
BS 1110 PRINT:GOTO 990
GC 1120 REM SAVE FILE
AR 1130 IF XW$="**NONE**"THEN
        {SPACE}PRINT"NO FILE E
        XISTS! [HIT ANY KEY]"
FX 1140 IF XW$="**NONE**" THEN
         GOTO 2570
JR 1150 PRINT"{CLR}{15 SPACES}
        SAVE FILE":PRINT
MX 1160 PRINT"{8}ENTER SET YEA
        R{WHT}"
FQ 1170 POKE19,65:INPUT SY$:PR
        INT:PRINT"{8}ENTER SET
         NAME [MAX 5 CHARS.]
        {WHT}"
ME 1180 INPUT SN$:IF LEN(SN$)>
        5 THEN 1180
FA 1190 PRINT:PRINT:PRINT"{8}I
        NSERT DISK AND PRESS A
         KEY/'N' ABORTS"
KK 1200 GET K$:IF K$="" THEN 1
        200
BD 1210 IF K$="N" THEN 20
GC 1220 GOSUB 2350
HX 1230 F$=SY$+SN$:XW$=F$:OPEN
        8,8,8,F$+",S,W"
RK 1240 PRINT#8,YT:PRINT#8,GC
KC 1250 PRINT"{CLR}":PRINT"TOT
        AL RECORDS IN THE SET:
        "YT
GH 1260 PRINT"ON RECORD NUMBER
        :{WHT} 1"
PQ 1270 FOR TL=1 TO YT
BC 1280 PRINT#8,CM$(TL):PRINT#
        8,MT$(TL):PRINT#8,NM$(
        TL):PRINT#8,GD$(TL)
QK 1290 PRINT#8,FP$(TL):PRINT#
        8,LO$(TL):PRINT#8,HI$(
        TL)
JC 1300 PRINT"{HOME}{2 DOWN}
        {17 RIGHT}"TL
FD 1310 NEXT TL
KK 1320 CLOSE8
SH 1330 OPEN15,8,15:INPUT#15,E
        N,EM$,ET,ES
XE 1340 PRINT:PRINT:PRINT:PRIN
        T"{8}DRIVE STATUS:":PR
        INTEN;EM$;ET;ES
JF 1350 CLOSE15:PRINT:PRINT"PR
        ESS ANY KEY TO CONTINU
        E"
KE 1360 GET WO$:IF WO$="" THEN
         1360
PS 1370 GOTO 20
JX 1380 REM PRINTOUT
QX 1390 IF XW$="**NONE**" OR F
        $="**NONE**" THEN 20
GG 1400 PRINT"{CLR}"
QB 1410 PRINT"{13 SPACES}HARD
        {SPACE}COPY"
FH 1420 PRINT"{2 SPACES}THIS W
        ILL PRINT THE FILE IN
        {SPACE}MEMORY"
AD 1430 PRINT"{2 SPACES}MAKE S
        URE YOUR PRINTER IS ON
         DEV 4"
ER 1440 PRINT:PRINT"ENTER YOUR
         DATA LINE [UNDER 40 C
        HARS.]{WHT}"
HE 1450 POKE19,65:INPUT DL$:IF
         LEN(DL$)>40 THEN 1440
HC 1460 PRINT:PRINT:PRINT:PRIN
        T"{8}CHOOSE [1] SEP. C
        ARD COND. [2] STANDARD
        {WHT}"
FA 1470 POKE19,65:INPUT VR:IF
        {SPACE}VR=2 THEN 1720
FJ 1480 PRINT:PRINT"{9 SPACES}
        THEN PRESS ANY KEY"
FE 1490 GET WE$:IF WE$="" THEN
         1490
JF 1500 OPEN4,4
QF 1510 GH$=CHR$(14)
GK 1520 PRINT#4,"":PRINT#4,"":
        PRINT#4,CHR$(14)"
        {10 SPACES}SPORT CARD
        {SPACE}COLLECTOR"
KE 1530 PRINT#4,CHR$(14)"
        {39 T}"CHR$(15)
DC 1540 PRINT#4,GH$"C# CARD-NA
        ME #MT #NM #EG #FP LO
        {3 SPACES}HI{2 SPACES}
        "CHR$(15)
BA 1550 FOR TP=1 TO YT
DR 1560 PRINT#4,CHR$(16)"01"+S
        TR$(TP);
CC 1570 PRINT#4,CHR$(16)"08"+C
        M$(TP);
GR 1580 PRINT#4,CHR$(16)"28"+M
        T$(TP);
KC 1590 PRINT#4,CHR$(16)"36"+N
        M$(TP);
HM 1600 PRINT#4,CHR$(16)"44"+G
        D$(TP);
HJ 1610 PRINT#4,CHR$(16)"52"+F
        P$(TP);
BK 1620 PRINT#4,CHR$(16)"58"+L
        O$(TP);
GX 1630 PRINT#4,CHR$(16)"68"+H
        I$(TP)
HP 1640 NEXT TP
JQ 1650 PRINT#4,CHR$(14)"
        {39 T}"CHR$(15)
MJ 1660 PQ=1:GOTO 1920
FJ 1670 PRINT#4,"":PRINT#4,""
HK 1680 OO=LEN(DL$):SS=40-OO:S
        D=.5*SS
QJ 1690 PRINT#4,CHR$(14)""SPC(
        SD)""DL$
EX 1700 CLOSE 4
HF 1710 GOTO 20
FC 1720 OPEN4,4
HE 1730 GH$=CHR$(14)
JH 1740 PRINT#4,"":PRINT#4,"":
        PRINT#4,CHR$(14)"
        {10 SPACES}SPORT CARD
        {SPACE}COLLECTOR"
SG 1750 PRINT#4,CHR$(14)"
        {39 T}"CHR$(15)
XX 1760 PRINT#4,CHR$(14)"C# CA
        RD-NAME{2 SPACES}#/CAR
        DS{2 SPACES}LO
        {2 SPACES}HI{2 SPACES}
        "CHR$(15)
EC 1770 FOR TP=1TOYT
CP 1780 PRINT#4,CHR$(16)"01"+S
        TR$(TP);
DQ 1790 PRINT#4,CHR$(16)"08"+C
        M$(TP);
CH 1800 M=VAL(MT$(TP)):N=VAL(N
```

```
        M$(TP)):E=VAL(GD$(TP))
        :F=VAL(FP$(TP))
ED 1810 TH=M+N+E+F
HJ 1820 PRINT#4,CHR$(16)"36"+S
        TR$(TH);
EC 1830 PRINT#4,CHR$(16)"46"+L
        O$(TP);
RJ 1840 PRINT#4,CHR$(16)"54"+H
        I$(TP)
RG 1850 NEXT TP
AK 1860 PRINT#4,CHR$(14)"
        {39 T}"CHR$(15)
CM 1870 PS=2:GOTO 1920
JC 1880 REM EVAL SET WORTH
PF 1890 IF XW$="**NONE**"THEN
        {SPACE}PRINT"NO FILE!
        {SPACE}[HIT ANY KEY]"
MR 1900 IF XW$="**NONE**"GOTO
        {SPACE}2570
QA 1910 PS=1:PQ=0
FA 1920 IF GC=1 THEN 2140
FP 1930 PRINT"{CLR}{8}EVALUATI
        NG SET WORTH:"YT" ITEM
        S."
DK 1940 PRINT"SCANNING RECORD
        {SPACE}NUMBER:{WHT} 1"
MB 1950 HS=0:LS=0
KB 1960 FOR T=1 TO YT
JK 1970 PRINT"{HOME}{DOWN}
        {23 RIGHT}"T
GC 1980 M=VAL(MT$(T)):N=VAL(NM
        $(T)):E=VAL(GD$(T)):P=
        VAL(FP$(T)):LP=VAL(LO$
        (T))
SK 1990 HP=VAL(HI$(T))
XA 2000 IF PS<>2 THEN LV=((M+(
        .75*N)+(.60*E)+(.10*G)
        )*LP)
SK 2010 IF PS=2 THEN LV=((M+N+
        E+P)*LP)
FR 2020 IF PS<>2 THEN HV=((M+(
        .75*N)+(.60*E)+(.10*P)
        )*HP)
ED 2030 IF PS=2 THEN HV=((M+N+
        E+P)*HP)
PX 2040 HS=HS+HV:LS=LS+LV
GA 2050 NEXT T
KA 2060 PRINT"{5}LOW SET VALUE
        "LS
XR 2070 IF PQ=1 OR PS=2 THEN P
        RINT#4,"SET - LOW VALU
        E"LS
AD 2080 PRINT"HIGH SET VALUE"H
        S
SS 2090 IF PQ=1 OR PS=2 THEN P
        RINT#4,"SET - HIGH VAL
        UE"HS
MH 2100 IF PS=2 OR PQ=1 GOTO 1
        670
CS 2110 PRINT"PRESS ANY KEY"
ER 2120 GET HH$:IF HH$=""THEN
        {SPACE}2120
HX 2130 GOTO 20
PM 2140 GOTO 1930
SS 2150 REM CLEAR DATA
FD 2160 PRINT"{RVS}ARE YOU POS
        ITIVE [Y/N]{OFF}"
SB 2170 GET QW$:IF QW$="" THEN
        2170
GF 2180 IF QW$="N" THEN 20
HF 2190 RUN
FP 2200 REM VIEW CARDS
KP 2210 PRINT"{CLR}"
CC 2220 PRINT:PRINT"{8}SET: "F
        $:PRINT"CARD NUMBER? [
        0 TO EXIT]"
QS 2230 PRINT"THERE ARE"YT"CAR
        DS IN THE SET.{WHT}"
MD 2240 POKE19,65:INPUT CD$:CD
        =VAL(CD$)
DF 2250 IF CD=0 THEN 20
EP 2260 IF CD>YT THEN 2220
XH 2270 PRINT"{CLR}":PRINT"{8}
        PLAYER'S NAME: "CM$(CD
        )
RG 2280 PRINT"CARDS IN MT:
        {2 SPACES}"MT$(CD)
HF 2290 PRINT"CARDS IN NM:
        {2 SPACES}"NM$(CD)
AK 2300 PRINT"CARDS IN EG:
        {2 SPACES}"GD$(CD)
MJ 2310 PRINT"CARDS IN FP:
        {2 SPACES}"FP$(CD)
MR 2320 PRINT"LOW PRICE:
        {4 SPACES}"LO$(CD)
RX 2330 PRINT"HIGH PRICE:
        {3 SPACES}"HI$(CD)
GG 2340 PRINT:GOTO 2220
RC 2350 F$=SY$+SN$:OPEN 15,8,1
        5:PRINT#15,"S0:"+F$+",
        S":CLOSE15:RETURN
HD 2360 REM DIM SUBROUTINE
PF 2370 IF YT<=0 THEN PRINT"
        {8}ERROR! PRESS ANY KE
        Y"
EP 2380 IF YT<=0 THEN GET XH$
SH 2390 IF YT<=0 AND XH$="" TH
        EN 2380
JA 2400 IF YT<=0 THEN 20
ED 2410 DIM CM$(YT)
AK 2420 DIM MT$(YT)
MM 2430 DIM NM$(YT)
SC 2440 DIM GD$(YT)
RF 2450 DIM FP$(YT)
BK 2460 DIM LO$(YT)
ME 2470 DIM HI$(YT)
FR 2480 RETURN
CG 2490 PRINT"{CLR}{8}SETTING
        {SPACE}UP FILE -"YT"RE
        CORDS"
QP 2500 PRINT"ON RECORD NUMBER
        : {WHT}1"
MQ 2510 FOR TQ=1 TO YT
AK 2520 CM$(TQ)="0":MT$(TQ)="0
        ":NM$(TQ)="0":GD$(TQ)=
        "0"
CH 2530 FP$(TQ)="0":LO$(TQ)="0
        ":HI$(TQ)="0"
HD 2540 PRINT"{HOME}{DOWN}
        {17 RIGHT}"TQ
BC 2550 NEXT TQ
CA 2560 RETURN
SG 2570 GET XL$:IF XL$="" THEN
        2570
QM 2580 GOTO 20
```

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FILE COPIER

By Daniel Lightner

Use this disk utility program to copy single files or groups of files and to perform other functions as well. *File Copier* loads the disk directory into memory and lets you freely thumb through its contents, tagging as many files as you like.

For example, you can copy these tagged files to another disk, scratch them, or rename them. *File Copier* performs other operations as well, such as formatting or validating a disk.

File Copier is written entirely in machine language. To type it in, use *MLX*, our machine language entry program; see "Typing Aids" elsewhere in this section. When prompted for starting and ending addresses, respond with the following values.

Starting address: 0801
Ending address: 1458

Be sure to save a copy of *File Copier* before you exit *MLX*.

Getting Started

File Copier loads and runs like a BASIC program. After *File Copier* has been started, it deletes 684 bytes, about three disk blocks, from the end of itself. This is where *File Copier* starts loading the files you select.

File Copier can load up to 48,722 bytes or 191 disk blocks at a time. When this memory is filled, the program will instruct you to place the target disk (the disk you want these files copied to) in drive 8 for saving.

When it has finished saving this first block of memory and you have selected more files, *File Copier* will instruct you to put the source disk back in the drive to continue the copying process.

First Things First

When you first run *File Copier*, it attempts to load the directory of any disk in drive 8. If you wish to format a disk, do not place it in the drive until af-

ter *File Copier* has read a disk directory, perhaps the one that you loaded *File Copier* from. After it has read the directory, if you wish to format a disk, then place the unformatted disk in the drive and choose the format option.

Menu Selections

When *File Copier* runs, all of its functions are listed on the screen, as shown below. Make selections by pressing the appropriate function key.

f1—VALIDATE DISK
f2—SCRATCH
f3—RENAME
f4—FORMAT
f5—DIRECTORY
f6—QUIT
f7—COPY
f8—ABORT

You will see the greater-than sign (>) on the lower left portion of the screen. This pointer is where all information will be displayed during operation.

To select files after *File Copier* has loaded the directory, use the Crsr Up/Down keys to scroll up and down the directory listing. When you see a file you wish to select, press the Return key. Notice that the filename is now followed by an arrow. This arrow is to indicate that this file has been selected. If you change your mind about your selection, you may press the Return key again to toggle the selection off again.

After you have made your selections, choose the desired function key. If you find that you have made the wrong choice, use the f8 key to abort that selection. Abort the selection only when *File Copier* is showing the option name and the Press Key prompt. If you press any other key, the program will activate the indicated function. So be careful; you could accidentally delete files that you intended to copy. If you only want to copy files, it is best to put a write-protect tab on your source disk.

When you choose the Format option, *File Copier* asks you to provide a name for the disk you are formatting; then it asks for an ID. This is a two-step process, so do not provide the ID when you enter a disk name.

To rename selected files, just follow the onscreen prompts. *File Copier* first shows you the current selection and prompts for a keypress. It then asks for the desired new name. Enter the new name and press Return.

If you select the Scratch option, *File Copier* will delete all marked files unless you decide to abort the process at the Press Key prompt. So be sure that the files you have picked are ones that you really don't need.

The remaining functions are self-explanatory. *File Copier* keeps you informed with various onscreen messages while all selected functions are being carried out.

FILE COPIER

```
0801:1E 08 0A 00 9E 32 30 38 B9
0809:38 20 3A 20 46 49 4C 45 BB
0811:20 43 4F 50 49 45 52 20 15
0819:27 39 31 27 00 00 00 00 A3
0821:00 00 00 00 00 00 00 20 51
0829:CC FF D8 A9 00 8D 21 D0 9E
0831:A9 05 8D 20 D0 AD 0E DC 41
0839:29 FE 8D 0E DC A5 01 29 D8
0841:FE 85 01 AD 0E DC 09 01 24
0849:8D 0E DC A9 C1 8D 18 03 51
0851:A9 34 8D 14 03 20 B7 11 4F
0859:20 94 0D 20 B9 0D 20 87 0C
0861:10 20 FE 09 20 46 0A 20 40
0869:31 0B A9 00 8D A5 03 8D A0
0871:A8 02 8D C3 02 A9 01 8D 8A
0879:A2 03 20 07 0A 20 6F 09 C8
0881:20 E4 FF C9 11 F0 27 C9 DB
0889:91 F0 29 C9 0D F0 68 C9 27
0891:89 F0 27 C9 87 F0 2C C9 46
0899:8A F0 2B C9 85 F0 2D C9 41
08A1:8B F0 38 C9 86 F0 2B C9 6F
08A9:88 F0 43 4C 81 08 20 21 F4
08B1:0A 4C 7B 08 20 34 0A 4C FB
08B9:7B 08 20 12 09 20 7C 0B 7B
08C1:4C 59 08 4C 62 08 20 E8 70
08C9:0B 4C 59 08 20 64 0C 4C 15
08D1:59 08 20 12 09 20 AA 0C DF
08D9:4C 59 08 20 07 0A 20 E6 F0
08E1:0D 20 B9 0D 20 87 10 C9 91
08E9:8C F0 E4 4C E2 FC 20 12 3B
08F1:09 20 9D 0E 4C 59 08 AC A7
08F9:A2 03 B9 01 70 C9 00 F0 FE
0901:08 A9 00 99 01 70 4C 7B F8
0909:08 A9 01 99 01 70 4C 7B 21
0911:08 20 FE 09 A0 00 8C FF BD
0919:02 A9 01 8D A8 02 EE 00 BA
0921:70 B9 01 70 C9 01 F0 0C 41
0929:C8 CC 00 70 D0 F3 A9 00 83
0931:8D A8 02 60 8C FA 03 8C 5D
0939:A2 03 20 07 0A 20 6F 09 8A
0941:20 4A 09 AC FA 03 4C 29 87
0949:09 A0 00 A2 00 BD 35 03 96
0951:91 FD E8 20 EC 0A EC 34 68
0959:03 D0 F2 A9 00 91 FD 20 7C
0961:EC 0A 91 FD 20 EC 0A EE 36
0969:FF 02 60 4C 74 0B AD A0 98
0971:03 C9 00 F0 F6 A9 01 8D 74
0979:A5 03 20 BD 0A A0 00 AD 7F
0981:A5 03 CD A2 03 F0 1E B1 D4
0989:FB C9 2C F0 06 20 DE 0A 19
0991:4C 88 09 20 DE 0A 20 DE 4D
0999:0A 18 AD A5 03 69 01 8D 14
09A1:A5 03 4C 80 09 A9 00 8D 55
09A9:34 03 A2 00 B1 FB C9 2C 28
09B1:F0 10 20 F0 09 9D 35 03 7F
09B9:E8 EE 34 03 20 DE 0A 4C 8F
09C1:AD 09 9D 35 03 EE 34 03 33
09C9:20 F0 09 E8 20 DE 0A B1 1A
09D1:FB 9D 35 03 EE 34 03 20 8E
09D9:F0 09 AC A2 03 B9 01 70 D7
09E1:C9 01 F0 01 60 A9 20 20 51
09E9:F0 09 A9 5F 4C F0 09 48 62
09F1:AD A8 02 C9 01 F0 04 68 1E
09F9:4C D2 FF 68 60 A9 B7 85 0C
0A01:FD A9 11 85 FE 60 20 16 C8
0A09:0A A2 00 A9 20 20 D2 FF 8C
0A11:E8 E0 26 D0 F6 A9 13 85 AD
0A19:D6 A9 02 85 D3 4C 6C E5 2A
0A21:AD A2 03 CD A0 03 90 01 25
0A29:60 18 AD A2 03 69 01 8D A0
0A31:A2 03 60 AD A2 03 C9 02 F4
0A39:B0 01 60 38 AD A2 03 E9 5D
0A41:01 8D A2 03 60 A0 00 A9 EC
0A49:00 A9 01 A2 B6 A0 11 20 8C
0A51:BD FF A9 02 A2 08 A0 00 10
0A59:20 BA FF 20 C0 FF 20 97 0C
0A61:0D C0 0E B0 3C A2 02 20 89
0A69:C6 FF A9 9A 20 D2 FF A0 AC
0A71:00 8C B1 02 20 BD 0A A9 B4
0A79:01 8D B3 02 20 E4 FF 20 BC
0A81:E4 FF 20 E4 FF 8D B0 02 F3
0A89:20 E4 FF 0D B0 02 F0 1C 43
0A91:20 E4 FF 20 E4 FF 20 E4 3D
0A99:FF F0 E7 20 C6 0A 4C 97 77
0AA1:0A 20 B9 0D A2 00 20 C6 E6
0AA9:FF 20 87 10 A9 00 A0 00 46
0AB1:91 FB A2 00 20 C6 FF A9 A7
0AB9:02 4C C3 FF A9 00 85 FB AE
0AC1:A9 C0 85 FC 60 C9 22 F0 BA
0AC9:30 AA AD B3 02 C9 01 F0 BB
0AD1:19 AD B1 02 C9 01 D0 12 3A
0AD9:8A A0 00 91 FB 18 A5 FB FB
0AE1:69 01 85 FB A5 FC 69 00 4F
0AE9:85 FC 60 18 A5 FD 69 01 86
0AF1:85 FD A5 FE 69 00 85 FE 42
0AF9:60 AD B1 02 C9 01 F0 06 3A
0B01:A9 01 8D B1 02 60 A9 00 DD
0B09:8D B1 02 AD B3 02 C9 01 A7
0B11:F0 18 A9 2C A0 00 91 FB C1
0B19:20 DE 0A 20 E4 FF C9 20 15
0B21:F0 F9 A0 00 91 FB 4C DE 36
0B29:0A 60 A9 00 8D B3 02 60 31
0B31:20 BD 0A A0 00 A9 00 8D 46
0B39:A0 03 B1 FB C9 00 F0 1C A2
0B41:C9 2C F0 06 20 DE 0A 4C A2
0B49:3B 0B 20 DE 0A 18 AD A0 5E
0B51:03 69 01 8D A0 03 20 DE 6C
0B59:0A 4C 3B 0B AD A0 03 8D 23
0B61:00 70 A0 00 A9 00 99 01 29
0B69:70 CC A0 03 F0 04 C8 4C A4
0B71:65 0B 60 20 07 0A A2 08 B8
0B79:4C 06 0E 20 07 0A 20 BE 5A
0B81:0D 20 B9 0D 20 87 10 C9 37
0B89:8C F0 59 AD FF 02 C9 00 C3
0B91:F0 52 A9 01 8D BD 02 20 81
0B99:FE 09 20 2B 0F 20 07 0A 39
0BA1:20 BE 0D 20 F0 0D 20 64 7B
0BA9:0D A0 00 B9 F0 10 99 48 4D
0BB1:03 C8 C0 03 D0 F5 CE 34 F3
0BB9:03 CE 34 03 A0 00 B9 35 69
```

```
0BC1:03 99 4B 03 C8 CC 34 03 3E
0BC9:D0 F4 18 AD 34 03 69 03 E6
0BD1:8D 34 03 20 76 0D AD BD 1F
0BD9:02 CD FF 02 F0 06 EE BD BF
0BE1:02 4C 98 0B 4C 94 0D 20 BE
0BE9:07 0A 20 D2 0D 20 B9 0D A0
0BF1:20 87 10 C9 8C F0 6B 20 B7
0BF9:07 0A 20 C8 0D 20 34 0E 06
0C01:A0 00 B9 E4 10 99 48 03 69
0C09:C8 C0 03 D0 F5 A0 00 B9 0F
0C11:35 03 99 4B 03 C8 CC 34 75
0C19:03 D0 F4 AD 34 03 85 FB 15
0C21:20 07 0A 20 CD 0D 20 34 65
0C29:0E A6 FB A9 2C 9D 4B 03 7D
0C31:E8 A0 00 B9 35 03 9D 4B BD
0C39:03 E8 C8 C0 03 D0 F4 18 8F
0C41:8A 69 03 8D 34 03 20 07 27
0C49:0A 20 04 0E 20 B9 0D 20 F1
0C51:87 10 C9 8C F0 0C 20 07 32
0C59:0A 20 D2 0D 20 F0 0D 4C D4
0C61:76 0D 60 20 07 0A 20 D7 7E
0C69:0D 20 B9 0D 20 87 10 C9 21
0C71:8C F0 35 A0 00 B9 E8 10 85
0C79:99 48 03 C8 C0 03 D0 F5 07
0C81:A0 00 A9 03 8D 34 03 20 B2
0C89:07 0A 20 04 0E 20 B9 0D 5D
0C91:20 87 10 C9 8C F0 11 20 A4
0C99:07 0A 20 D7 0D A9 14 20 90
0CA1:D2 FF 20 F0 0D 4C 76 0D C9
0CA9:60 20 07 0A 20 DC 0D 20 2A
0CB1:B9 0D 20 87 10 C9 8C F0 18
0CB9:A9 20 FE 09 A0 00 A2 00 69
0CC1:AD FF 02 C9 00 F0 9B B1 3A
0CC9:FD C9 2C F0 0A 9D 35 03 1C
0CD1:E8 20 EC 0A 4C C8 0C 8E D0
0CD9:34 03 20 58 0D A0 00 B9 FA
0CE1:EC 10 99 48 03 C8 C0 03 EB
0CE9:D0 F5 20 07 0A 20 EB 0D 12
0CF1:A0 00 B9 35 03 99 70 03 47
0CF9:20 D2 FF C8 CC 34 03 D0 71
0D01:F1 8C 6F 03 20 B9 0D 20 77
0D09:87 10 C9 8C F0 48 20 07 DC
0D11:0A 20 C3 0D 20 34 0E A0 10
0D19:00 B9 35 03 99 4B 03 C8 41
0D21:CC 34 03 D0 F4 A9 3D 99 7E
0D29:4B 03 C8 18 AD 34 03 69 F1
0D31:04 8D 34 03 A2 00 BD 70 68
0D39:03 99 4B 03 C8 E8 EC 6F 08
0D41:03 D0 F3 18 AD 34 03 6D C2
0D49:6F 03 8D 34 03 20 76 0D 63
0D51:CE FF 02 4C BD 0C 60 20 D6
0D59:EC 0A 20 EC 0A 20 EC 0A F3
0D61:4C EC 0A A0 00 B9 35 03 7C
0D69:99 70 03 20 D2 FF C8 CC C3
0D71:34 03 D0 F1 60 A9 0F A2 0A
0D79:08 A0 0F 20 BA FF AD 34 09
0D81:03 A2 48 A0 03 20 BD FF EC
0D89:20 C0 FF A9 0F 20 C3 FF FE
0D91:4C CC FF 20 CC FF 20 07 B4
0D99:0A A5 BA 20 B4 FF A9 6F E3
0DA1:85 B9 20 96 FF A0 00 20 FC
0DA9:A5 FF C9 0D F0 07 20 D2 57
0DB1:FF C8 4C A8 0D 4C AB FF 03
0DB9:A2 09 4C 06 0E A2 0A 4C AC
0DC1:06 0E A2 00 4C 06 0E A2 EF
0DC9:01 4C 06 0E A2 02 4C 06 D4
0DD1:0E A2 03 4C 06 0E A2 04 72
0DD9:4C 06 0E A2 05 4C 06 0E FA
0DE1:A2 06 4C 06 0E A2 07 4C 0E
0DE9:06 0E A2 0B 4C 06 0E A2 C8
0DF1:0E 4C 06 0E A2 0C 4C 06 AB
0DF9:0E A2 10 4C 06 0E A2 0D 45
0E01:4C 06 0E A2 0F A9 F4 85 3F
0E09:30 A9 10 85 31 A0 00 18 26
0E11:A5 30 7D A5 11 85 30 A5 BA
0E19:31 69 00 85 31 E0 00 F0 7E
0E21:04 CA 4C 10 0E B1 30 C9 DD
0E29:2A F0 07 20 D2 FF C8 4C ED
0E31:26 0E 60 A0 00 A9 00 8D 2E
0E39:34 03 20 E4 FF C9 00 F0 9A
0E41:F9 C9 14 F0 3E C9 7B B0 1F
0E49:F1 C9 11 F0 ED C9 13 F0 AF
0E51:E9 C9 1D F0 E5 C9 22 F0 13
0E59:E1 C9 2C F0 DD C9 0D F0 8E
0E61:10 AC 34 03 C0 10 F0 D2 62
0E69:20 D2 FF 20 7A 0E 4C 3B 2C
0E71:0E AC 34 03 C0 00 F0 C2 21
0E79:60 AC 34 03 99 35 03 EE 3E
0E81:34 03 60 AC 34 03 C0 01 7F
0E89:B0 03 4C 3B 0E 20 D2 FF 92
0E91:38 AD 34 03 E9 01 8D 34 8E
0E99:03 4C 3B 0E 20 07 0A 20 E3
0EA1:E1 0D 20 B9 0D 20 87 10 99
0EA9:C9 8C F0 49 A9 00 8D C3 AC
0EB1:02 20 EC 0A A5 FD 85 FB 41
0EB9:8D C9 02 A5 FE 85 FC 8D 3F
0EC1:CA 02 A9 01 8D E0 02 8D 8A
0EC9:D1 02 AD FF 02 C9 00 F0 2D
0ED1:24 AD D1 02 8D BD 02 20 4D
0ED9:FE 09 20 2B 0F 20 72 0F 5B
0EE1:AD C3 02 C9 01 F0 15 AD 46
0EE9:BD 02 CD FF 02 F0 07 EE EF
0EF1:D1 02 4C D2 0E 60 20 8F EF
0EF9:10 4C 0B 0F A9 00 8D C3 AF
0F01:02 20 8F 10 20 0B 0F 4C B2
0F09:F0 0E 20 07 0A 20 FA 0D 6B
0F11:20 B9 0D AD D1 02 8D E0 BC
0F19:02 EE E0 02 20 87 10 AD 1D
0F21:C9 02 85 FB AD CA 02 85 37
0F29:FC 60 A0 00 A2 01 EC BD A2
0F31:02 F0 13 B1 FD C9 2C F0 6A
0F39:06 20 EC 0A 4C 34 0F E8 DA
0F41:20 58 0D 4C 2F 0F A0 00 E2
0F49:B1 FD C9 2C F0 07 99 35 C7
0F51:03 C8 4C 49 0F 99 35 03 8D
0F59:C8 B1 FD 99 35 03 C8 8C 75
0F61:C0 02 8C 34 03 B1 FD 8D 9D
0F69:BE 02 C8 B1 FD 8D BF 02 43
0F71:60 A9 02 8D FC 03 20 61 D8
0F79:10 20 97 0D C0 0E B0 69 74
0F81:20 07 0A 20 F5 0D 20 64 3D
0F89:0D A2 02 20 C6 FF A5 FB 96
0F91:8D C1 02 A5 FC 8D C2 02 27
0F99:A9 00 8D BA 02 8D BB 02 A9
0FA1:A0 00 20 CF FF 91 FB 20 6F
0FA9:DE 0A 20 04 10 A5 FB C9 D6
0FB1:FF F0 0A 20 B7 FF C9 40 E0
0FB9:F0 0C 4C A3 0F A5 FC C9 E9
0FC1:CF F0 52 4C B4 0F AC C0 0F
0FC9:02 AD BA 02 91 FD C8 AD 8F
0FD1:BB 02 91 FD A2 00 20 C6 7C
0FD9:FF A2 00 20 C9 FF 20 07 38
0FE1:0A 20 94 0D A9 02 4C C3 22
0FE9:FF 68 68 18 AD BE 02 65 82
0FF1:FB 85 FB AD BF 02 65 FC 97
0FF9:85 FC 20 B9 0D 20 87 10 C1
1001:4C D5 0F 18 AD BA 02 69 E5
1009:01 8D BA 02 AD BB 02 69 4E
1011:00 8D BB 02 60 A9 01 8D 65
1019:C3 02 CE D1 02 4C C7 0F 72
1021:A9 01 8D FC 03 20 61 10 43
1029:20 97 0D C0 0E B0 BC 20 B9
1031:07 0A 20 FF 0D 20 64 0D 1A
1039:A2 02 20 C9 FF A0 00 B1 FF
1041:FB 20 D2 FF 20 DE 0A 20 72
1049:04 10 AD BA 02 CD BE 02 97
1051:F0 03 4C 40 10 AD BB 02 E8
1059:CD BF 02 D0 E2 4C D5 0F A0
1061:20 CC FF AD 34 03 A2 35 C7
1069:A0 03 20 BD FF A9 02 A2 C7
1071:08 AC FC 03 20 BA FF 20 9C
1079:C0 FF A9 00 8D BA 02 8D 18
1081:BB 02 8D C3 02 60 20 E4 A4
1089:FF C9 00 F0 F9 60 20 07 C3
1091:0A 20 04 0E 20 B9 0D 20 42
1099:87 10 C9 8C F0 39 AD E0 2C
10A1:02 8D BD 02 AD C9 02 85 1C
10A9:FB AD CA 02 85 FC 20 FE 0C
10B1:09 20 2B 0F AE 34 03 A9 AA
10B9:2C 9D 35 03 E8 A9 57 9D 68
10C1:35 03 E8 8E 34 03 20 21 52
10C9:10 AD BD 02 CD D1 02 F0 DF
10D1:07 EE BD 02 4C AF 10 60 AA
10D9:AD C1 02 85 FB AD C2 02 F7
10E1:85 FC 60 4E 30 3A 2A 56 0A
10E9:30 3A 2A 52 30 3A 2A 53 2D
10F1:30 3A 2A 4E 45 57 20 4E F8
10F9:41 4D 45 20 3E 2A 44 49 25
1101:53 4B 20 4E 41 4D 45 20 72
1109:3E 2A 55 4E 49 51 55 45 E3
1111:20 49 44 20 3E 2A 46 4F 96
1119:52 4D 41 54 2A 56 41 4C 9E
1121:49 44 41 54 45 2A 52 45 23
1129:4E 41 4D 45 2A 43 4F 50 0E
1131:59 2A 51 55 49 54 2A 4E 48
1139:4F 20 46 49 4C 45 53 2A B0
1141:20 3A 50 52 45 53 53 20 6F
1149:4B 45 59 2A 53 43 52 41 BD
1151:54 43 48 2A 43 48 41 4E 26
1159:47 45 20 2A 4C 4F 41 44 7D
1161:49 4E 47 20 2A 53 41 56 1E
1169:49 4E 47 20 2A 49 4E 47 09
1171:20 2A 50 55 54 20 54 41 9A
1179:52 47 45 54 20 44 49 53 7C
1181:4B 20 49 4E 20 44 52 49 5F
1189:56 45 2A 50 55 54 20 53 02
1191:4F 55 52 43 45 20 44 49 AB
1199:53 4B 20 49 4E 20 44 52 9E
11A1:49 56 45 2A 00 0B 0C 0C 99
11A9:07 09 07 05 05 09 0C 08 2F
11B1:08 09 08 05 19 24 A0 00 06
11B9:A9 D5 85 FB A9 11 85 FC 30
11C1:B1 FB C9 00 F0 09 20 D2 B3
11C9:FF 20 DE 0A 4C C1 11 A9 A5
11D1:13 4C D2 FF 93 11 1D 1C 22
11D9:12 D5 C0 C0 C0 C0 C0 C0 E9
11E1:C0 C0 C0 C0 C0 C0 C0 C0 04
11E9:C0 C0 C0 C0 C0 C0 C0 C0 0C
11F1:C0 C0 C0 C0 C0 C0 C0 C0 14
11F9:C0 C0 C0 C0 C0 C0 C9 0D 7A
1201:1D 1C 12 DD 20 20 20 20 BC
1209:20 20 20 20 20 20 20 20 2D
1211:20 20 20 20 20 20 20 20 35
1219:20 20 20 20 20 20 20 20 3D
1221:20 20 20 20 20 20 20 20 45
1229:DD 0D 1D 1C 12 DD 20 9E CB
1231:D5 C0 C9 20 D5 C0 C9 20 11
1239:B2 C9 D5 B2 20 B2 C0 C9 26
1241:20 AE 20 B0 20 B0 B2 AE 08
1249:20 B2 C0 AE 20 CE D5 C0 D5
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1251:C9 20 1C 20 DD 0D 1D 1C 61
1259:12 DD 20 9E DD 20 20 20 BB
1261:DD 20 DD 20 DD CA CB DD C9
1269:20 AB C0 CB 20 DD 20 DD F3
1271:20 20 DD 20 20 AB C0 20 BC
1279:20 20 CA C0 C9 20 1C 20 42
1281:DD 0D 1D 1C 12 DD 20 9E 24
1289:CA C0 CB 20 CA C0 CB 20 CF
1291:BD 20 20 AD 20 B1 20 20 A3
1299:20 CA C0 CB 20 20 B1 20 5A
12A1:20 B1 C0 BD 20 20 CA C0 0E
12A9:CB 20 1C 20 DD 0D 1D 1C BA
12B1:12 DD 20 20 20 20 20 20 3E
12B9:20 20 20 20 20 20 20 20 DD
12C1:20 20 20 20 20 20 20 20 E5
12C9:20 20 20 20 20 20 20 20 ED
12D1:20 20 20 20 20 20 DD 0D 5E
12D9:1D 1C 12 CA C0 C0 C0 C0 CD
12E1:C0 C0 C0 C0 C0 C0 C0 C0 06
12E9:C0 C0 C0 C0 C0 C0 C0 C0 0E
12F1:C0 C0 C0 C0 C0 C0 C0 C0 16
12F9:C0 C0 C0 C0 C0 C0 C0 C0 1E
1301:CB 0D 11 9A 1D 1D 1D 1D D0
1309:20 B2 AE 20 B2 20 20 B2 CC
1311:20 20 B2 AE 20 20 20 B2 05
1319:AE 20 B0 AE 20 B2 AE 20 E8
1321:B2 20 B2 AE 20 B2 AE 0D 20
1329:1D 1D 1D 1D 20 AB 20 20 AA
1331:DD A0 20 DD 20 20 AB 20 49
1339:20 20 20 DD 20 20 DD DD 74
1341:20 AB BD 20 DD 20 AB 20 03
1349:20 AB B3 0D 1D 1D 1D 1D 66
1351:20 B1 20 20 B1 20 20 B1 F9
1359:BD 20 B1 BD 20 20 20 B1 EB
1361:BD 20 AD BD 20 B1 20 20 28
1369:B1 20 B1 BD 20 B1 AD 0D B2
1371:11 96 1D 1D 1D 1D 1D 1D EF
1379:1D 1D 1D 1D 1D 1D 1D 43 C5
1381:4F 50 59 52 49 47 48 54 FF
1389:20 31 39 39 31 0D 11 96 3D
1391:1D 1D 1D 1D 1D 1D 43 4F 36
1399:4D 50 55 54 45 20 50 55 0B
13A1:42 4C 49 43 41 54 49 4F 96
13A9:4E 53 20 49 4E 54 4C 20 E0
13B1:4C 54 44 11 0D 1D 1D 1D E0
13B9:1D 1D 1D 1D 1D 1D 1D 41 04
13C1:4C 4C 20 52 49 47 48 54 96
13C9:53 20 52 45 53 45 52 56 EA
13D1:45 44 11 0D 1C 3E 11 1F B9
13D9:0D 1D 1C 46 31 2D 1F 20 52
13E1:56 41 4C 49 44 41 54 45 B6
13E9:20 20 1C 46 32 2D 20 1F B5
13F1:53 43 52 41 54 43 48 20 51
13F9:20 1C 46 33 2D 20 1F 52 AD
1401:45 4E 41 4D 45 0D 1D 1D 12
1409:1D 1D 1C 46 34 2D 20 1F A4
1411:46 4F 52 4D 41 54 20 20 0B
1419:20 1C 46 35 2D 20 1F 4C E8
1421:4F 41 44 20 44 49 52 45 FC
1429:43 54 4F 52 59 0D 1D 1D 6D
1431:1D 1D 1D 1C 46 36 2D 20 1A
1439:1F 51 55 49 54 20 20 1C 04
1441:46 37 2D 20 1F 43 4F 50 F6
1449:59 20 20 1C 46 38 2D 20 79
1451:1F 41 42 4F 52 54 0D 00 94
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PUZZLE MANIA

By Maurice Yanney

As different pieces fall from the sky in *Puzzle Mania*, it's your job to see that they land on identically shaped pieces on rows at the bottom of the screen. You control the position of the lower shapes, but lining them up with the falling pieces can be tricky.

Completing a puzzle and continuing to the next level require matching all the pieces on each of the three rows at the bottom of the puzzle. *Puzzle Mania* is a one-player game which requires fast reactions and quick thinking.

Getting Started

Although *Puzzle Mania* is written in machine language, it loads and runs like a BASIC program. To type it in, use *MLX*, our machine language entry program. When *MLX* prompts you, respond with the values given below.

Starting address: 0801
Ending address: 12E0

Be sure to save a copy of the program before exiting *MLX*. Movement is controlled by using a joystick (in either port) or the keyboard.

Playing the Game

As pieces fall, you try to see to it that they land on matching pieces before time expires. Complete one level, and then proceed to the next. Each level contains a more difficult puzzle.

The first level consists of the falling pieces and three bottom rows. An additional row is added on subsequent levels. Each row consists of five shapes to be matched. When a piece is matched by a falling piece, it disappears from the row. When all the pieces have been matched, you move to the next level.

You position the shapes on the bottom rows with a joystick (in either port) or by using the I, J, K, and M keys to move up, left, right, and down, respectively. When you move up, the top row of the puzzle becomes the bottom row, and all the other rows move up one row. Moving down does the opposite; the bottom row becomes the top row, and all the other rows move down one row. Moving left and right affects only the top row by moving the shapes left or right. If you move a shape off one side of the screen, it will wrap to the other side. Moving 39 positions to the left is the same as moving one position to the right, except that it takes longer.

Pieces fall three at a time, and there are eight different pieces in all. Each piece has a unique match. If a falling piece is not met by its match, then a different shape takes its place. If the falling piece matches, that piece disappears, and you receive 100 points. Then a new piece starts to fall.

The time given to complete the first level is 500 ticks. An onscreen clock shows ticks remaining. An additional 100 ticks are given to complete subsequent levels until level 6, and then no additional time is awarded. When all the pieces are matched and a level is completed, bonus points are awarded based on the amount of time remaining. Ten bonus points are given for each remaining tick.

To pause the game, hold down the Shift key (or press the Shift Lock key). When the Shift key (or Shift Lock key) is released, the game continues.

Tips on Playing

The puzzle pieces fall slowly in the first few levels, so utilize this time to your advantage. Instead of just lining up one piece and waiting for it to fall into place, plan a move or two ahead. One way of doing this is to line up the second falling piece with its match on the second or third bottom row. Once the first piece is matched, move up or down until the row with the prealigned piece is on top. You can then get pieces that are going to reach the top row at nearly the same time. On higher levels you'll need to do this often.

Another tip useful on higher levels involves putting a priority on which piece you're trying to match. There are eight different pieces. Although the pieces fall in a somewhat random order, all eight pieces will fall before a new sequence starts. If one piece appears many times on the puzzle board and another only a few times, you should try to match the ones appearing more frequently. You may have only a couple of pieces remaining, don't waste time waiting for the the same one or two pieces to reappear.

PUZZLE MANIA

```
0801:0B 0B 0A 00 9E 20 32 30 A4
0809:36 32 00 00 00 A9 0C 8D 0D
0811:20 D0 A9 0F 8D 21 D0 20 3E
0819:95 10 20 D9 11 20 CB 08 42
0821:20 A9 12 20 03 0D 20 D9 56
0829:11 20 8B 12 20 72 0F AD F2
0831:8D 02 C9 01 F0 F9 20 F7 79
0839:0C AD E6 12 18 69 01 8D AE
0841:E6 12 F0 0B C9 FA F0 12 46
0849:C9 FD F0 0E 4C 30 08 20 10
0851:16 10 20 EA 0B A9 F7 8D 9F
0859:E6 12 A5 C5 C9 25 F0 35 6C
0861:C9 22 F0 37 C9 21 F0 39 5E
0869:C9 24 F0 3B AD 00 DC C9 2A
0871:77 F0 22 C9 7B F0 24 C9 0C
0879:7E F0 26 C9 7D F0 28 AD 14
0881:01 DC C9 F7 F0 0F C9 FB 55
0889:F0 11 C9 FE F0 13 C9 FD E4
0891:F0 15 4C AE 08 20 B4 0D 0B
0899:4C AE 08 20 CA 0D 4C AE 50
08A1:08 20 63 0D 4C AE 08 20 48
08A9:F7 0D 4C AE 08 20 CB 0A CF
08B1:AD F5 12 D0 03 20 3A 0C 7E
08B9:AD DB 12 C9 FF F0 08 A9 F3
08C1:01 20 2F 0B 4C 30 08 4C 70
08C9:AB 09 20 22 12 A0 00 A9 D4
08D1:FF 99 D0 06 C8 C0 C8 D0 6E
08D9:F8 A2 13 A0 02 18 20 0A 36
08E1:E5 A9 51 A0 09 20 1E AB 34
08E9:A2 15 20 7D 12 A9 01 8D 33
08F1:DF 12 A2 00 AD DF 12 38 14
08F9:E9 01 C9 FF D0 02 A9 0C 66
0901:8D DF 12 A8 B9 9E 09 9D 96
0909:00 04 9D B4 04 9D 68 05 87
0911:9D 1C 06 AD DF 12 29 07 35
0919:0A 9D 00 D8 9D B4 D8 9D 34
0921:68 D9 9D 1C DA C8 C0 0D DB
0929:D0 02 A0 00 E8 E0 B4 F0 5D
0931:03 4C 05 09 A2 00 AD 00 79
0939:DC C9 7F D0 12 AD 01 DC 4F
0941:C9 FF D0 0B 20 F7 0C E8 E4
0949:E0 03 D0 EA 4C F3 08 60 F7
0951:96 54 4F 20 4D 4F 56 45 49
0959:3A 20 20 4A 4F 59 53 54 14
0961:49 43 4B 20 4F 52 20 49 A1
0969:2C 4A 2C 4B 20 26 20 4D 85
0971:20 4B 45 59 53 00 96 4D B9
0979:4F 56 45 20 4A 4F 59 53 09
0981:54 49 43 4B 20 4F 52 20 30
0989:50 52 45 53 53 20 53 50 48
0991:41 43 45 20 54 4F 20 53 33
0999:54 41 52 54 00 10 15 1A 3A
09A1:1A 0C 05 20 0D 01 0E 09 F7
09A9:01 20 20 2F 0B A2 01 A0 C0
09B1:0F 18 20 0A E5 A9 F6 A0 5A
09B9:09 20 1E AB A2 C8 20 F7 47
09C1:0C E8 D0 FA A2 03 20 7D BC
09C9:12 A2 05 A0 0F 18 20 0A 5B
09D1:E5 A9 01 A0 0A 20 1E AB 24
09D9:AD 00 DC C9 7F F0 03 4C 0D
09E1:21 08 AD 01 DC C9 FF F0 4B
09E9:03 4C 21 08 A5 C5 C9 27 34
09F1:D0 E6 20 E2 FC 96 47 41 6A
09F9:4D 45 20 4F 56 45 52 00 69
0A01:96 4E 20 54 4F 20 51 55 30
0A09:49 54 00 AC F7 12 B9 EC 0A
0A11:12 85 FB B9 ED 12 85 FC 6A
0A19:A0 00 B1 FB C9 20 F0 7D A1
0A21:C9 FF F0 76 C9 EF B0 75 84
0A29:AC F6 12 B9 F2 12 18 69 A8
0A31:01 29 FE AA A0 00 B1 FB FE
0A39:A8 C0 EE D0 07 E0 FE D0 47
0A41:59 4C 8F 0A C0 ED D0 07 0E
0A49:E0 FC D0 4E 4C 8F 0A C0 81
0A51:EC D0 07 E0 FA D0 43 4C EC
0A59:8F 0A C0 EB D0 07 E0 F8 EB
0A61:D0 38 4C 8F 0A C0 EA D0 68
0A69:07 E0 F6 D0 2D 4C 8F 0A E8
0A71:C0 E9 D0 07 E0 F4 D0 22 89
0A79:4C 8F 0A C0 E8 D0 07 E0 5E
0A81:F2 D0 17 4C 8F 0A C0 E7 F8
0A89:D0 10 E0 F0 D0 0C 20 9F CB
0A91:0A AD F5 12 38 E9 01 8D EE
0A99:F5 12 20 6D 0B 60 A0 00 23
0AA1:A9 FF 91 FB 20 3B 0D A0 25
0AA9:02 A9 00 91 FB AD DF 12 AA
0AB1:85 FD AD E0 12 85 FE 88 F8
0AB9:88 B1 FD C8 C8 C8 91 FB 53
0AC1:C0 2A D0 F3 A9 0A 20 03 D2
0AC9:10 60 A9 00 8D F6 12 8D 2D
0AD1:F7 12 20 0C 0A A9 01 8D B1
0AD9:F6 12 A9 02 8D F7 12 20 D3
0AE1:0C 0A A9 02 8D F6 12 A9 E9
0AE9:04 8D F7 12 20 0C 0A 60 29
0AF1:AC F6 12 B9 F8 12 49 01 9B
0AF9:99 F8 12 D0 03 20 BE 0B 89
0B01:60 A9 C8 8D DA 12 A9 00 16
0B09:8D DB 12 AC E3 12 C0 07 D9
0B11:90 02 A0 07 AD DA 12 18 89
0B19:69 64 8D DA 12 AD DB 12 6D
0B21:69 00 8D DB 12 88 C0 FF 8F
0B29:D0 EA 20 4E 0F 60 8D E1 42
0B31:12 A2 00 A0 00 B9 E9 12 CF
0B39:D0 2A BD EC 12 85 FB E8 50
0B41:BD EC 12 85 FC 98 8D DF 51
0B49:12 AD E1 12 F0 0A B9 F2 47
0B51:12 38 F9 F8 12 4C 5B 0B D0
0B59:A9 20 A0 00 91 FB AC DF 16
0B61:12 4C 66 0B E8 E8 C8 C0 4E
0B69:03 D0 CA 60 20 97 E0 A5 5B
0B71:8F 29 0F 69 01 AC F6 12 CC
0B79:99 E9 12 20 CA 0E 0A 69 27
0B81:F0 AC F6 12 99 F2 12 20 18
0B89:97 E0 A5 8F AC F6 12 C0 77
0B91:00 F0 14 C0 01 F0 08 29 77
0B99:0F 18 69 18 4C AA 0B 29 38
0BA1:07 18 69 10 4C AA 0B 29 BB
0BA9:0F AC F7 12 99 EC 12 A9 E0
0BB1:04 99 ED 12 A9 01 AC F6 B0
0BB9:12 99 F8 12 60 AC F7 12 37
0BC1:B9 EC 12 85 FB B9 ED 12 3F
0BC9:85 FC 98 8D DF 12 A0 00 56
0BD1:A9 20 91 FB AC DF 12 B9 79
0BD9:EC 12 18 69 28 99 EC 12 18
0BE1:B9 ED 12 69 00 99 ED 12 7D
0BE9:60 AD E9 12 F0 09 38 E9 FF
0BF1:01 8D E9 12 4C 03 0C A9 7A
0BF9:00 8D F6 12 8D F7 12 20 04
0C01:F1 0A AD EA 12 F0 09 38 97
0C09:E9 01 8D EA 12 4C 1E 0C C0
0C11:A9 01 8D F6 12 A9 02 8D 28
0C19:F7 12 20 F1 0A AD EB 12 C5
0C21:F0 09 38 E9 01 8D EB 12 C1
0C29:4C 39 0C A9 02 8D F6 12 18
0C31:A9 04 8D F7 12 20 F1 0A 4F
0C39:60 A9 00 20 2F 0B 18 AD 71
0C41:E2 12 69 01 C9 0D D0 02 B2
0C49:A9 0C 8D E2 12 8D E3 12 B9
0C51:A9 0F 8D F5 12 AE E2 12 36
0C59:AD F5 12 18 69 05 8D F5 F9
0C61:12 CA E0 02 D0 F2 A2 06 0F
0C69:A0 0D 18 20 0A E5 A9 E3 39
0C71:A0 0C 20 1E AB A2 06 A0 57
0C79:1A 18 20 0A E5 A9 00 AE CD
0C81:DC 12 20 CD BD A2 08 A0 96
0C89:0F 18 20 0A E5 A9 F0 A0 2C
0C91:0C 20 1E AB A9 00 8D E7 86
0C99:12 8D E8 12 18 AD E7 12 B5
0CA1:69 0A 8D E7 12 AD E8 12 4C
0CA9:69 00 8D E8 12 A2 08 A0 82
0CB1:16 18 20 0A E5 AD E8 12 49
0CB9:AE E7 12 20 CD BD A9 01 21
0CC1:20 03 10 AD DB 12 C9 FF 42
0CC9:F0 06 20 16 10 4C 9D 0C 3A
0CD1:20 38 12 A2 7D 20 F7 0C DC
0CD9:E8 D0 FA 20 8B 12 20 2B 0C
0CE1:10 60 45 4E 44 20 4F 46 2F
0CE9:20 4C 45 56 45 4C 00 42 D0
0CF1:4F 4E 55 53 3A 00 A0 4B 83
0CF9:A9 DC 69 01 D0 FC C8 D0 38
0D01:F7 60 A2 00 A9 70 85 FD 9B
0D09:A9 07 85 FE A9 FB 85 FB 9E
0D11:A9 12 85 FC A0 00 A5 FD 53
0D19:91 FB C8 A5 FE 91 FB C8 6D
0D21:A9 02 91 FB 38 A5 FD E9 C0
0D29:28 85 FD A5 FE E9 00 85 F7
0D31:FE 20 9B 12 E8 E0 0D D0 1D
0D39:DB 60 20 48 0E A9 FB 85 76
0D41:FB A9 12 85 FC A0 00 38 01
0D49:B1 FB ED DF 12 8D E1 12 93
0D51:C8 B1 FB ED E0 12 0D E1 E5
0D59:12 F0 06 20 9B 12 4C 46 7F
0D61:0D 60 20 48 0E 20 E0 0D 62
0D69:A0 00 38 B1 FB ED DF 12 5F
0D71:8D E1 12 C8 B1 FB ED E0 D3
0D79:12 0D E1 12 D0 0E A0 00 3D
0D81:A9 70 91 FB C8 A9 07 91 0B
0D89:FB 4C 9D 0D A0 00 38 B1 60
0D91:FB E9 28 91 FB C8 B1 FB A4
0D99:E9 00 91 FB 38 AD E2 12 EA
0DA1:E9 01 8D E2 12 C9 FF D0 59
0DA9:BC AD E3 12 8D E2 12 20 67
0DB1:6F 0E 60 20 3B 0D A0 02 66
0DB9:38 B1 FB E9 01 C9 FF D0 7A
0DC1:02 A9 27 91 FB 20 91 0E D6
0DC9:60 20 3B 0D A0 02 18 B1 43
0DD1:FB 69 01 C9 28 D0 02 A9 33
0DD9:00 91 FB 20 91 0E 60 AC 0C
0DE1:E2 12 A9 FB 85 FB A9 12 68
0DE9:85 FC C0 00 F0 07 88 20 F2
0DF1:9B 12 4C EB 0D 60 20 E0 B1
0DF9:0D A0 00 38 B1 FB E9 70 08
0E01:8D E1 12 C8 B1 FB E9 07 83
0E09:0D E1 12 D0 13 20 48 0E 2B
0E11:A0 00 AD DF 12 91 FB C8 C8
0E19:AD E0 12 91 FB 4C 31 0E 21
0E21:A0 00 18 B1 FB 69 28 91 13
0E29:FB C8 B1 FB 69 00 91 FB D5
0E31:38 AD E2 12 E9 01 8D E2 A3
0E39:12 C9 FF D0 B9 AD E3 12 3C
0E41:8D E2 12 20 6F 0E 60 AC 42
0E49:E3 12 A9 70 8D DF 12 A9 D1
0E51:07 8D E0 12 C0 00 F0 15 8E
0E59:88 38 AD DF 12 E9 28 8D 91
0E61:DF 12 AD E0 12 E9 00 8D 7B
0E69:E0 12 4C 55 0E 60 A2 00 90
0E71:A9 FB 85 FB A9 12 85 FC 6F
0E79:8A 8D DF 12 20 91 0E AD 6C
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0E81:DF 12 AA EC E3 12 F0 07 86
0E89:20 9B 12 E8 4C 79 0E 60 32
0E91:A2 00 A0 00 B1 FB 85 FD 99
0E99:C8 B1 FB 85 FE C8 18 B1 5B
0EA1:FB 69 03 A8 A5 FE F0 20 2C
0EA9:B1 FB 8D E0 12 98 8D E1 4D
0EB1:12 8A A8 AD E0 12 91 FD D9
0EB9:AD E1 12 A8 C8 E8 C0 2B 88
0EC1:D0 02 A0 03 E0 28 D0 E0 35
0EC9:60 AD E4 12 C9 07 D0 0F 5A
0ED1:A9 00 8D E4 12 20 97 E0 E3
0ED9:A5 8F 29 07 8D E5 12 18 82
0EE1:AD E4 12 69 01 8D E4 12 01
0EE9:18 AD E5 12 69 01 29 07 04
0EF1:8D E5 12 60 20 E0 0D A0 D5
0EF9:03 A9 00 8D E1 12 A9 FF 85
0F01:91 FB C8 C0 2B D0 F9 A0 3D
0F09:03 C8 C8 C8 C8 C8 C8 C8 44
0F11:98 8D DF 12 20 CA 0E 18 5C
0F19:69 E7 AC DF 12 91 FB AD F5
0F21:E1 12 18 69 01 8D E1 12 62
0F29:C9 05 D0 DD 20 97 E0 29 AF
0F31:07 A0 02 91 FB 60 20 F5 EB
0F39:0E 38 AD E2 12 E9 01 8D 18
0F41:E2 12 C9 FF D0 F0 AD E3 18
0F49:12 8D E2 12 60 A2 18 A0 AF
0F51:06 AD DA 12 8D DF 12 AD 18
0F59:DB 12 8D E0 12 20 B2 0F 2F
0F61:20 38 10 18 20 0A E5 AD C3
0F69:DB 12 AE DA 12 20 CD BD E7
0F71:60 A2 18 A0 21 AD DC 12 01
0F79:8D DF 12 A9 00 8D E0 12 3D
0F81:20 B2 0F 18 20 0A E5 A9 5E
0F89:00 AE DC 12 20 CD BD 60 24
0F91:A2 18 A0 14 AD DD 12 8D F2
0F99:DF 12 AD DE 12 8D E0 12 6A
0FA1:20 B2 0F 18 20 0A E5 AD 82
0FA9:DE 12 AE DD 12 20 CD BD D9
0FB1:60 38 A9 0F ED DF 12 8D D4
0FB9:E1 12 A9 27 ED E0 12 0D 19
0FC1:E1 12 90 3D C8 38 A9 E7 9D
0FC9:ED DF 12 8D E1 12 A9 03 9F
0FD1:ED E0 12 0D E1 12 90 29 D3
0FD9:C8 38 A9 63 ED DF 12 8D 76
0FE1:E1 12 A9 00 ED E0 12 0D CE
0FE9:E1 12 90 15 C8 38 A9 09 64
0FF1:ED DF 12 8D E1 12 A9 00 C4
0FF9:ED E0 12 0D E1 12 90 01 D3
1001:C8 60 18 6D DD 12 8D DD A7
1009:12 AD DE 12 69 00 8D DE DF
1011:12 20 91 0F 60 20 4E 0F 94
1019:38 AD DA 12 E9 01 8D DA 86
1021:12 AD DB 12 E9 00 8D DB 98
1029:12 60 18 AD DC 12 69 01 4B
1031:8D DC 12 20 72 0F 60 38 5C
1039:A9 E7 ED DA 12 8D E1 12 30
1041:A9 03 ED DB 12 0D E1 12 0D
1049:D0 05 A9 30 8D C7 07 38 1D
1051:A9 63 ED DA 12 8D E1 12 27
1059:A9 00 ED DB 12 0D E1 12 64
1061:D0 05 A9 30 8D C8 07 38 39
1069:A9 09 ED DA 12 8D E1 12 A8
1071:A9 00 ED DB 12 0D E1 12 7C
1079:D0 05 A9 30 8D C9 07 60 7D
1081:A0 00 A9 20 99 00 04 99 97
1089:00 05 99 00 06 99 98 06 EB
1091:C8 D0 F1 60 A9 30 85 34 DB
1099:85 38 AD 0E DC 29 FE 8D 38
10A1:0E DC A5 01 29 FB 85 01 0A
10A9:A9 00 A0 00 B9 00 D0 99 BB
10B1:00 30 B9 00 D1 99 00 31 3B
10B9:B9 00 D2 99 00 32 B9 00 E6
10C1:D3 99 00 33 B9 00 D4 99 76
10C9:00 34 B9 00 D5 99 00 35 78
10D1:B9 00 D6 99 00 36 B9 00 8F
10D9:D7 99 00 37 C8 D0 CD A5 8A
10E1:01 09 04 85 01 AD 0E DC 55
10E9:09 01 8D 0E DC 18 AD 18 1C
10F1:D0 29 F0 69 0C 8D 18 D0 11
10F9:A0 00 B9 71 11 99 80 31 D9
1101:C8 C0 50 D0 F5 A0 00 A2 A3
1109:00 A9 00 20 55 11 20 5E 25
1111:12 CA CA 20 5E 12 E8 A9 01
1119:00 20 55 11 C0 80 D0 E9 92
1121:A0 00 A2 00 A9 00 99 38 A0
1129:37 C8 20 71 12 20 71 12 3A
1131:20 71 12 A9 FF 99 38 37 AA
1139:C8 99 38 37 C8 99 38 37 F4
1141:C8 99 38 37 C8 C0 40 D0 43
1149:DB A0 F7 A9 FF 99 01 37 BA
1151:C8 D0 FA 60 99 78 37 C8 57
1159:99 78 37 C8 99 78 37 C8 BF
1161:99 78 37 C8 60 20 68 12 48
1169:20 68 12 20 68 12 CA 60 7B
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12B1:A9 0F 8D F5 12 A9 02 8D 48
12B9:E2 12 8D E3 12 A9 F7 8D 78
12C1:E6 12 A9 01 8D DC 12 8D B4
12C9:F8 12 8D F9 12 8D FA 12 0F
12D1:A9 08 8D E4 12 20 38 12 60
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ONLY ON DISK

In addition to the type-in programs found in each issue of the magazine, *Gazette Disk* offers bonus programs and original 64 and 128 artwork. Here are this month's bonuses.

Connect the Letters
Richard J. Sands
Atlanta, GA

This version of a popular paper-and-pencil game is played on a grid of five rows by five columns with 25 letters. The object is to draw horizontal and vertical lines that connect the letters. You and the computer take turns drawing one line at a time. You win a square when you draw the line that completes it. The player with the most squares wins.

Sport Card Collector
Kevin Scott Davis
Winter Park, FL

To help you use *Sport Card Collector,* we have included a partial listing of the author's basketball card collection.

You may order this disk ($9.95 plus $2.00 shipping and handling) from Gazette Disk, COMPUTE Publications, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408.

TYPING AIDS

MLX, our machine language entry program for the 64 and 128, and *The Automatic Proofreader* are utilities that help you type in Gazette programs without making mistakes. To make room for more programs, we no longer include these labor-saving utilities in every issue, but they can be found on each *Gazette Disk* and are printed in all issues of *Gazette* through June 1990.

If you don't have access to a back issue or to one of our disks, write to us, and we'll send you free copies of both of these handy programs. We'll also include instructions on how to type in Gazette programs. Please enclose a self-addressed, stamped envelope.

Write to Typing Aids, COMPUTE's Gazette, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408.

REVIEWS

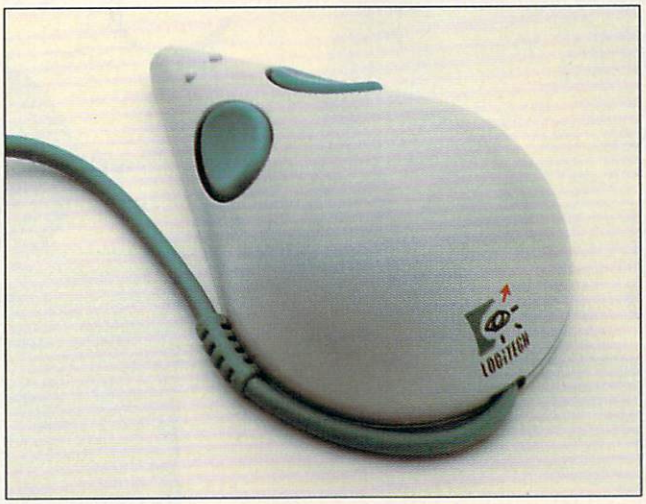
Get your Police Quest III briefing, take an advance look at the Kidz Mouse, and sample a cornucopia of reviews.

KIDZ MOUSE

Anyone who has introduced a preschooler to the world of computing soon discovers several rules. First, little kids don't need an introduction to computers. Their agile minds immediately grasp cause and effect, and they are soon encamped permanently in front of the PC, happily tapping keys while watching letters appear on the screen. The second thing a computer-using parent learns is to forbid drinks and snacks in the home office. Third, you soon realize that using a mouse with a PC isn't imprinted from birth; it's a skill that requires practice, coordination, and a complex appreciation for manipulating images.

Using a mouse also requires the right kind of tool. Logitech delivers it in the form of the Kidz Mouse, a pint-size device shaped much more like its namesake than the bars of soap we grownups insist on calling mice. The Kidz Mouse is smaller than the standard-issue device, allowing small hands to better hold and control the pointer. The physical design of the mouse calls for a raised back and a pointed front (thus the mouse shape) with the tail (cord) issuing from the back and clipped to run alongside the mouse and then out toward the front (nose).

My four-year-old, who learned his mousing on a Microsoft model and then switched gamely to a three-button MouseMan, adapted quickly to the new device. I did notice that the shape of the mouse—its high back is reminiscent of the shape of a real mouse—encouraged him to use his thumb to click the left mouse button. Somewhat older children, with hands just a bit bigger, will probably be able to use the correct fingering.



The unintimidating Kidz Mouse cuts the distance between your kids and the PC.

Your wife Marie, is the latest victim in a series of brutal murders—can you bring her attacker to justice?

The mouse driver deserves special mention because here, too, Logitech has made special efforts to make the Kidz Mouse easy to install and use. The installation procedure puts the mouse driver in a directory called KIDZ (or you can select your own name—just don't put it in the same directory as your present mouse). An option called Kids Support turns the two-button Kidz Mouse into a one-button mouse. Not only does this eliminate unnecessary complexity, but it makes the mouse equally effective for right- and left-handed kids. Interestingly, I found that the Kidz Mouse worked fine using my standard Logitech MouseMan driver.

Only a single caveat is worth mentioning here, and that is that you need two free serial ports if you plan to activate the Kidz Mouse and a regular mouse simultaneously. The driver software will support dual mice, but you'll only be able to use a single button on either mouse when they operate together. My solution is to connect the Kidz Mouse before I head off to work in the morning and then reconnect my MouseMan when I sit down for work late at night. If you're not comfortable with letting your kids have access to the back of your PC, Logitech offers a serial cord extension.

As an added bonus, the Kidz Mouse comes bundled with *The Dinosaur Discovery* kit from First Byte software. This excellent program guarantees that your kids won't be able to keep their hands off the Kidz Mouse.

PETER SCISCO

Scheduled Release: October 1991
IBM PC and compatibles—$79
Five-foot serial extension cord—$10

LOGITECH
6505 Kaiser Dr.
Fremont, CA 94555
(800) 231-7717

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POLICE QUEST III: THE KINDRED

Police Quest players of old, you're in for a real surprise. Gone are the days of a pixel-faced bobby scouring the streets of small-town Lytton for tattoo-bearing drug kingpins. Nothing is simple and everything is complicated about your surrogate life as the *new* Sonny Bonds, dashing young homicide detective turned sergeant.

Now a full-blown metropolis, Lytton offers the rewards and woes of any big-time city, a new ethnically mixed police department, and a hodgepodge of weirdos, traffic violators, and other major and minor offenders.

In the opening sequence, you meet the program's creator, retired California Highway Patrol officer Jim Walls, who charges you to look at

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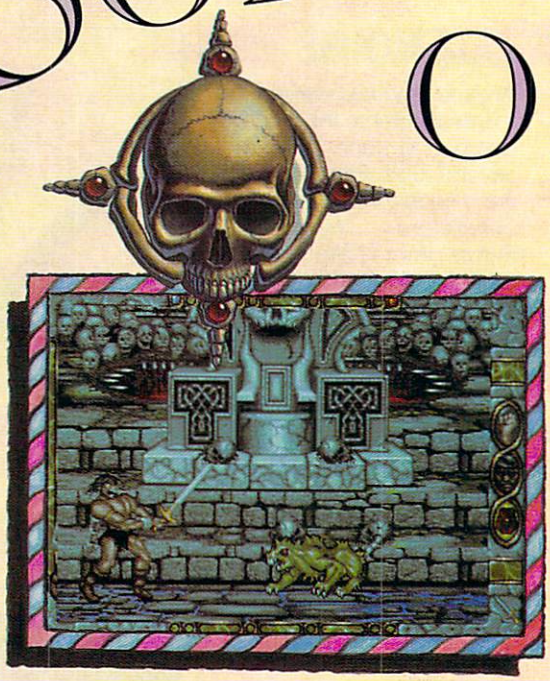


The greatest hero for the Hyborean Age was a fierce barbarian born of the harsh northlands,

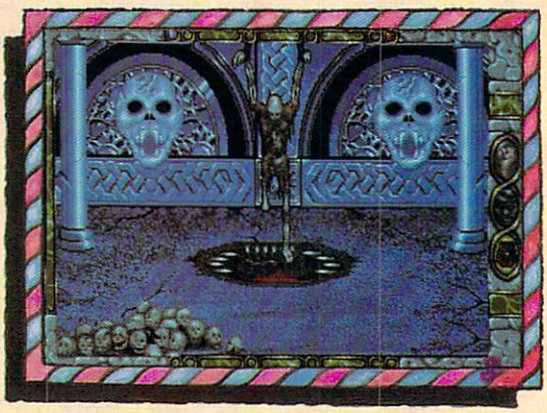
CONAN THE CIMMERIAN

You have heard the tales of Conan's adventures. Only now will you have the opportunity to live the life of this fierce barbarian from the land of Hyborea.

Our odyssey begins with murder most foul. When Conan's village is massacred by the ravening hordes of Thoth Amon, high priest of the vile cult of Set, Conan vows to avenge the death of his family and friends.

In your search for vengeance, you as Conan, will explore Hyborea to seek out its hidden secrets and learn of its powers. Visit over 200 locations – taverns and inns, crypts and dungeons, temples and tombs, lavish homes and poor hovels – to learn the mysteries of Hyborea's sorceries to help Conan overcome its many natural and supernatural perils.

Only with luck, courage and constant struggle will Conan have the chance to force a reckoning with the powerful Thoth Amon.



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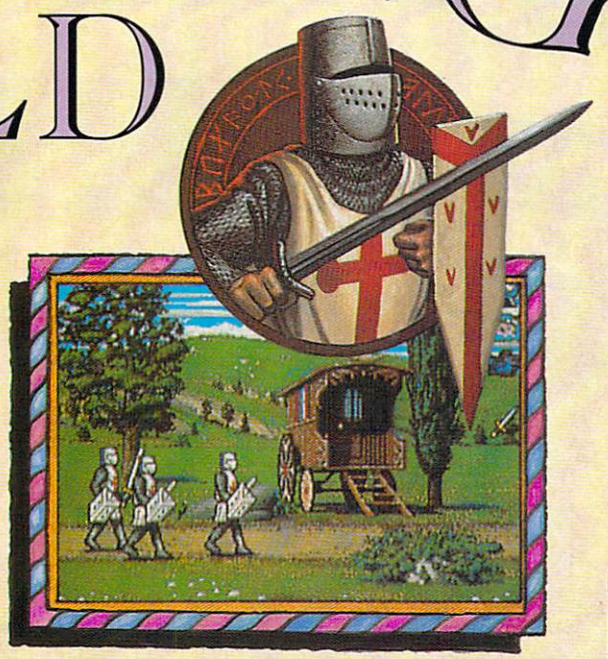

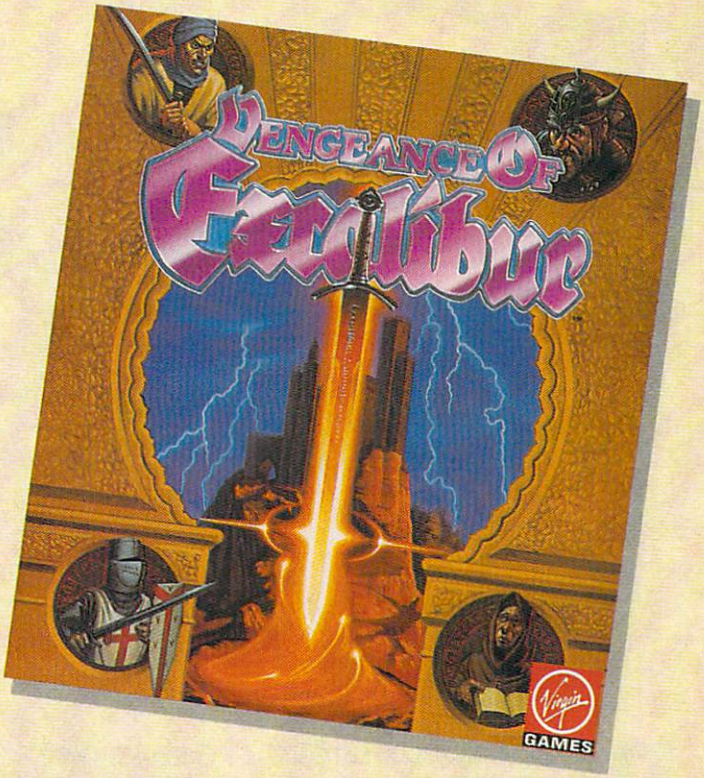

In Spirit of Excalibur, the Knights of the Round Table fought to defend medieval Britain from the evil sorceress, Morgan Le Fay. Morgan, dabbling in dark arts beyond even her ability to control, had summoned a great Lord of Demons, the Shadowmaster.

With Morgan's death, the Shadowmaster was freed to work his evil will against the unprepared folk of Britain. Striking in the night, he imprisoned the King with a spell, stole the greatest treasures of the realm and kidnapped Nineve, the court enchantress. With the loss of the sword Excalibur and the newly recovered Holy Grail, Britain begins to sicken and die. The Shadowmaster must be stopped!

Command knights and whatever followers they are able to recruit to track the Shadowmaster through hazardous, beautiful and mysterious medieval Spain. Explore the hundreds of villages and cities, fortresses and castles, dungeons and palaces and all the secret places where the Shadowmaster may dwell.

Seek what aid you can as you acquire and learn the use of the sorceries of Moorish Spain, for only with the aid of enchantments and the loyalty of strong allies will you stand a chance of ridding the world of the demonic Shadowmaster once and for all.

AVAILABLE FOR THE IBM, AMIGA, ATARI ST AND MAC THIS SUMMER.
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Developed by Synergistic Software.

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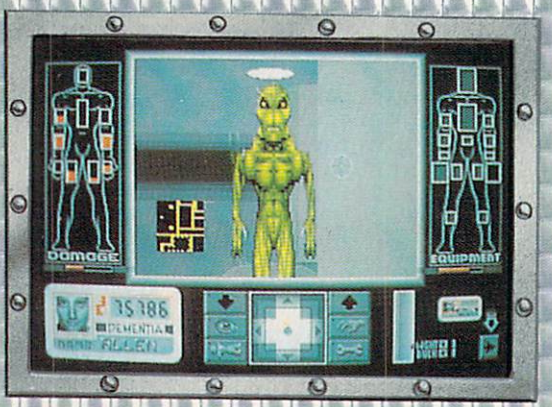
ALSO TAKING OVER A SEGA GENESIS NEAR YOU THIS FALL



ARE YOU TOUGH ENOUGH TO TAKE ON THE 21st CENTURY AND SAVE MANKIND FROM HIS UNTIMELY DESTRUCTION BY A GENETICALLY ENGINEERED WAR MACHINE?!?

Talk about your work-related stress! As a ZODIAC special agent, your job is to crack the complex security systems of the Universal Cybernetics Corporation and track down the mutant robot they have designed as the ultimate killing machine.

You'll arm yourself with a whole arsenal of weapons – everything from hologram projectors to special vision enhancement visors to thermal infra-red image intensifiers. If all else fails – you'll have to rely on your own psychic powers!

FEATURES INCLUDE:

- **16-level 3-dimensional environment complete with fast, smooth scrolling**
- **Realistic action control of six characters: 2 male, 2 female and 2 droid**
- **360 degree vision**
- **Environmental sound effects**

"Tension and unease, with danger lurking around every corner.... This Number One European Hit will keep you on your toes and coming back for more."

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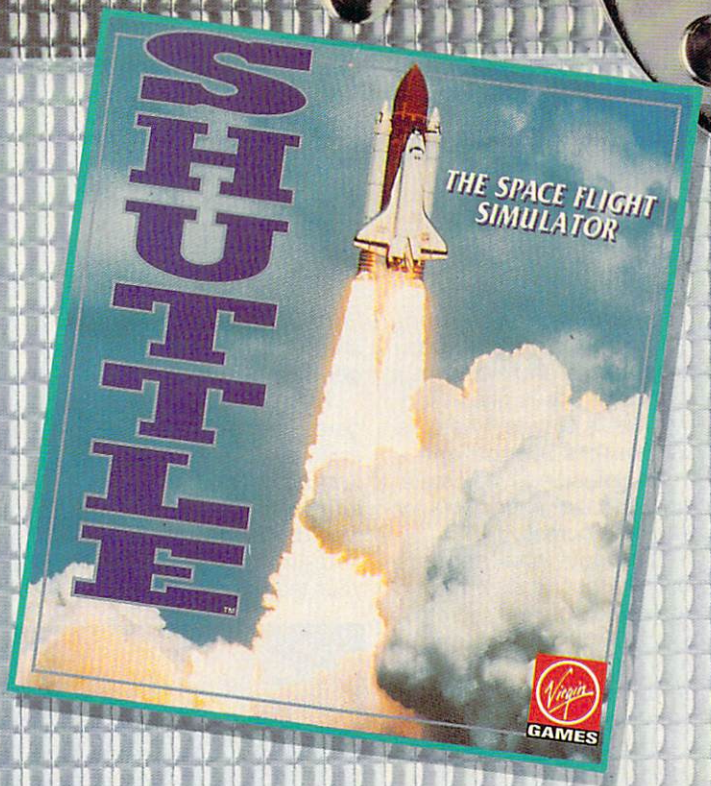

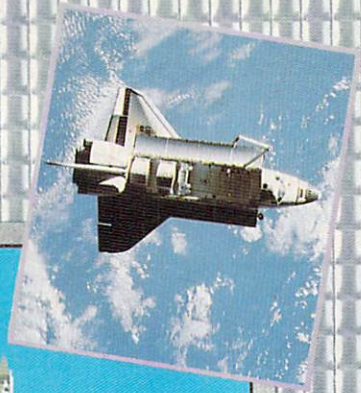

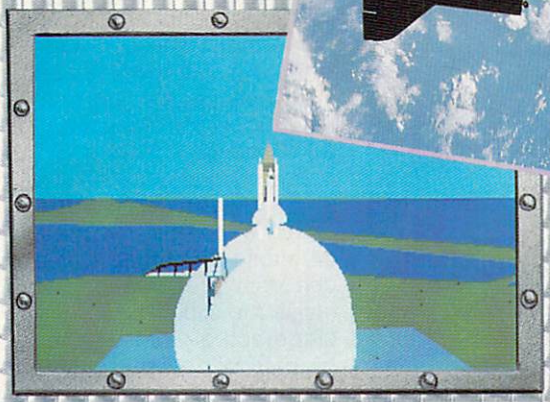

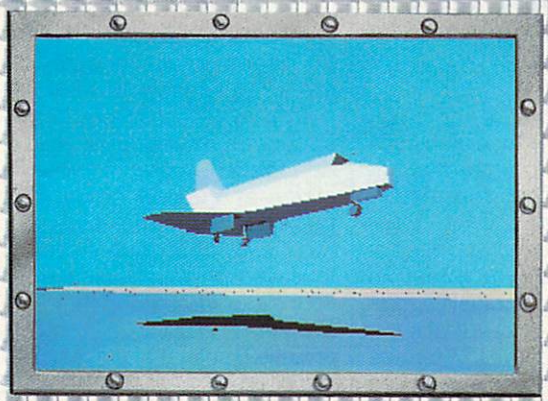

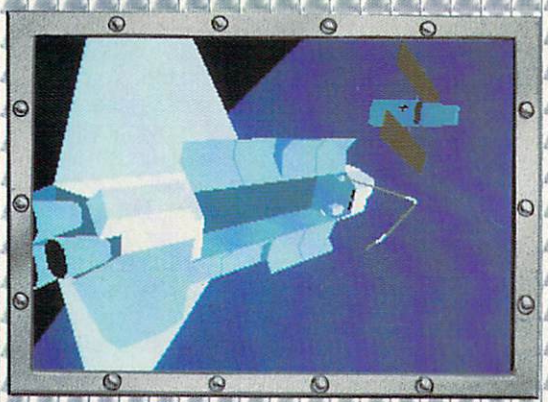

The space flight simulator to end all simulators, SHUTTLE is the most accurate and comprehensive simulation of NASA's Space Shuttle ever produced for the home computer.

With the aid of Mission Control, you will master such challenges as deploying and repairing satellites, launching spy satellites, maneuvering your craft in zero gravity, attaining the correct re-entry trajectory, and pulling off complicated landings.

Advanced polygon and elliptical graphics, along with actual land and star maps were used to create the breathtaking 3D panoramas of the Orbiter and its environment, which can be viewed from any angle at any time.

Other features include:

- **Authentic control panel display**
- **Detailed comprehensive training and reference manual**
- **Numerous training, scientific and "Star Wars" (SDI) Missions**
- **Multiple help levels from "novice" to "veteran"**
- **Various launch and landing sites**
- **Orchestral quality music**
- **Fold-out Shuttle flight deck poster**

AVAILABLE FOR THE IBM, AMIGA AND ATARI ST LATE SUMMER. SUGGESTED RETAIL – $59.99

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this not as fun and games but as a learning experience, to see and live what a real cop's life is like. "Sonny's life is simple," he tells us, "but it's a good one—worth defending." That statement lays the groundwork for what's to come.

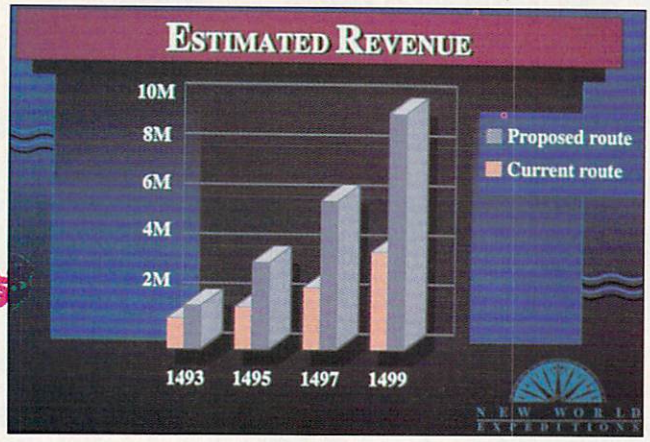
You begin what appears to be a routine day, having agreed to help out in traffic, which, Walls tells us tongue in cheek, always seems to be understaffed. You begin your average cop's day with a disciplinary complaint against Officer Pat Morales—Hispanic, female, and carrying a chip on her shoulder the size of Mount Rushmore.

Eventually comes patrol duty, bringing with it the usual number of metropolitan complaints, including a maniac taking off his clothes in the park. The nut ends up attacking you at one point, and if you aren't swift, Sonny bites the dust then and there.

Responding to an attempted murder while out on patrol, you discover a stabbing victim who turns out to be your beloved wife, Marie. Lying motionless and dead, she still grasps the gold chain she grabbed from her attacker's neck. Later you find a military bronze star at the crime scene, directly beneath your wife's car. Therein lies the mystery, and at that point, you're assigned homicide detective duty on your wife's case.

A series of fatal stabbings, rife with satanic undertones, linger unsolved in the city, and now with your wife as the latest victim, it's up to you to conduct a thorough investigation into the crimes. Homicide is run by Captain Tate, a Philip Michael Thomas look-alike minus the Italian designer duds, and your partner turns out to be none other than the hot-tempered Pat Morales, who promises she's "not so bad" once you get to know her.

The real challenge of this game is to use logic and insight to rule your actions. You have to use your best judgment (as a real cop would), follow procedure, and know when to call on your team members.



PowerPoint for Windows *incorporates graphic design in your presentations.*

Amidst the darkness and apprehension, *The Kindred* isn't without humor—try walking into the women's locker room, and you'll get socked in the eye by a female cop—but mercifully minus the silly banter and comic relief of Police Quests past.

Also missing are type-in commands. Sierra's parserless interface allows you to move through a room quickly. Placing the hand icon on a doorknob walks the character to the door *and* opens the door. You're left to think about which course of action to take rather than ask a dozen questions. A look around with the eye icon explains everything you see, and "talking" with characters helps you gather pertinent information and clues you in on whether you're behaving correctly or wasting your time.

From the time the credits roll to the cliff-hanger end, *The Kindred* delivers role-playing adventure you can feel. The characters and settings are as true to life as I've seen. It's obvious to me how carefully planned and well orchestrated the whole scenario is. Most notable in a long list of pluses here, Jan Hammer of "Miami Vice" fame sets a moody tone with a riveting musical score that enthralls and captivates and is, in a word, electrifying. It will make you tingle from head to toe. Indeed, you'll feel as though you're actually in *Police Quest III,* and that's the whole point, isn't it? Perhaps for those of us who would walk a desktop beat every day if we could, Sierra On-Line could continue the entertaining Sonny Bonds police mystery series.

JILL CHAMPION

Scheduled Release: September 1991
IBM PC and compatibles with 286 or better processor, 640K RAM, MCGA or VGA; supports mouse or joystick, supports Ad Lib, Game Blaster, PS/1, Roland, and Sound Blaster—$59.95

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MICROSOFT POWERPOINT FOR WINDOWS

If you make repeated or important presentations such as speeches, seminars, or sales pitches, a presentation graphics package can prove indispensable. *Windows* 3.0 users who need such a package should consider *Microsoft PowerPoint for Windows.*

PowerPoint enables you to quickly and easily create dramatic, coordinated presentations. While the basic unit of a presentation remains the slide, "slides" include actual 35mm photographic slides (produced from your file by a service bureau), full-color or black-and-white overhead transparencies, color or standard printed pages, or a computer-screen slide show.

PowerPoint also creates speaker's notes with reduced-size copies of your slides at the top of each page and printed slides (one, two, or six to a page) to leave with your audience. Your slides, notes, and handouts reside in a single file, coordinated so that any changes you make are reflected in all parts of your presentation.

As your presentation takes shape, you view your slides on a simulated on-screen light table. You can change the order of the presentation by moving slides around with your mouse, making *PowerPoint* not just a presentation creator, but a presentation manager as well.

For the not really artistic (like me), *PowerPoint*'s extensive built-in help can solve many graphics predicaments. Have you ever agonized over a color scheme? *PowerPoint* has over 5000

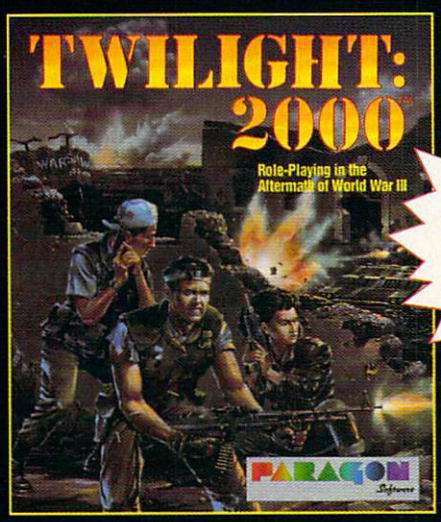
"World War III Eliminated The Weak... Now The Real Fight Begins."

Actual screen shown.

In the wake of nuclear holocaust not even the strong are guaranteed survival. Staying alive requires resourcefulness as well as might.

You lead a squadron of 20 highly-trained soldiers who discover World War III isn't over. An insane genius named Baron Czarny has built an army from the dispossessed and armed it with abandoned high-tech weaponry. Now, you must pit your group's diverse skills, and your leadership abilities, against an onslaught of marauders and military madmen determined to win a war the world lost.

Twilight: 2000 is state-of-the-art, futuristic role-playing: Extensive character generation • Over 2MB of stunning bit-mapped graphics • Movement in military vehicles is shown in detailed 3-D; actions outside vehicles are presented in scaled 2-D 3/4 views • Digitized sound effects and a mood-setting soundtrack • 9 unique vehicle types ranging from an American-made HUM-VEE to a Soviet-made T-72 tank • Scenario design by GDW founder Marc Miller!



Based on the world's most popular war role-playing system!

Actual screens may vary.

PARAGON Software

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180 Lakefront Drive • Hunt Valley, MD 21030

For IBM-PC/Tandy compatibles. For the latest information on release dates and availabilities, call Paragon Customer Service at 412-838-1173, 9 am to 5 pm EST, weekdays. © 1991 Paragon Software and Game Designers Workshop. Twilight: 2000 is produced under license from Game Designers Workshop.

Circle Reader Service Number 115

carefully crafted color schemes built in—your color choices need never clash.

Templates for many kinds of slides offer you proven choices of fonts, underlines, graphic frames and boxes, drop shadows, and so forth. Beautiful in their unity, the template sets coordinate well; four-item basic bullet charts carry on the visual theme of your title screen, your paragraph slides, and your three-column tables, for example. The templates range in mood from lighthearted to stuffed-shirt boardroom. *PowerPoint* even separates sets of templates into 35mm slides, overheads, and PC screens, each optimized for the different aspect ratios of these media.

All presentation files include a slide master, on which you put items that appear on all slides. Borders, corporate logos, and other theme graphics go here.

Stunning slide presentations no longer require the attention of professional artists or graphics designers—bad news for the company graphics department. This power has its price, however. *PowerPoint* demands a PC outfitted for *Windows* 3.0. Depending on how many features you install, *PowerPoint* takes upwards of 8.5 megabytes of hard disk space, and learning to use the program takes some time.

Produced in cooperation with Genigraphics, *PowerPoint* certainly packs serious design muscle. The Genigraphics artists prepared the color schemes and provided the 400 full-color, resizable clip art images that come with the product. They provide overnight 35mm and color overhead transparency production services. You can take your file on disk to one of their offices (in many major cities) or send it by modem to the nearest office. You get five slides free as an introduction to the service; after that they run $10 to $20 per first slide of each image, depending on how quickly you want them. *PowerPoint* has a built-in modem communications program to call Genigraphics—it even knows all the phone numbers.

Creating your presentation requires some tools. The limited word processing function seems perfectly adequate to create whatever you may need for slides. If you know *Word for Windows,* you'll find this smaller look-alike familiar. It even has its own spelling checker to keep you from projecting misspelled words in glorious color for all the world to see.

Drawing functions, too, have specific limitations. Don't expect to do any freehand drawing here; you choose from simple lines, rectangles, circles, and ellipses. Anything more complex requires creation in another paint program. *PowerPoint* imports PIC, GCM, TIFF, EPS, HPGL, WMF, and PCX file formats directly.

Always an important part of a business presentation, graphs take shape in a separate module, a near clone of the *Excel* graph module. You start with a separate data sheet (a small spreadsheet) that you see on-screen along with its graph. Basic graph types, including area, pie, bar, line, column, and scattered data points (including high-low-close) get support. Many competitive presentation packages offer greater flexibility and diversity of graphs; *PowerPoint* gives you a workmanlike set of normal graphs along with tools to customize them only a little. You can import graphs created in other *Windows* packages such as *Wingz* or *3-D Charts for Windows* as images; you can import the data sheet from most spreadsheet programs.

Other packages outshine *PowerPoint* in screen-show features. *PowerPoint* displays the slides in order on a full screen waiting either for a timed advance or a click or keystroke. Slide shows run only from a full-scale copy of *PowerPoint.* Other packages provide a series of special effects such as fades, zooms, and wipes to add interest to the process of changing slide images. Some provide runtime capabilities, meaning that they create a self-executing slide show that does not require the parent program to run on other computers.

Strong in coordinating presentations through master slides, color schemes, and templates that tie everything together, *PowerPoint* certainly doesn't lack fine features. Its flexibility in working with other *Windows* applications further enhances its value. With this amazing tool, nonartists can create truly professional-looking presentations. A little well-deserved self-confidence about the quality of the visuals in a presentation can make the difference between success and failure for the whole event. Before you go before the board with slide carousel in hand, sample *PowerPoint* to make your points unforgettable.

RICHARD O. MANN

IBM 286 or 386 and compatibles, *Windows* 3.0—$495

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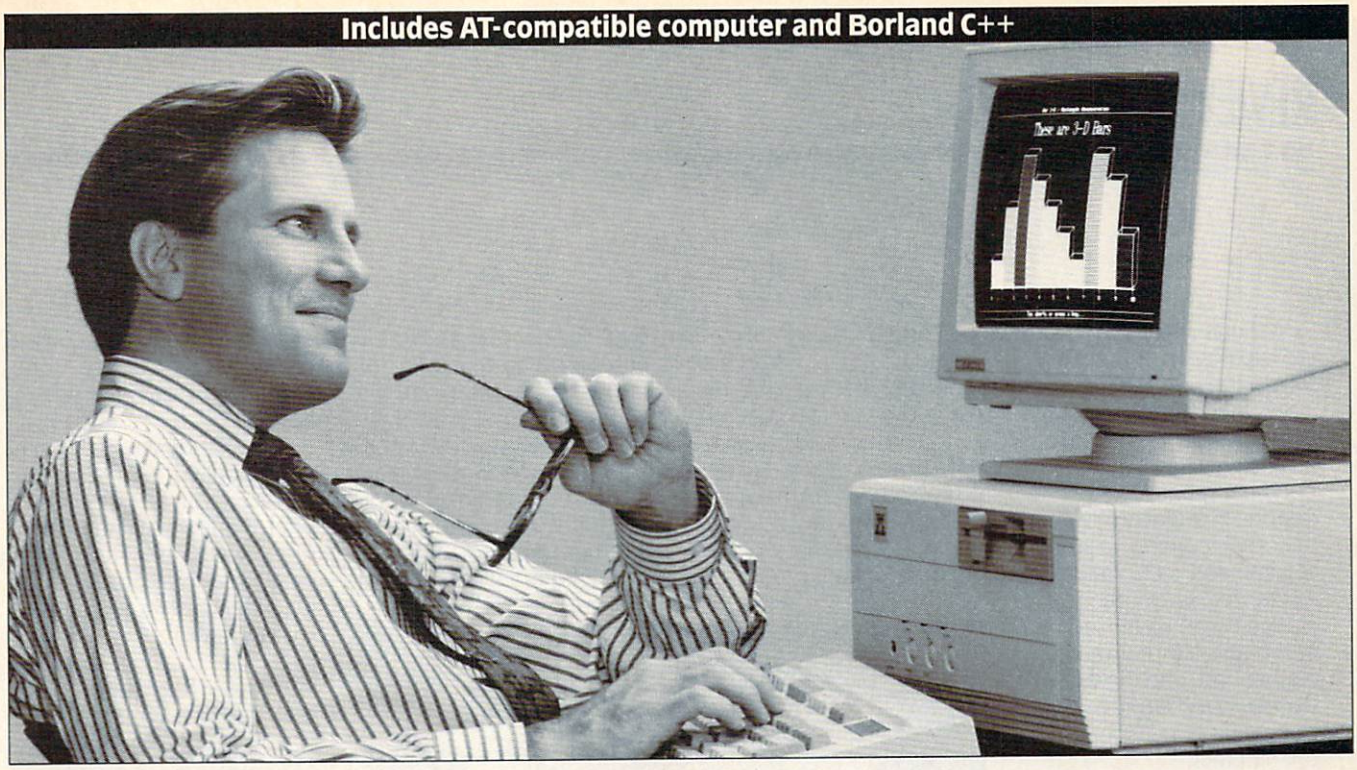
DOS BATCH FILE POWER WITH THE JAMSA BATCH UTILITIES

Programmer Kris Jamsa packs everything you could want to know about DOS batch file programming into this hefty edition. Jamsa clearly explains the ins and outs of all the batch file commands and their myriad switches and options. Beginners can build from this solid foundation, and more advanced programmers can benefit from the tricks and tips displayed in the book's plentiful program examples.

Going well beyond the basics, Jamsa includes dozens of programming examples and more than 100 batch language extenders on the three disks included with the book. With this set of utilities, batch files become extraordinarily sophisticated.

These programs, called *Jamsa Batch Utilities,* permit batch files to process input and to format output; to work with system information such as dates, filenames, and available hardware; to accept mouse input; and to compare and manipulate strings. These programs will permit you to use batch programs to automate activities in even the most complex of computer environments.

Jamsa has structured this book like a textbook, building from the very basic to the complex. The chapters are short and focused. Thanks to repetition, less advanced programmers can study the information from a number of angles, and each chapter includes a set of review questions and answers designed to make certain you understand the material that's been presented.



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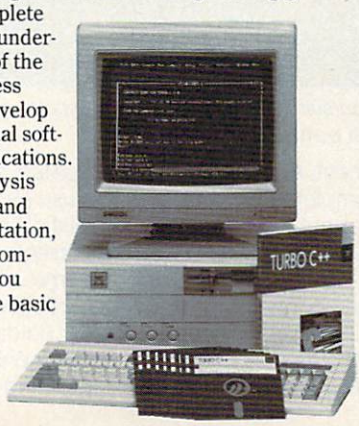

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While jammed with valuable information, this book unfortunately seems to talk down to all but the most elementary of users, and the amateurish illustrations that introduce each chapter help engender this feeling. Despite this shortcoming in form, I recommend *DOS Batch File Power* for its content. It includes nearly all the information batch file programmers could need, and the value of *Jamsa Batch Utilities* to programmers is indisputable.
TONY ROBERTS

Author: Kris Jamsa
604 pages and three disks—$39.95

SAMS
11711 N. College Ave.
Carmel, IN 46032
Circle Reader Service Number 327

BIG BUSINESS

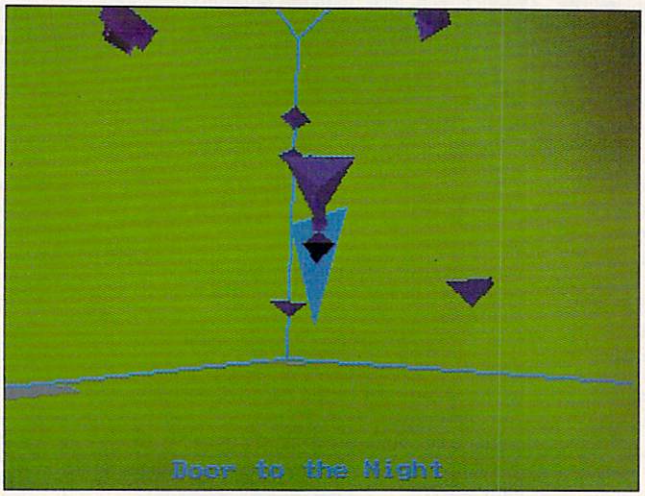
What would you do if you were the chief financial officer of a large company? Would you manufacture cigarettes or microchips? Would you pump money into marketing or product development? How much would you sell your product for? All of these issues and more are considered in the humorous—but accurate—simulation of the business world seen in *Big Business*.

Big Business comes on eight 5¼-inch 360K disks for a total of almost 3MB of code. The game's size is partly a result of the extensive graphics and sound support and partly owing to the multitudinous factors in the running of a large business.

Although *Big Business* is targeted at players over 16, it nevertheless captivated my children, aged 9 to 13. The business concepts of marketing, production, and pricing are well illustrated by the simulation and might be well received in an academic setting. The game is based upon a complex algorithm that mediates the interplay of the factors that must be balanced to produce success in a manufacturing business. You control the actions of five caricatured corporate officers in finance, purchasing, production, product development, and marketing. If you complete the game with a higher net worth than your opponents, you win.

The interface supports mouse, keyboard, and joystick. Though the mouse is by far the easiest to use, the keyboard runs a close second. The game uses 256-color VGA mode with 50 colors and realtime animation that is compatible with all major color adapters and IBM-compatible machines. All major sound boards are supported, but if all you have is an internal speaker, *Big Business* offers digitized sound.

You'll learn the ropes fast in the corporate free-for-all of Big Business, *or your company flounders.*



Lose yourself in Continuum *either to soothe your frazzled nerves or to score points.*

Also packaged with *Big Business* is *Wall Street*, a realistic simulation of the stock market. This share-trading game allows you to trade a portfolio of stocks from a modest holding up to a large investment—or go broke, depending on how well you analyze the market trends. *Wall Street* also contains a stock market trivia quiz game as a bonus.

If you fancy yourself a junior executive, see how you rate in *Big Business*. Don't expect the keys to the corporate washroom to come easy, but do expect a lot of fun playing chief executive.
ALFRED GIOVETTI

IBM PC and compatibles, 512K RAM, CGA, EGA, VGA, or Tandy 16-color; hard disk recommended, supports Ad Lib, Sound Blaster, and Covox Speech Thing—$49.95

Also available for Amiga—$49.95, Atari ST—$39.95, and Macintosh—$49.95

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CONTINUUM

Given the power of today's personal computers, you'd think it would be easy to come up with an original game concept. Unfortunately, 99 out of 100 games are variations on old themes. However, it is with great delight that this computerist reports stumbling upon a game so captivating and fresh that nothing short of a nuclear attack will stop me from playing it. Load *Continuum*, and you'll see.

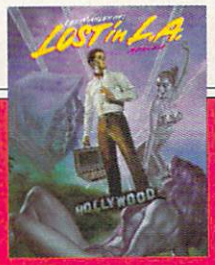
Pilot your "mobile" through a 256-room maze, searching for 16 cubes and 15 crystals. Mobiles can turn right or left and can accelerate forward. To become airborne, however, they must bounce on one of many colored platforms scattered throughout each room. Moving from one platform to the next means bouncing to the appropriate height and applying enough thrust to reach your target. Too much or too

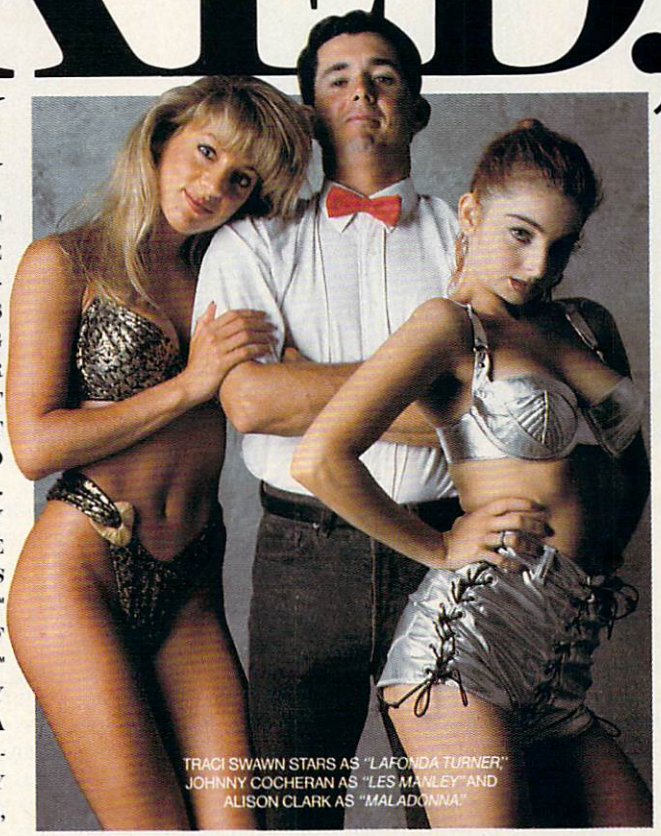
Les Manley in: Lost in L.A.

"SHE STOOD NAKED,

HER WET BODY BATHED IN BEVERLY

HILLS MOONLIGHT. THE STRANGER CREPT OUT FROM THE SHADOWS TOWARDS THE POOL. LIKE THE STARLETS WHO HAD VANISHED BEFORE HER, SHE WAS OBLIVIOUS TO HIS MENACING PRESENCE. HER SCREAM WAS NOT HEARD." THE HIPPEST STARS IN HOLLYWOOD ARE BEING KIDNAPPED. AND ONLY ONE MANLEY CAN SOLVE THE CRIME OF THE CENTURY. *LES MANLEY IN LOST IN L.A.*™ PLUNGES THE HERO OF *SEARCH FOR THE KING*™ INTO A MEGA-MYSTERY THAT SPANS ALL OF LA LA LAND. MEET GORGEOUS BABES, BODY BUILDERS, ROCK STARS, OUT-OF-WORK ACTORS—ALL FULLY ANIMATED AND DIGITIZED IN AWESOME 256 VGA CALIFORNIA COLOR. HERE'S A REALITY CHECK (LIST) ♦ LIVE VIDEO FOOTAGE OF REAL ACTORS AND ACTRESSES ♦ A POWERFUL PLOT AND DIALOGUE FROM A PROFESSIONAL SCREENWRITER ♦ REAL COOL CHARACTER SCALING WITH FULL ANIMATION ♦ ROCKIN' L.A. SOUNDTRACK WITH TOTAL MUSIC & SOUND BOARD SUPPORT ♦ REAL L.A. LOCATIONS—FROM HOLLYWOOD BOULEVARD TO MULHOLLAND DRIVE MANSIONS ♦ REAL EASY 100% POINT & CLICK CONTROL ♦ SO IF YOU WANT A HOT STORYLINE, A SHOT TO SOLVE A MYSTERY AND THE GLAMOUR AND GLITZ OF SOUTHERN CALIFORNIA, GET *LOST IN L.A.* LIKE IT'S TOTALLY REAL, DUDE. TO ORDER, VISIT YOUR FAVORITE RETAILER OR CALL 1-800-245-7744.





TRACI SWAWN STARS AS *"LAFONDA TURNER,"* JOHNNY COCHERAN AS *"LES MANLEY"* AND ALISON CLARK AS *"MALADONNA."*

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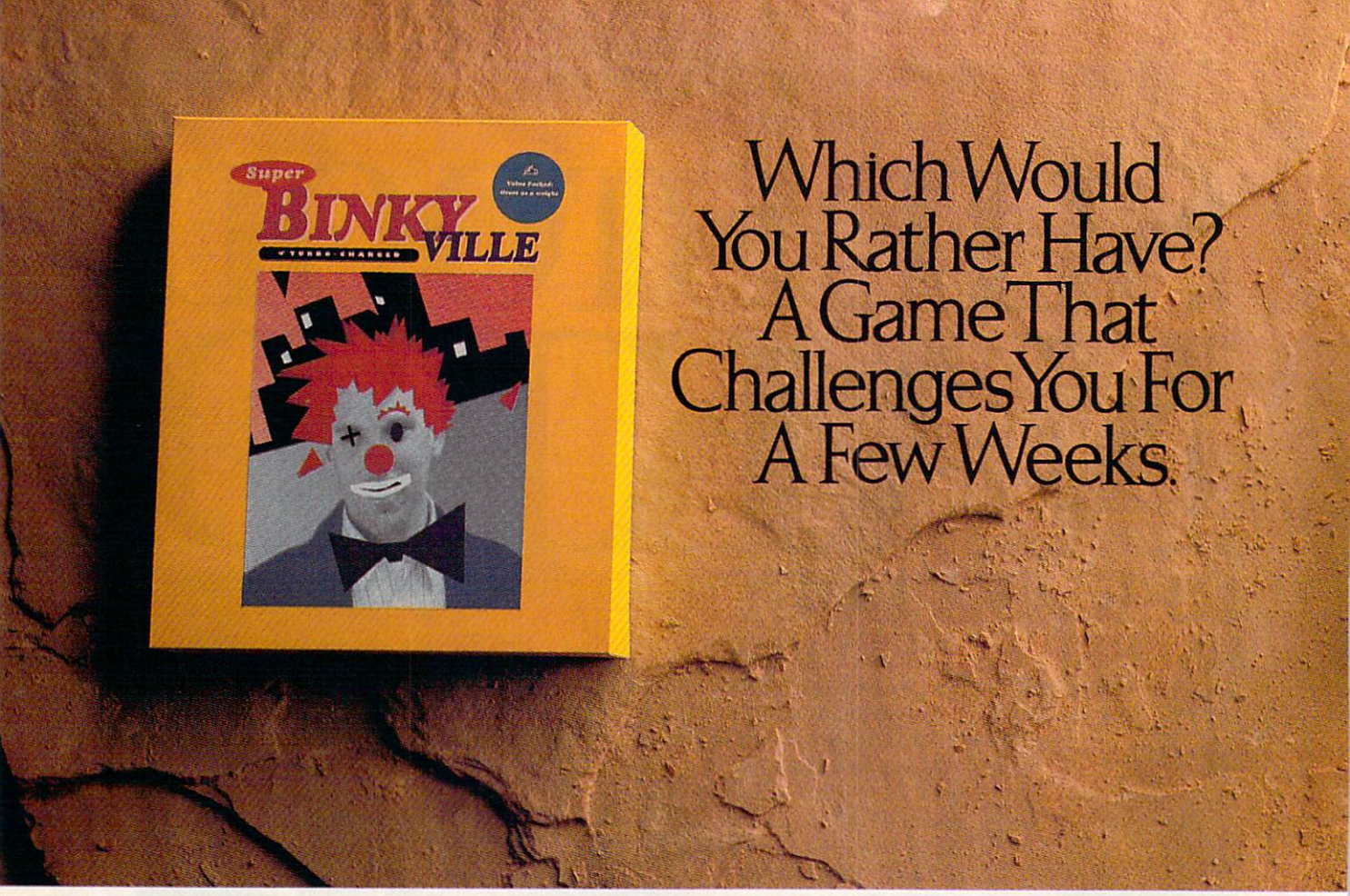

little thrust, and you miss the platform and fall back to the floor, where you restart your laborious climb.

To exit a room, you must reach any of several windows high on the room's walls. Each window leads to a different room in the maze. Reaching a window is as difficult as getting a date with Michelle Pfeiffer. As if bouncing from platform to platform isn't challenging enough, some rooms contain obstacles—force fields, energy drains, and enemy mobiles—which block exits, knock you from platforms, or bounce you out of control. In addition, platforms are often arranged in puzzling patterns. Some platforms even move, gliding back and forth through a room, placing high demands on your mobile-control skills.

The game, which is played from first-person perspective, features 3-D graphics and animation so well implemented that if you're prone to motion sickness, you may want to keep a box of Dramamine next to your computer. To make the environment even more realistic, the room can be viewed from any angle by adjusting the camera. The camera, too, is well implemented—changing the viewing angle feels as natural as raising and lowering your head. You won't experience the lose-your-place disorientation common to so many shifting-viewpoint games.

Continuum can be played in two modes, action or emotion. In action mode, you start the maze with three minutes on the clock. Entering a room adds one minute, whereas capturing crystals and cubes may add substantially more time. Your score is based on flight time and the number of objects you captured.

Of course, scoring isn't everything. *Continuum*'s designers give you the opportunity to merely explore. In emotion mode, you navigate specially designed mazes without worrying about score or time. The mazes are, according to the manual, "scientifically proven" to evoke certain emotions. Each region of the maze is tagged with an appropriate name, including *Dream, Relax, Motivation,* and *Meditate,* among others. While I can't attest to the game's ability to affect your psyche, I can say that the Ad Lib–compatible music is wonderfully melodious.

One in a hundred, *Continuum* will draw you into its world again and again. Keep this puppy locked up, and give the key to someone you trust. Otherwise, you'll get no work done.

CLAYTON WALNUM

IBM PC and compatibles, 512K RAM, CGA, EGA, VGA, Tandy 16-color, or Hercules; supports Ad Lib and Sound Blaster sound cards—$49.95

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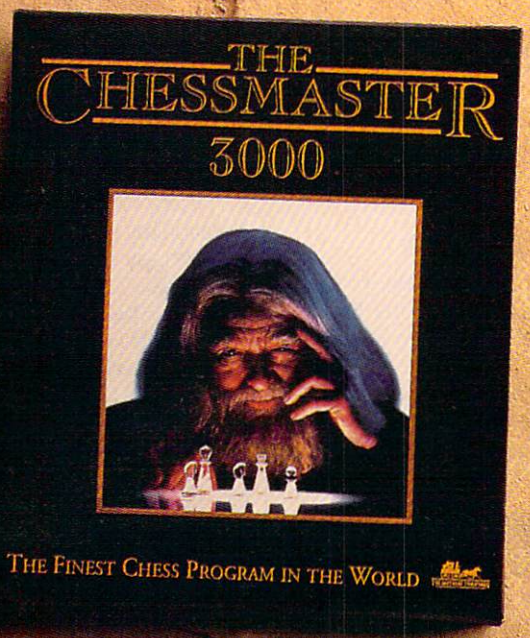
Circle Reader Service Number 329

THE NORTON UTILITIES 6.0

A longtime favorite of personal computer users, *The Norton Utilities* has earned public approval and even fame through its usefulness and reliability. Version 6.0 continues the tradition by adding many valuable features and expanding and improving on the capabilities of earlier versions. Now with categories of data recovery and disk repair, speed and performance enhancement, and security tools, the utilities will consume almost three megabytes of your hard disk space—a price warranted by the improvements.

The *Norton Disk Doctor* runs numerous tests on your hard disk to verify the integrity of the partition table, the boot record, the file allocation table, and the directory and file structure. Further, it checks the free space for lost chains and cross-linked files. *Norton Disk Doctor*



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So why wait? Exercise your fingers one last time and call 1-800-234-3088 to order. Or visit your nearest dealer.

THE SOFTWARE TOOLWORKS

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Circle Reader Service Number 119

calls any errors to your attention and gives you the opportunity to correct them.

Powerful and sophisticated, the *Disk Editor* tool offers far more than the name implies. Use it to work on files or directories, the partition table, the file allocation table, and the boot record. You can even rescue sectors from a bad cluster.

Perhaps you forgot to use the system switch when you formatted a disk, but you'd like to make it bootable. Invoke *Disk Tools*. One utility will insert the system files while preserving the data on the disk. Another utility lets you recover from the mess often created by the DOS *Recover* program. Another revives a defective floppy disk, reformatting without loss of data, while others provide a rescue feature for your hard disk by creating a floppy which contains the vital information for the hard disk.

Calibrate optimizes your hard disk interleave to maximize data transfer speed and performs nondestructive low-level formatting of the disk. Pattern testing takes place at the level which you specify; it can be superficial or very deep. The prudent user will low-level format the disk about once every three months.

DOS has an unfortunate tendency to fragment files, splattering them over the disk with a consequent increase in read and write times. *Speed Disk* lets you optimize the use of disk space by collecting the fragmented files and consolidating the unused space on the disk. In version 6.0, this function requires significantly less time to perform than in earlier versions. Along with defragmentation, you might choose to reorder your directory structure and place often-used directories at the head of the search path.

If you have extended or expanded memory, the use of a disk cache can provide remarkable improvement in performance. If you're not already using another cache program like *Windows' Smartdrive*, for instance, you could find the *Norton Cache* quite helpful. On an 80286 or 80386 machine, the cache will perform both read and write operations, make guesses at what file you will call next, and, with the help of a memory manager, occupy less than a kilobyte of DOS RAM. *Norton Cache* works with *Windows* 3.0.

Speaking of *Windows, Norton Utilities* 6.0 works efficiently from the *Windows Program Manager*. Complete with icons, the utilities make keeping up with files a matter of pointing and clicking, though some modules, like *Speed Disk*, won't perform in a multitasking environment.

Want protection of your files not only from unauthorized persons but also from viruses, programming errors, and yourself? *Disk Monitor* allows you to prevent any write operations to specified files from taking place without your permission. You may specify just the system files, system and all executable files, or even the entire disk. When a write operation is attempted to a protected file, a message appears on the screen, and you must accept or deny the operation.

When prevented from writing to a system or executable file, many forms of viruses fail in their corruption duties. Closer to home, most C programmers have lost control of a pointer at one time or another and created havoc in the system files. Even closer to home, since Delete is a write operation, *Disk Monitor* prevents inadvertent erasure of a vital file.

The security utility *Diskreet* protects your confidential files from snoopers by encrypting the files and requiring a password for access. Two encryption schemes come with *Diskreet*. The first, a proprietary encryptor, is sufficient protection from amateur data thieves. The other meets the secure Data Encryption Standard approved

by the U.S. Government.

The difference in time required for encryption and decryption is significant. You may encrypt individual files requiring individual passwords, or you may create an entity called an NDisk, which behaves like a hidden directory, requires password access, and contains encrypted files. A convenient feature closes this directory after a user-defined interval of no keyboard activity. In the simplest form of machine security, you can block the keyboard and blank the screen. Access then requires the entry of a password.

The tools category contains the utilities familiar to users of previous editions of the program, with a *System Information* utility greatly improved over the old *SI*. It now provides many screens of information about your computer, including one detailing the performance of your CPU and another concerning the performance of your hard disk. The performance indices have improved; rather than some mysterious number, you now see a bar chart which compares your computer with an XT, an AT, and a Compaq 386.

Does DOS still get you down, even after you've installed *Norton Utilities*? Try Norton's NDOS, a slick, intuitive DOS replacement. Improved commands include Color (sets foreground and background colors) and CD (climbs directory trees when you add multiple periods to this command). Entirely new commands such as Describe (attaches file descriptions up to 40 characters in length) and List (displays a file with the option to scroll forward and back) should draw applause from DOS users everywhere. If you've already moved up to DOS 5.0, *Norton Utilities* will meet you there with support for DOS 5.0's LOADHI command and task-switching capabilities, among other things.

The utilities of *Norton Utilities* 6.0 run fast and without a snag; menus support mouse or keyboard input. Disk Explorer, a companion volume to the User's Guide, tells you more about your disks than you knew you wanted to know, but if you care about the maintenance and performance of your disks, *Norton Utilities* 6.0 belongs in your toolkit.

CHARLES IDOL

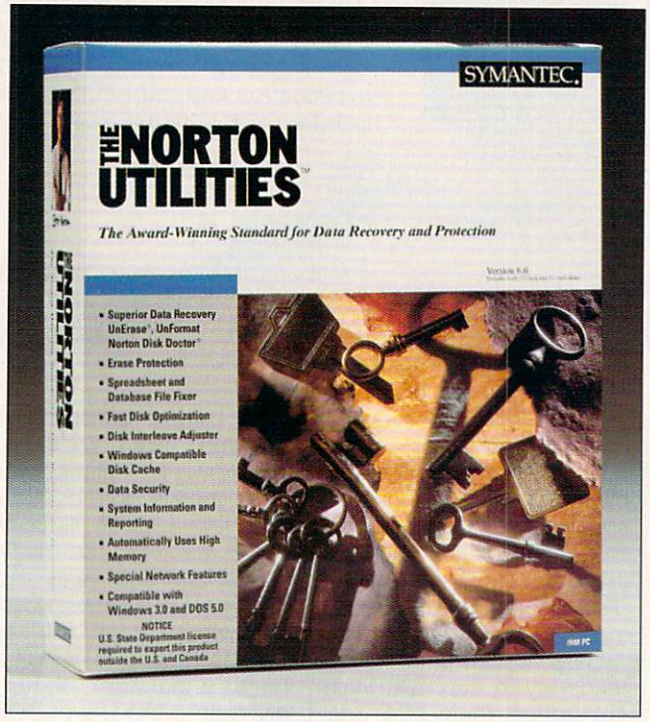
IBM PC and compatibles, 512K RAM; hard disk recommended, supports mouse—$179

SYMANTEC
10201 Torre Ave.
Cupertino, CA 95014-2132
(800) 441-7234

Circle Reader Service Number 330

BY DESIGN

Most *WordPerfect* users know that versions 5.0 and 5.1 have features for mixing text and state-of-the-art graphics to make professional-looking documents. Many people, however, find that these features are hard to use—so they don't use them.



More of a magic act than a toolkit, The Norton Utilities *can make PC problems disappear.*

A memory-resident program, *By Design* automatically loads when you run *WordPerfect*. Pressing Alt-D installs pull-down menus across the top of the screen. At your fingertips (through the keyboard or mouse) are design tools for creating page borders, titles, letterheads, page layouts, résumés, and labels, and an option for previewing pages. Also included are sample designs, clip art, and fonts. *By Design* looks and works great on my system and contains many of the features that ought to but won't necessarily be included in *WordPerfect* version 6.0. For now, you can increase your productivity painlessly by installing *By Design*.

JOEY LATIMER

IBM PC and compatibles, 640K RAM, hard drive, *WordPerfect* 5.0 or later—$89.95

STREETWISE SOFTWARE
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Circle Reader Service Number 331

XENOCIDE

Insectoids called Xenomorphs have invaded your solar system; you'll need to kill all of them, of course, and that constitutes xenocide—hence the name of this thriller. Guilty of genocide, cross-species genetic experimentation, biological warfare, and eating your peace envoys, the Xenomorphs deserve extinction. So blast away; you're one of the good guys.

You'll need to blow up the three Xenomorph-infested moons of your home planet, Argenia. Since the only interest that the Xenomorphs have in humans is "how they taste with catsup," there's no chance of an armistice. Fight your way across the surface of each moon, killing alien bugs, avoiding large rocks, collecting ammunition canisters, and looking for the docking station that allows you to proceed further into each moon. You'll unleash fireballs, missiles, and nuclear bombs while on the lunar surface, but to actually destroy the moon, you must collect bombs on level 1 and leave them on level 4, the biolab level, before hurriedly teleporting away to safety.

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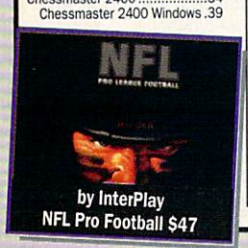

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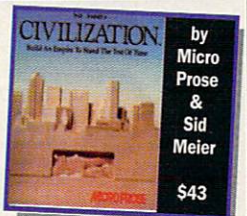

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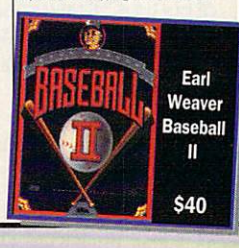

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A good shoot-'em-up with all the bells and whistles, *Xenocide* doesn't allow for saving games. You may forgive this deficiency when you watch the colorful graphics scroll effortlessly. This one's for arcade addicts of all sorts, but especially trigger-happy xenophobes.

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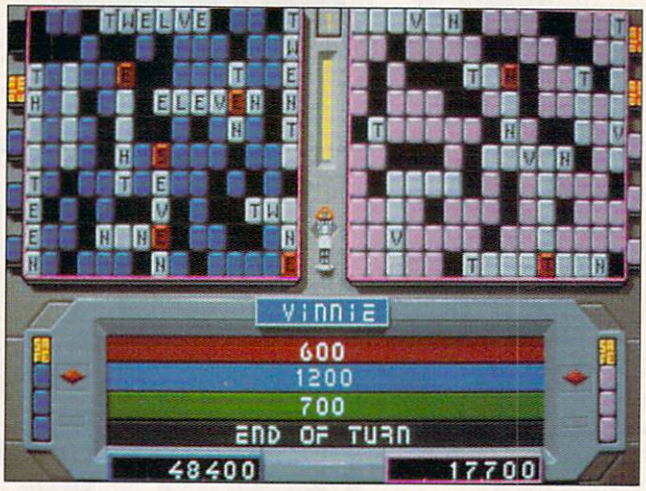

Wordplay's the name of the game in Interplay's addictive game show–style puzzler Lexi-Cross.

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In the twenty-first century *Lexi-Cross* has been the hottest holovision game show for years, loved by humans, aliens, and cyborgs alike. *Lexi-Cross* is a cross between Scrabble and the hit television game show "Wheel of Fortune" that replaces Vanna with Robanna the Robot and Pat Sajak with Cyborg Chip Ramsey.

At the start of the game, a beautiful cyborg backstage assistant named Pristine Mint helps you assemble your television persona, allowing you to choose from eight sets of heads, torsos, and arms. When you're ready to go, *Lexi-Cross* can be played "on the air" or in practice mode in various combinations of robot, human, and modem play. The game itself consists of four rounds in which the points double, triple, and eventually multiply by 10,000 as the rounds increase.

You can select to reveal tiles from each player's 150-tile board, spin the wheel for a letter, choose a vowel (if you have a vowel token), or solve the puzzle. Robanna turns tiles for you to reveal blank-letter, vowel, point, safety, lose-turn, lose-safety, and peek-and-poke tokens. When the wheel spins, you win (or lose) points by picking a letter for the blank-letter tokens, lose a turn, end your turn, reveal a column or a row, or go bankrupt.

As in "Wheel of Fortune," you solve the literal, common theme, and other puzzles from the scrambled or unscrambled words and partial phrases revealed on the board. There are only 600 puzzles in the current game, and you'll run through these quickly if you get hooked on *Lexi-Cross*—and you most likely will. Luckily, Interplay plans to release specialty trivia upgrade disks in the areas of sports, cinema, music, literature, and history.

Robot opponents can be set at five levels of difficulty, though I found *robot intelligence* a bit of a misnomer; *cheating* seems more appropriate than *intelligence*. On the highest mode, the robots know too much about the game. Your best bet is to find a human opponent.

Both 3½- and 5¼-inch disks were enclosed in the box with a humorous manual that was nevertheless hard to decipher. A quick reference card to clarify the instructions would've been useful, but the 20,000-word *Webster's Pocket Dictionary* does assist players of *Lexi-Cross* to some extent. Besides, play a few rounds, and you'll find the function keys won't be a problem. Worry more about beating your computerized game show nemeses.

Quite addictive, *Lexi-Cross* delivers many hours of play. The colors and graphics are dazzling for a word-oriented game, and the sounds never become tiresome. The well-thought-out puzzles, though, soon become stale because of their limited number. Average players memorize the puzzles quickly, so the proposed puzzle disks are a must.

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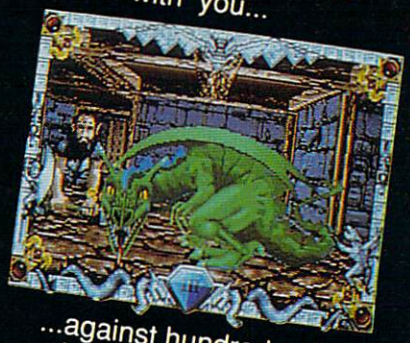

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FINALSOFT EXECUTIVE

Hard to categorize, *FinalSoft Executive* operates under *Windows* as a groupware/hypertext/scheduling/E-mail application and, though designed mainly for group work, proves quite effective for personal use. *Executive* might be what you need to tie your office together.

Installation is well explained, with each of its dozen or so directories and its two environment variables detailed. Two configuration files, similar in format to WIN.INI, are not explained at all. This could pose a problem to a system administrator who found one of these files damaged.

The hypertext editor is less powerful than *Write,* the word processor bundled free with *Windows;* it doesn't even let you change fonts, but then it's not really meant to produce hardcopy. A simple but very useful hypertext scheme lets you create links to PCX graphics files, other text files, and *Windows* or DOS programs. And there's more to the hypertext editor than meets the initial, skeptical eye. It supports the import and export of files in ASCII, *WordPerfect,* and Microsoft *Word for Windows* formats, and files can be any size. With this modest feature set anyone can create online documentation for anyone else on the network, with both text and images, without reinventing the wheel. Paperless manuals might actually become practical using *Executive.*

Though flat-file oriented and possessing a very limited report writer, the database manager does create *dBASE III* data files with all the trimmings: memo fields (free-form text of arbitrary length), index files, and forms. Each file may also include a single graphics field. That means, for example, that a real estate office could use scanned-in images of properties in PCX format, tie them directly into a database manager and scheduler, and allow all the realtors in the office to view them from their personal machines. And while *FinalSoft Executive* won't knock *Superbase* out of the *Windows* market, its graphic interface makes creation and maintenance of databases an order of magnitude easier than in the bad old DOS days.

FinalSoft Executive's personal scheduler, group scheduler, and to-do list make good use of the program's other modules and of *Windows* itself. For example, when you schedule a group meeting, you set priority levels for the people involved. If someone of only peripheral importance to the meeting has a conflicting appointment, the meeting will be scheduled without him or her. A graphic Find Best Time chart scans the participants' schedules and displays them all in bar charts, so that you can see who's busy, who has a tentative appointment, and so forth—far simpler than trying to check with everyone and settle on a mutually agreeable time.

Is *FinalSoft Executive* for you? The answer is a qualified *Yes;* you must know exactly what you want from a program like this. Without a programming language, *FinalSoft Executive* may not let you work around its limits. Unlike, say, *dBASE* or *Lotus 1-2-3,* this program is less likely to offer a work-around if its built-in features don't do the trick. And while not one of its modules is a powerhouse, the integration is everything it should be. Just run it on a fast machine; a slow net server could render *FinalSoft Executive* useless.

TOM CAMPBELL

IBM PC and compatibles, hard drive, *Windows* 3.0—$249

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Web your way to Mary Jane's rescue in this comics-inspired action game.

THE AMAZING SPIDER-MAN

As a devotee of Marvel Comics not so very many years ago, I looked forward to this new game starring the Amazing Spider-Man, the most intriguing character in Marvel publisher Stan Lee's heroic pantheon. Lee's attempt to infuse Spider-Man with psychological and social realism set the series apart from many that had come before it. Peter Parker, alias Spider-Man, felt fears and doubts, had family obligations, and wasn't trusted by the police. He even married! This attention to realism made Spider-Man stories popular for many years. Unfortunately, not much of this quality made it into *The Amazing Spider-Man.*

A standard arcade game with a tiny Spider-Man figure moving through essentially rectilinear mazes, *The Amazing Spider-Man* lacks any real depth. The scenario, too, seems familiar. Mysterio, a former stunt man and master of illusion, has kidnapped Spider-Man's wife (Mary Jane Parker) and hidden her in a Hollywood studio rigged with illusions, robots, and traps. (Just once, I'd like to see the girlfriend or wife rescue the superhero, but I guess that game programmers aren't any more willing to take risks than are comic-book writers.) Spidey must use his strength, agility, webs, and wits to deactivate each trap before confronting the sinister Mysterio.

It's not that this is a bad game—the graphics live up to industry standards, some of the puzzles challenge, and learning to play takes you little time. Nothing distinguishes this game from a dozen others though, except for the Spider-

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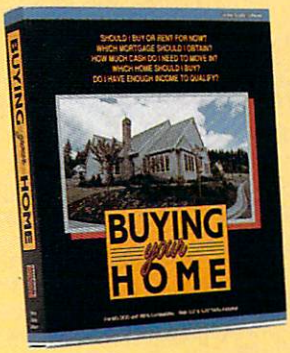

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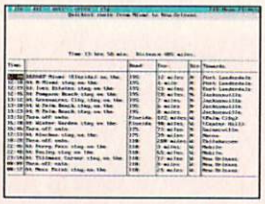

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REVIEWS

Man name. Longtime fans of Spidey's exploits may indeed want *The Amazing Spider-Man* anyway, but players seeking a new gaming experience will have to look elsewhere. 'Nuff said.

STEVEN ANZOVIN

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tion. The dictionary functions as a memory-resident utility enabling you to look up words from within a document with the touch of a key. I found the program to be user-friendly with a relatively short learning period. Well written and supplemented by helpful illustrations, the manual also serves as documentation for all of Inductel's add-on modules, which include technical terms for engineering, chemistry, physics, and other areas of specific interest. An online manual duplicates the printed one, less the illustrations. Installation is straightforward and should pose no problem for even novice users. One note regarding installation, though: There is a bug which requires the creation of the KAS subdirectory before running the installation. Inductel has a fix for this problem and will send a free update to all registered users upon request.

Despite its lack of bells and whistles, which are common to many of today's applications, Inductel's dictionary program effectively accomplishes the task for which it was designed. Students and professionals, such as writers, publishers, educators, and the like, will find *Funk & Wagnall's Standard Desk Dictionary* more than useful. If you can't afford the hardbound, multivolume *Oxford English Dictionary,* settle for a dramatic improvement in the speed of referencing definitions instead.

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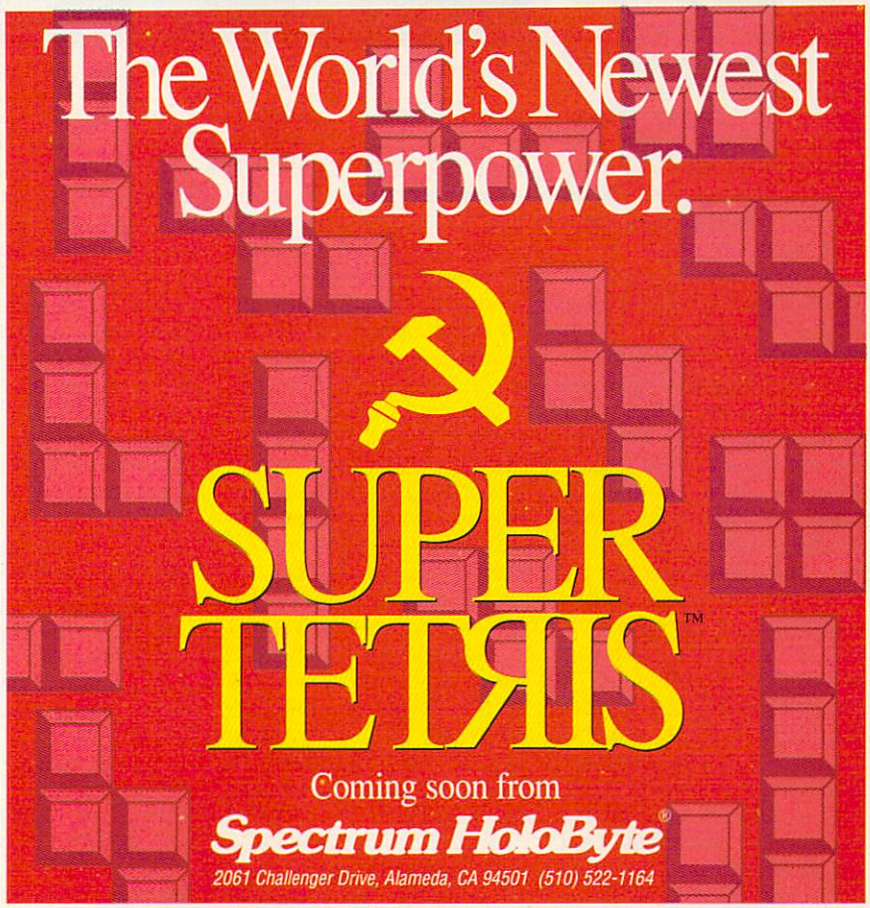


Circle Reader Service Number 173

es on our insatiable quest for knowledge about these giant reptiles.

An electronic strategy game with a flair for the arcade, *DinoWars* pits eight famous dinosaurs—including the ever-popular tyrannosaur, stegosaur, and brontosaur—against one another. Alternatively, dinosaurs may join forces and wage ferocious battles to retrieve a kidnapped dinosaur egg and ensure survival of their group.

Activities take place on an electronic game board measuring ten squares wide by nine squares deep. Five game board layouts—including river valley, volcanic terrain, lush jungle, and barren desert—harbor perilous environmental dangers.

Play begins with competing dinosaur armies lined up in a chesslike arrangement along opposite sides of the board. Two human players (or one human player and the computer) take turns moving dinosaur pieces across the board in an effort to capture the enemy egg.

If two dinosaurs meet on the same board square, the screen changes to a closeup view of the animals, and the players manipulate their reptilian alter egos in a battle to the death. The winner remains on the board (usually in a weakened state), but ready to continue the fight for survival with the next prehistoric enemy.

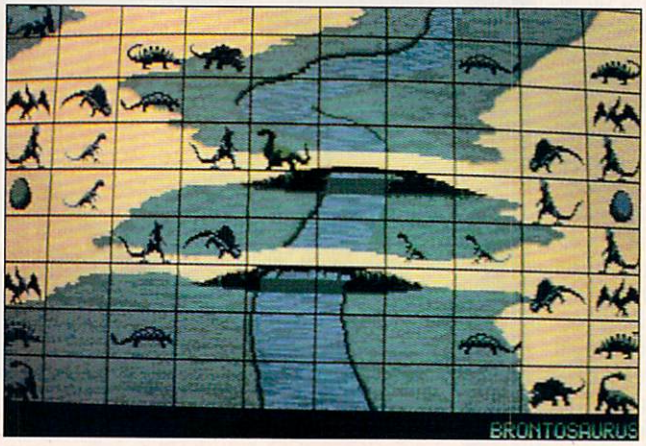
To win the game, either obliterate your opponent's entire army or recapture the kidnapped egg and return it to the farthest edge of your side of the board. As straightforward as this sounds, *DinoWars* consists of more than a senseless contest of brute force. Like chess, it's a game of ploy and counterploy, strategy, and tactics.

Each dinosaur has its own personality, moving at a particular speed and with limited range (a designated number of *x*-axis and *y*-axis squares). Configured with a certain level of strength, agility, and armor, attributes that significantly affect a dino's ability to do well in battle, some dinosaurs fare better against certain opponents. Players may choose to alter their dinosaurs' attributes and customize their dinosaur armies to contain only certain animals.

For example, my ten-year-old assistant decided that he wanted an army consisting predominantly of powerful tyrannosaurs. He configured each *T-rex* with maximum strength, agility, and armor, gave them all the ability to survive aquatic obstacles, and equipped them to move over maximum range. He then configured the computer's army with wimpy dimetrodons, set to move over a minimum range. To further guarantee the odds of winning, he elected to play at the Advanced level and set the computer at Novice. Of course, he won every battle.

DinoWars does have a high level of configurability, with an online encyclopedia featuring 15 categories of information about the dinosaurs' geologic time, extinction theories, and related topics. As much as it offers and as impressive as these educational aids are, however, it's a kids' game. While I quickly tired of the violence, my ten-year-old son really enjoyed being able to test new fighting strategies. Colorful graphics, animation, and realistic sounds, such as animal roars and gushing river waters increased the program's entertainment value. An Ad Lib sound card magnified the sound intensity. If you're looking for a game that will entertainingly teach your children something about dinosaurs, *DinoWars* could be the product for you.

CAROL HOLZBERG



DinoWars *makes you commander in the clash of reptilian titans.*

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LIGHTSPEED

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Lightspeed's action revolves around your Trailblazer-class scouting ship. No subcompact, this jewel sports a hull 3400 meters long and 2960 meters wide. You can even tailor its configuration to your needs, rearranging components to enhance your defenses, armament, or drive.

You control your Trailblazer from a comfortable and fully instrumented cockpit that boasts a three-dimensional radar view of surrounding space, plus holographic views of any alien ship you target. The main view screen dominates the cockpit view with its smoothly animated 3-D representation of space.

Besides humble you, the Trailblazer carries three automated mining systems and up to ten missile chassis for hauling remotely guided missiles, kamikazes, and fighters. It also sports a main gun and a steerable blaster turret. Why all the firepower? Well, humankind's not the only species with a claim on space. MicroProse has peopled its universe with beaucoup alien species. Some can be bartered with. Some will even sign peace treaties. All require your constant attention.

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Circle Reader Service Number 105

veys ideas but also shows you the alien you're talking to. Sometimes you can pick up valuable information by watching for clues in facial expressions. There's even an automated trade balance system to help you strike deals. Still, remember that these creatures view you as the alien. You'll need all the political skill you can muster, but when negotiations go awry, you've got all those blasters.

Much to MicroProse's credit, *Lightspeed* entails more than simply blowing away aliens. Your trigger finger won't see you through every difficult situation; expect to use your brain quite a lot. You need treaties, new drive components, and resources. Sure, you can take them by force sometimes, but you may find it less painful to negotiate with the aliens instead of blasting them into cosmic dust.

How does the simulation end? Two possible scenarios await you. One has you fleeing for your life in an escape pod. Rest assured you'll ride the pod to safety a few times along the way. Alternatively, if you bring a star cluster to the point where it will support a new human colony, you can say you've won the game.

But *Lightspeed* never really ends. Plenty of Conestogas still search for homes, and every star cluster means fresh challenges. Your job is just beginning—you'll be lost in space for many hours to come.

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If you use a hard drive, you may be experiencing DOS-lexia, an inability to remember the correct order of directory paths. *Menu!* lets you bypass DOS by helping you set up a menu of the programs you most often use and then access them at the touch of a key. The main menu provides for up to 26 directories, within which you may create subdirectories to group related programs or to handle frequent DOS functions such as copying or formatting—without recourse to DOS commands. During installation, *Menu!* will insinuate itself into your AUTOEXEC.BAT file and will be ready to use as soon as you boot up your computer.

So will *Reminders!*, a prosthesis for the absent-minded. After your system boots, *Reminders!* will appear, notify you of your business for the day, and discreetly withdraw at a keystroke. If you wish, it will beep to remind you when appointments roll around and even wake you in the morning (five-minute snooze alarm included). Accessed by hot-key commands, *Reminders!* will also pop into other programs to display a three-month calendar with important dates highlighted, an autodial phone book, and a datebook that allows you to check appointments months in advance. You can also create specialized and password-protected *Reminders!* levels if more than one person uses your system.

Menu! and *Reminders!* provide clear manuals and copious help screens to prompt you through their functions. Both are solid, streamlined programs—and all that many people will ever really need.

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Your uncle, former owner of Magic Canyon Theme Park, died insane. What provoked his suicide? You face this mystery when you pass through the front gates of the deserted park. Perhaps you'll fare better than your poor uncle.

Three arcade games in one, *Theme Park Mystery* requires you to capture eight gremlins in the park that have caused all the problems.

Yesterdayland provides the only entrance to the park and the monorail of fear, and it houses three coin/token machines: a Zoltan machine, a bagatelle machine, and a grabber full of marching soldiers. The bagatelle machine allows you to win tokens to use on the other machines. You capture a gremlin from the grabber. For tokens, Zoltan trades clues, tickets for the monorail, and extra lives.

Dragonland features you as a barbarian in loincloth. Enter bizarre Dreamland by finding the sleeping potion in Dragonland. Dreamland presents you with an overhead view of a chessboard inhabited by boxes, birdseed, keys, demons, eyeballs, snowmen, sand, piglets, putty, and so on. Reveal boxes by moving into the spaces with chess pieces. You open boxes with keys that you get from birds. You trade birdseed to the birds for keys, and the birdseed comes from gold insects. You get the idea—you'll do a lot of bartering on this level. After collecting the two gremlins, you move on.

You'll find the monorail ticket to Futureland in Dreamland. A pure and simple shoot-'em-up, Futureland has you engaging alien spaceships; spaceship debris may be used to restore your shields.

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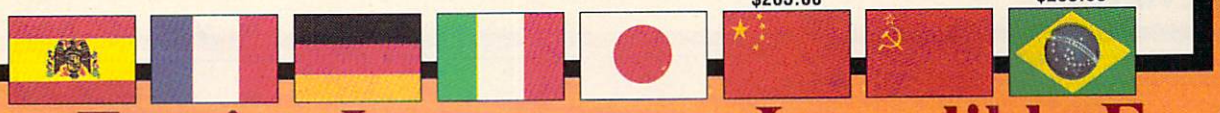

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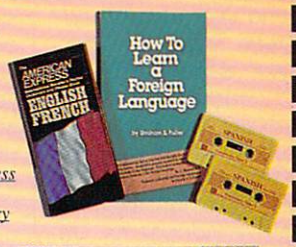

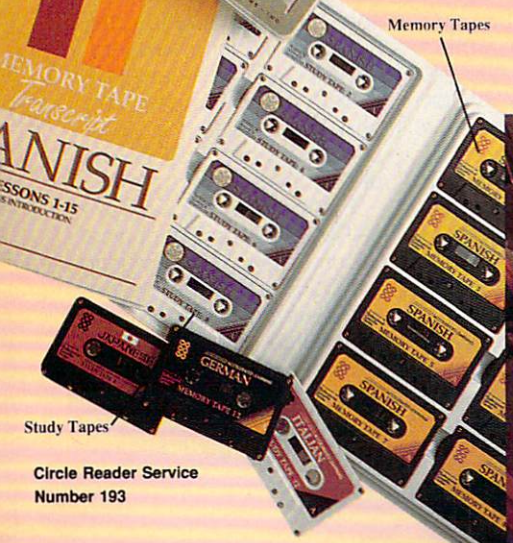

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In this world, the gremlins hide inside blue balls, which you'll also collect.

Plan carefully for the capture of the gremlins, or you won't complete the game. The way that all three arcade games and Yesterdayland interact creates a unique strategic situation; it's beatable but resistant to immediate solution. The hallmark of a successful adventure is its ability to entertain players as they work toward task completion, and *Theme Park Mystery* throws plenty of curiosities in your path to hold your interest throughout your travels. With first-rate animation and appropriate colors, the action should make arcade addicts take note. For those who love good puzzles, *Theme Park Mystery* offers more than enough weird ones. Fun, yes, and sometimes even a little creepy. The interface supports either the keyboard or a combination of joystick and mouse for game control. The combination joystick-and-mouse interface has one active while the other is inactive. In the beginning sequence the joystick is active and can be used for movement while the mouse is inactive. When you step in front of a coin-op machine, the machine screen replaces the Yesterdayland screen, the mouse becomes active, and the joystick becomes inactive. Obviously, the interface has tremendous potential to confuse.

Theme Park Mystery otherwise suffers only from having no save-game feature, requiring you to complete the game in one sitting. Replay of already completed sequences bores most gamers, but it shouldn't prevent you from playing. I wonder, though, why you shouldn't be able to save a position in Dreamland, for instance, and avoid another harrowing trip through Dragonland.

Combining three complete arcade games into an arcade adventure, *Theme Park Mystery*'s a bit quirky, but delightful. And as further incentive to buy, each game comes with a color poster of Zoltan and a chance to win back the purchase price of *Theme Park Mystery.* If you can live without a save-game option and you like your action a bit on the sinister side with some puzzles thrown in, then *Theme Park Mystery*'s truly worth the price of admission.

ALFRED C. GIOVETTI

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NIGHTBREED

What horrible and demented imaginings inspire a software title like *Nightbreed?* For Ocean Software, the inspiration is fright master Clive Barker's movie *Nightbreed.* Described by Ocean Software as an "interactive movie," this game struggles to capture the movie's feel in a videogame. Unfortunately, adventure game fans will likely find this game a disappointment.

As Aaron Boone, a diagnosed schizophrenic and suspected serial killer, you certainly have your share of problems, enough to drive anyone crazy. While being held for observation in a mental asylum, you hear of a place called Midian, where men can escape civilization's injustices. You decide to find Midian and join its inhabitants, misshapen creatures of the night known as the Breed. However, during your search, you unwittingly lead the police to Midian and place the survival of the Breed in jeopardy. Now you must fight to save them. As in the movie, you first have to escape the Breed—who seem bent on your death—before you can help them.

Nightbreed goes astray by forcing you to follow the movie's plot too closely. Often an adventure game's appeal stems from investigating and exploring a fictional world—something you can't control when you watch a movie, and something you can't do in this game. Exploration frequently merits swift, unavoidable death. Besides being frustrating, these unjust exterminations negate the reason for the game's existence. If we wanted to see the movie's plot line repeated verbatim, we'd just rent the movie.

The lack of basic features such as mouse support and a save-game facility adds to the frustration. A mouse seems the natural choice of controls for this game, given all the pointing and clicking you must do, and I'm frankly amazed that the designers didn't include mouse support as at least an option. Considering how often you die in this game, every concession to players should've been made.

Redeemed only by its graphics, *Nightbreed* does incorporate some appealing artwork, capturing the ambience of horror movies. Unfortunately, my opinion of *Nightbreed* the videogame parallels my opinion of the movie; it could've been an order of magnitude better.

RICHARD RAPP

IBM PC and compatibles, 640K RAM, CGA, EGA, MCGA, VGA, or Tandy 16-color; supports Roland sound card, joystick optional—$14.95

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UNDOCUMENTED DOS: A PROGRAMMER'S GUIDE TO RESERVED MS-DOS FUNCTIONS AND DATA STRUCTURES

An instant classic, *Undocumented DOS* explains DOS calls that Microsoft and IBM mark—infuriatingly—as "reserved" in their technical reference manuals. Well written by a team with impeccable credentials (including the original author of MS-DOS), this book/disk combination belongs on every serious programmer's shelf.

The book gives you everything you need to know to write TSRs, network code, alternate command processors, debuggers, and other high-performance software. The source code is largely in C, with dollops of assembly and *Turbo Pascal.* Luckily, *Undocumented DOS* explains using these calls.

Emphatically not a rehash of IBM or Microsoft technical documentation, *Undocumented DOS* also emphasizes complete programs, providing source code for utilities that not only teach but stand as useful programs on their own. Examples include a pro-

continued on page 154

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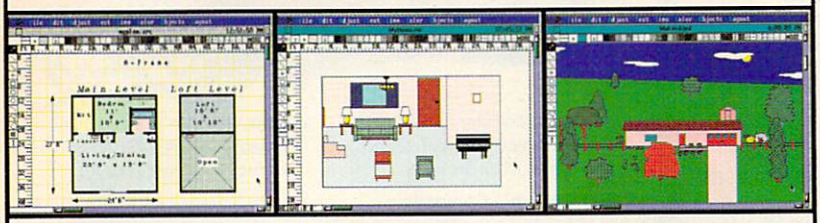

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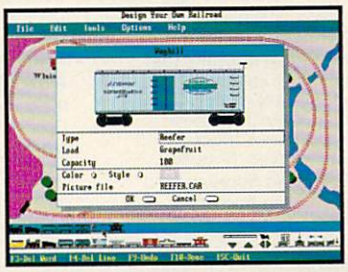

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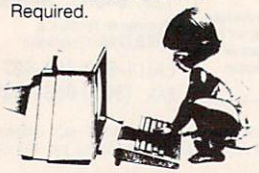

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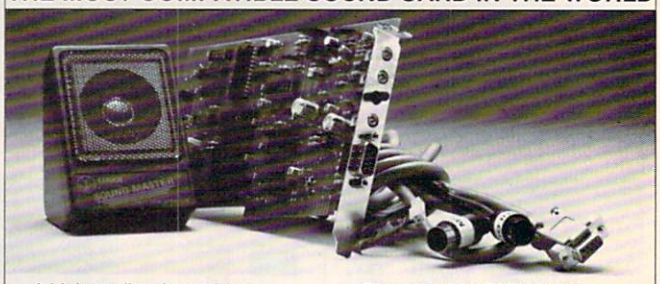

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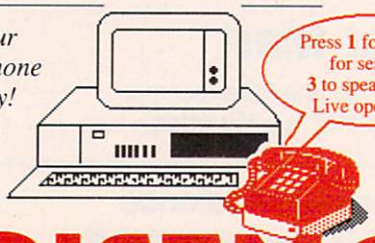

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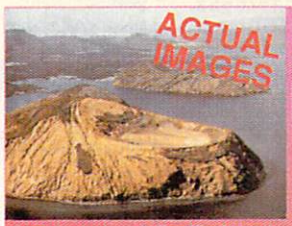

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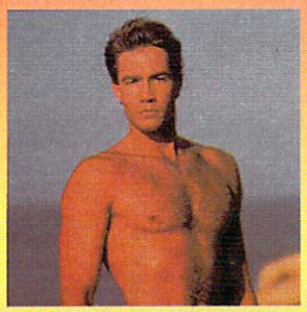

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REVIEWS

gram that lets you load and remove device drivers from the command line; a simple RAM disk, also loadable from the command line; a program that lets you hide disk volumes, making them invisible to DOS; and a utility that lets you rename files using wildcard specifications across directories (something that DOS won't let you do).

Learning anything well requires that you make connections between seemingly disparate ideas. *Undocumented DOS* is written by experts at such a Nirvana-like plane that they're able to make those connections for you. For example, the section on the network redirector, normally thought of as a way to create CD-ROM and network drivers, correctly points out that the network redirector can be used to graft any alien file system onto DOS, making it look like any other device. Another telling passage about version-specific DOS utilities remarks that "it is almost never necessary to patch DOS or the DOS utilities." Considering the huge number of DOS patches available on bulletin boards and in magazine articles, one might wonder if the authors haven't made a mistake. But sure enough, a program follows that lets you fool DOS into thinking it's a different version (without patching DOS).

The software, on two 1.2MB floppies, includes a hypertext reference guide, TSR template programs, and some great utility programs. One of them is an interrupt monitor program that has a full scripting language with replaceable parameters (like those in batch files) and access to the CPU registers. The hypertext guide (ironically, not a TSR) is itself worth the price of the book. Even though the guide itself takes up well over a megabyte of disk space, I'd like to see it with example code, even in fragmentary form, and as a swappable TSR. The insights that this code could provide would be well worth an extra disk to dedicated programmers.

While other books, including Microsoft's own *MS-DOS Encyclopedia,* have touched on a few of the issues covered by *Undocumented DOS,* none of them have even approached its scope. If you need to write code that *DOS Technical Reference* says you can't write, buy this book and code the impossible.

TOM CAMPBELL

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Go outside one cloudless night and tilt back your head. Unless you live deep in the country, you'll see only a smattering of the visible stars—city lights mask the rest. It's no wonder that we don't share the awe our ancestors held of the heavens. They imagined bears and warriors, bulls and crustaceans in the sky, and built legends, mythologies, even religions around what they saw. We look up and see nothing more than a few meaningless pinpricks of light.

You can rediscover the sweep of the Milky Way and the bright path of the planets with a good telescope and the time it takes you to drive out of the city. Or you can stay at home and turn your PC into a personal planetarium with *EZCosmos* 3.0, a fascinating and instructive astronomy program.

EZCosmos is delightfully simple to use. From a status screen, you select such things as your location, the date, and the time. Stepping through the setup is quick; the program recognizes 1150 cities across the world and automatically takes the date and time from your PC's clock. If you want to get adventurous, you can view the skies from any place on the planet by setting the longitude and latitude, or even transport yourself back in time as far as 4000 B.C. or as far ahead as A.D. 10,000. That's especially useful for hunting down solar eclipses, past or future, since *EZCosmos* can animate the planets and show you an eclipse close up.

Your monitor turns into a stunning display once you leave the status screen and plot the sky. On an EGA- or VGA-equipped system, planets are color-coded, and stars appear in their true colors—Betelgeuse, a red giant, gleams red on the PC screen, for instance. As expected, CGA and Hercules modes are far less satisfactory. Constellation lines, the sun and moon, and New General Catalogue objects (nebulae, clusters of stars, and distant galaxies) complete the display.

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With all this information on the screen, it's easy to go into stellar overload. *EZCosmos* conveniently solves the problem by letting you pare the display to the essentials—the stars. A small cursor box can be moved around the screen to identify stars and other galactic objects of interest. Mouse support—one of version 3.0's enhancements—makes it easy to move around the screen and choose objects for identification. Another way to get to where you want is with the program's fill-in-the-blank Find command, which lets you jump to stars you know by name. Although the program offers a menu list of commands at the press of a key, I'd like a system that doesn't require me to know the names of stars, one that would let me pop up all the stars whose names begin with *S* when I press that key, for example.

Once you've located an object, hit the Enter key, and an information box appears, filled with such things as its magnitude (brightness), azimuth (deviation from true north), and rising/setting times. The last is especially useful for planet watching. The moon appears when appropriate and shows its phases, as well. Though the stars don't move, you can animate the planets and watch them track across the sky. The outer planets seem to barely move from month to month, while the inner worlds fairly zip through the heavens. *EZCosmos* makes it easy to identify what planet is where, both onscreen and in the night sky.

Extras include 40 full-color graphics of planets, star clusters, galaxies, and nebulae; extensive online help; and a filter to display only the brighter stars. In all, you have access to more than 10,000 objects in the program's database—a good start towards a guide to the galaxy. But this program is more than a sky watcher's reference limited to your desktop. With version 3.0 of *EZCosmos*, you have the ability to generate a star map on your laser or dot-matrix printer. Maps can make your star gazing jaunts more productive.

EZCosmos brings a bit of astronomy into anyone's home. Its sights may be set too low for astronomers who have already memorized the skies, but for amateur enthusiasts, it's an enjoyable diversion and an educational voyage of discovery. More than that, it gives you an excuse to get up from your computer and go outside, to see the real interstellar sights of the night.

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MACE FORMAT

Have you ever formatted the wrong disk? In your hurry to prepare a disk for an important task, you grab the wrong one, shove it in the drive slot, and issue the fateful command, FORMAT A:. After the format is complete, you remove it from the drive, only to discover that it was the only copy of your club's membership list or your checkbook files. I can tell you from experience: It's not a good feeling.

A small set of programs, *Mace Format* helps you recover from such unhappy lapses in concentration. It includes a special formatting program for floppy disks, an undelete program, and a hard disk recovery program.

If you install Formatf, the disk formatter, in place of DOS's deadlier FORMAT command, you increase your safety level in two ways. First, Formatf won't format a hard disk, so you can't accidentally format your hard drive. Second, the program performs its own special brand of nondestructive formatting. Instead of wiping out everything on the disk, Formatf copies the files from the disk into temporary storage, formats the disk, and then writes the files back onto the disk and deletes them. Deleting a file doesn't remove the data from the disk; it just marks the file in the File Allocation Table (FAT) as no longer worth saving. If subsequent disk activity doesn't write over the sectors containing the original file, the undelete program can recover the data by restoring its entry in the FAT.

RxBak, the hard disk recovery program, stores an image of the essential FAT and directory files in a safe area. If you accidentally format your hard disk, the unformat program can mirac-

ulously restore your lost data.

Undelete and hard disk recovery programs are fairly common these days (*PC Tools* has both). While not unique, *Mace Format*'s special way of formatting floppy disks certainly makes this a valuable application, one you'll be glad you have the next time you grab the wrong disk.

RICHARD O. MANN

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PROCOMM PLUS

A longtime favorite among the legions of the DOS-faithful, *ProComm Plus,* a dependable, multipurpose telecommunications program, is back. And as the first major upgrade to Datastorm's premiere communications package in several years, *ProComm Plus* 2.0 debuts as a winner, touting some significant, much-appreciated enhancements.

Full mouse compatibility and 132-column support have been added. (Switching from 80 to 132 columns and back presents no problem to *ProComm.*) If your system doesn't have EGA or VGA higher-resolution modes, *ProComm Plus* scrolls across the larger 132-column window.

Roughly doubled in size, the Aspect script language now necessitates a separate manual. The manual itself has been rewritten and includes a helpful tutorial. Several appendices provide useful information on common problems such as file transfer protocols and terminal emulation. Background communications are supported, but notably, expanded and extended memory use isn't. However, the amount of memory required—300K for fully functional operations—is small enough to allow multitasking with ease. Intended primarily for DOS users, *ProComm Plus* nevertheless operates in the *Windows* multitasking environment. Just set it up as a DOS application and you can switch between telecommunicating and *Word for Windows,* for example. You're also saved the memory expense of accessing ZMODEM as an external protocol; *ProComm Plus* features it as part of the main executable file.

ProComm Plus remains, above all, easy to use. *ProComm Plus* 2.0 is fully compatible with the older 1.1B release and both the installation process and the program are supplemented by generous online help, which now includes a topic index. If problems occur that require outside assistance, unlimited technical support is quickly available. You'll find Datastorm's technicians very

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CONVERSATIONS

Darren P. Mckeeman

HACK TO THE FUTURE

Bruce Sterling, coauthor of The Difference Engine, is currently writing a nonfiction book about computer hacking.

I first corresponded with Bruce Sterling when the Electronic Frontiers Foundation referred him to me for sources on his latest book project. Recently, I spoke with him about his work and his ideas regarding writing and hacking.

COMPUTE: What is your new book going to be called?

Bruce Sterling: It's called, tentatively, *The Hacker Crackdown: The True Story of the Digital Dragnet of 1990 and the Start of the Electronic Frontiers Foundation.*

C: What prompted you to write about this?

Sterling: It was the [Steve] Jackson bust. . . . The Chicago Computer Fraud task force showed up in town . . . pursuing L.O.D. [Legion of Doom] people and fringe L.O.D. people, and they came down hard on [two alleged hackers]. They were in such a hurry that they went in and seized Steve Jackson's stuff, too, and Jackson didn't have anything to do with this. . . . Anybody could have told you that Steve Jackson was not into carding [using other people's calling card numbers], he was not a code kid [a person who sells long distance codes], he was not a software pirate. . . . They were trying to swat out a prairie fire.

C: Why do you think the public is so afraid of hackers?

Sterling: I think they are very afraid of computer hackers, but I think mostly they are afraid of computers. A computer hacker puts the face on the menace that is represented by computers. I mean, I am afraid of computers. . . . I'm not computerphobic; I'm rationally afraid of computers. Computers are a challenge and a threat, and they're changing our society in ways that we can't control and don't understand. They're not to be trusted.

C: What would your definition of computer hacker *be?*

Sterling: I would say that if you were really a computer hacker, there would have to be some sort of intellectual curiosity about what you were doing. In other words, you're not just a code thief. . . . There are people running call cell operations [calling card fraud] whom I wouldn't call computer hackers per se, but they have everything a hacker [has]. They've got a Commodore, and they've got a modem, and they've got codes, and they've got teenagers working for them, and they've got a subscription to *2600* [an underground magazine devoted to hacking], and they've got police that hate their guts. So what are you going to allow here, a blood test?

C: What is the difference between computer hackers and the guy at the office who uses the computer to transfer a few bucks into his account or the guy into coding?

Sterling: There are appeals to the things that computer hackers do, and [it isn't] money. It's not the ability to embezzle funds. That's not the major kick. The major kick of hacking is *power.*

C: Do you think computer hacking should be outlawed?

Sterling: No, I don't really think it should. I think there ought to be laws against code theft and such, and I think that "the heat" are probably right when they say it's getting worse, and maybe ten years ago it was the sort of thing that got done in college dorms. But now there are guys from, say, Pakistan, who shoulder surf [run programs at phone booths from laptops] at airports and sell codes and stuff. I don't think that ought to be legal.

C: What does the future have in store for computer hacking?

Sterling: As far as I'm concerned, computer hacking has already had its Summer of Love. And now you're going to see more and more people doing the sort of things people did who were in L.O.D. in 1985 or 1986, except these [people] are going to be so unsavory, man.

C: What do you think of the word cyberpunk *being used to describe hackers?*

Sterling: I think it's very regrettable. *[Cyberpunk]* is a literary/critical term. The idea that it would be used in this form sort of shows the basic ignorance of the science fiction milieu that's akin to the kind of ignorance that involves having Steve Jackson get busted. If he hadn't been making a game called *Cyberpunk,* this innocent guy would not have been struck down on his own property by agents of the federal government, not to mention the state of Illinois and Bell. Tagging people with line names, I guess it's useful, but not if it provokes some kind of knee-jerk reflex. I recognize it as a *fait accompli;* I'm not going to sue—not that I would—but I also recognize it is not a thing that is entirely without justice. The books we write do deal extensively with computer crime, and a lot of the characters do exhibit very militant antisocial attitudes. ❐

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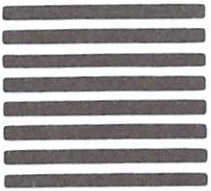

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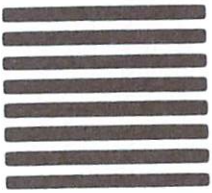

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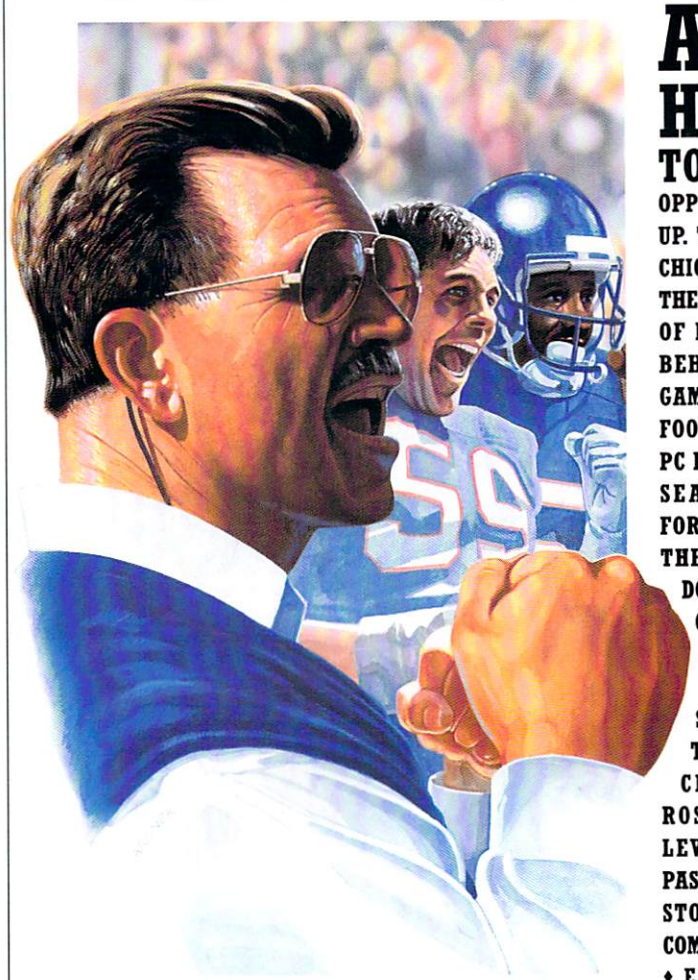

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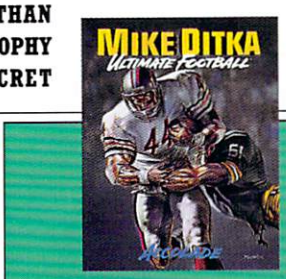

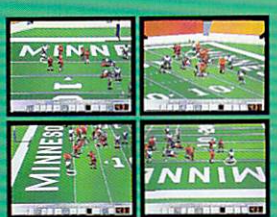

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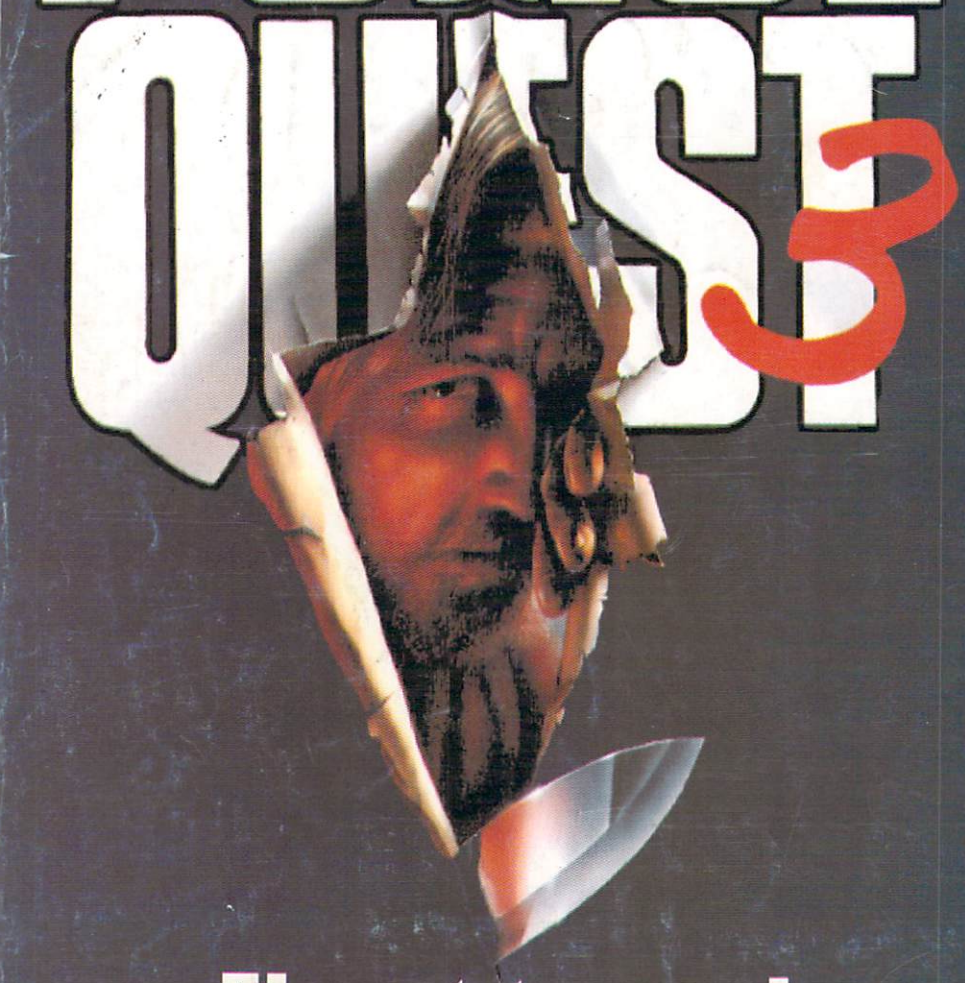

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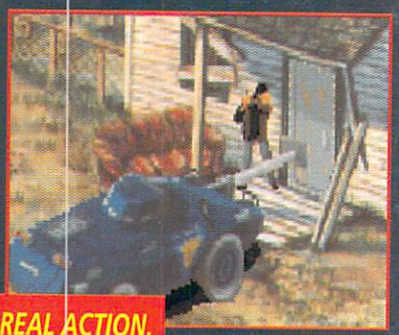

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