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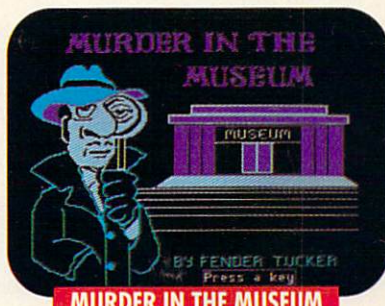
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Pete Turner's dynamic cover photo shouts Happy New Year and Congratulations to all the COMPUTE Choice award winners. Featured is a Tandy MPC, the multimedia machine that's this year's winner for best personal computer.

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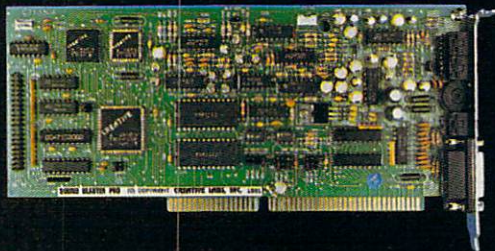
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"With its associated software, it has quietly (no pun intended, but what the heck) become the standard sound system for advanced PCs." **Jerry Pournelle, BYTE** June 1991

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).

The built-in mixer makes the Sound Blaster Pro fully compliant with Microsoft's Multimedia Level 1 Extensions to Windows. Multimedia software will be able to fade-in, fade-out and pan the various audio sources to create elaborate sound montages.

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.

All in all, the Sound Blaster Pro is chock-full of new features, yet it's fully compatible with its younger brother."

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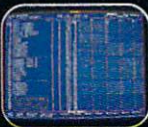
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and loads of **FREE** bundled software:

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"The big question is, at a list price of \$249.95, is the Sound Blaster worth the investment? Yes, yes, a thousand times yes!!!" **PC HOME JOURNAL**

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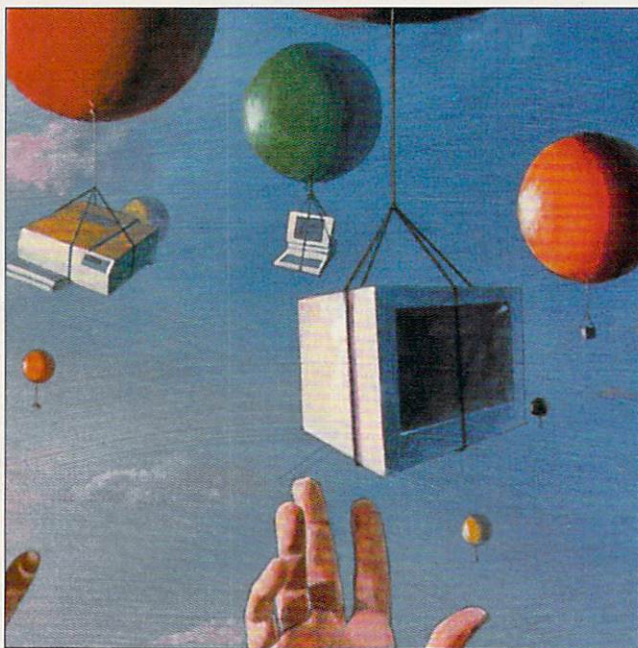
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We check out *The Terminator*, the hard-hitting game from Bethesda Softworks, as well as an inexpensive notebook computer, Leading Technology's 9800NB. We also look at today's leading computer software and hardware, including *FastLynx LapPack*, *Teenage Mutant Ninja Turtles World Tour—Electric Crayon Deluxe*, NEC Graphics CDs, *Mace Express Recovery*, *ThunderStrike*, *Flow Charting 3*, and *Dvorak on Typing*.

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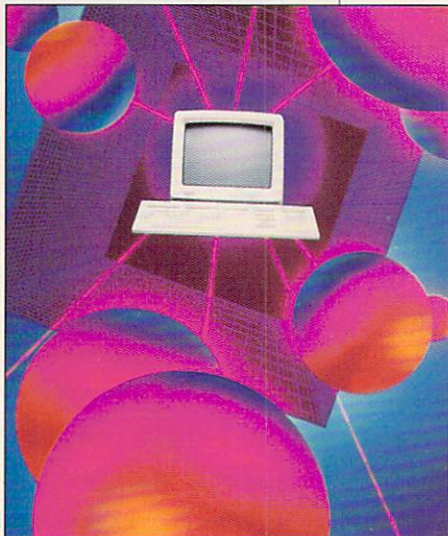
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Clifton Karnes

At COMDEX/Fall, held this past October in Las Vegas, Nevada, printer manufacturer Star Micronics hosted a breakfast press conference to present the results of a Gallup survey it had commissioned on the home computer market.

Some of the results were startling, some were what we expected to hear, but all pointed to a growing, healthy home computer market. Here are some highlights.

A look at this year's COMPUTE Choices will convince you that home computer users are a varied and exciting group.



According to the survey, about 25 percent of all American households have home computers. That's no surprise. The news is that 23 percent of all households plan to buy a computer in the next two years. That's 21 million households.

Of this 21 million, roughly one-quarter are upgrading; the majority, however, are first-time buyers. This means that the installed base of home computers is going to nearly double in the next two years.

Why are all these Americans buying PCs? The three E's: earnings, entertainment, and education.

Of those planning to buy a machine, nearly half say

they're going to use their new computer to earn money. This was a surprise, as was the fact that nearly a third of all home machines are currently being used to earn income.

A large number—76 percent—say they want to use their PCs to bring work home. More than half of this group think that the computer will increase their chance of a promotion (or increase their chance of keeping their present job if their company downsizes).

About 80 percent of those planning to buy a PC say they're interested in the machines as educational tools—both for their children and themselves.

Of those planning to buy for the first time, 59 percent state that they want a computer to play games. For those upgrading, this number is slightly higher—about 62 percent.

Obviously, there's a lot of overlap in these figures. It's clear that most people planning to buy a PC are interested in all three areas—home office, education, and entertainment.

What does all this boil down to? In short, a phenomenal growth in home computing that's being fueled by a combination of interests in home office, education, and entertainment.

At COMPUTE, we have more than a passing interest in the home computer market. For 13 years, it's been our mandate as a magazine to serve this exciting and constantly evolving group. We're dedicated to the home computer as a tool for the entire family.

And as Star's Gallup survey shows, the home market is anything but one-dimensional. In fact, home users place demands on their machines that far exceed the responsibilities given to the home PC's corporate cousins.

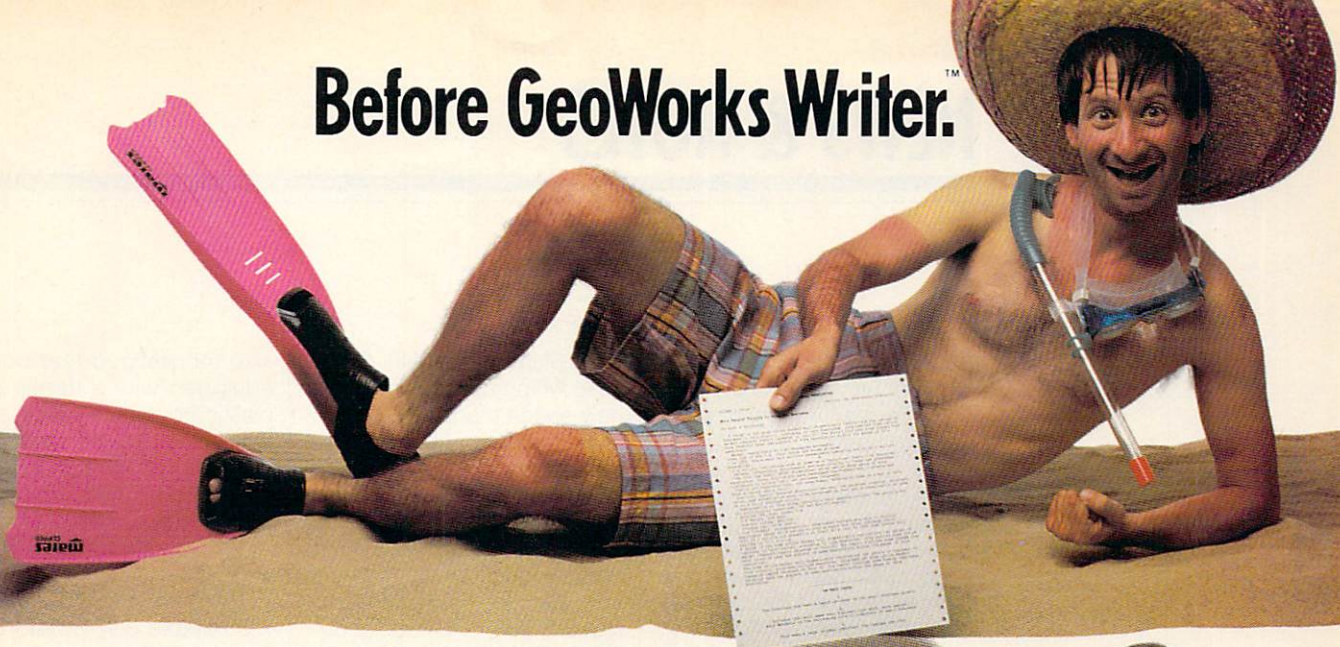
Nothing demonstrates this multifaceted nature of home computing or shows the range of COMPUTE's coverage better than our annual COMPUTE Choice Awards, where we choose the best software and hardware products for the year.

In this issue, you'll find our choices of the best products for 1991 in the categories of home office, entertainment, discovery (education), and technology.

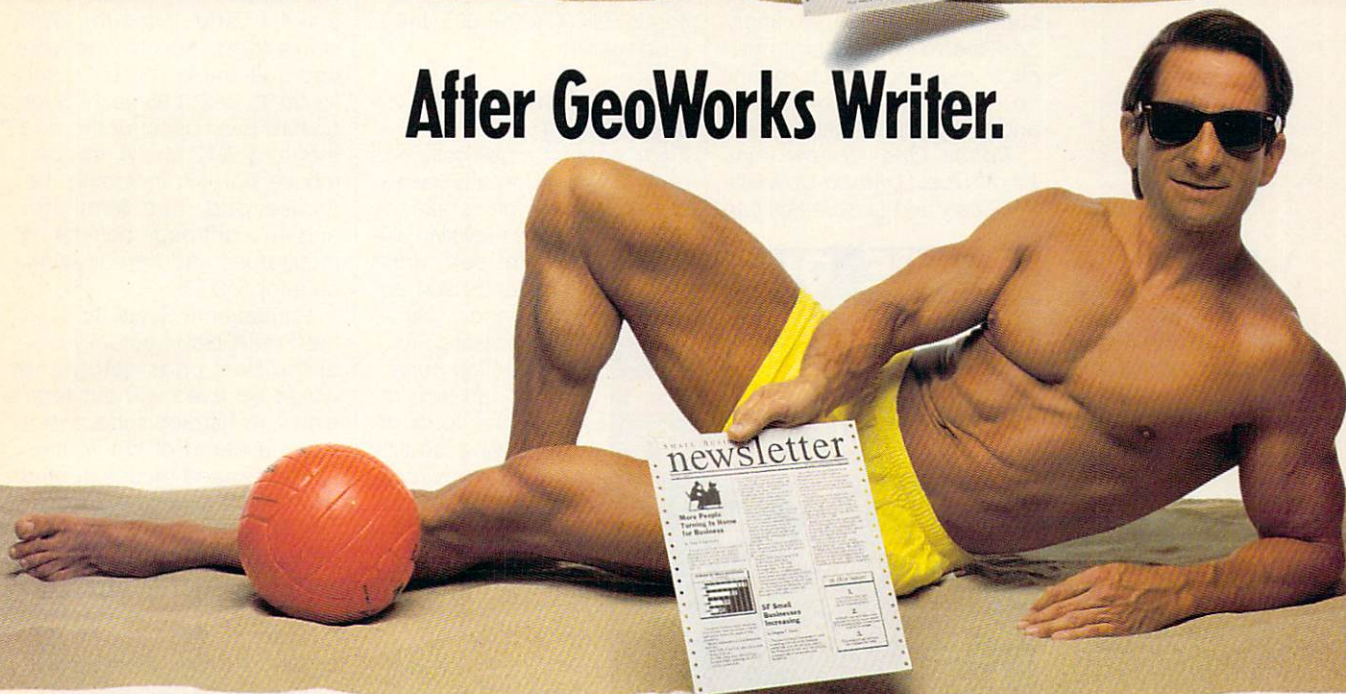
A look at this year's Choices will convince you that home computer users are a varied and exciting group. The awards show that home users are interested in everything from the best operating systems to the tops in education for their children, from the most demanding fantasy/role-playing game to the best utility, from the hottest arcade action to the most feature-rich programming language.

Star's Gallup survey and our own COMPUTE Choice awards give a clear idea of home computer users in broad strokes, but we're interested in our readers as individuals, too. That's why, every few months, we include a readership survey in our pages. In this issue, you'll find such a survey, and we hope you'll take the time to fill it out. This survey will provide us with specific information about you, your equipment, what you like about COMPUTE, and what you'd like to see changed. We use the results from these surveys to fine-tune COMPUTE so it's the magazine you want. Talk to us. We're listening. □

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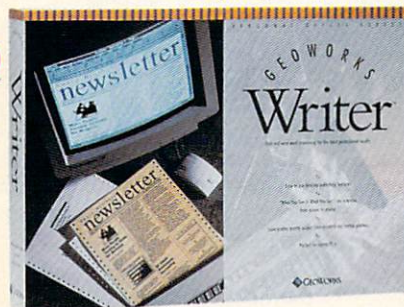
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NEWS & NOTES

Redesigning the Classics

Some of Sierra On-Line's classic role-playing games are getting dramatic facelifts. The "new" classics feature the same characters and stories, but animation, background, musical scores, and sound effects have been greatly enhanced to take full advantage of high-resolution VGA color, stereo sound capabilities, and Sierra's new point-and-click interface, which means no more type-in commands and lots of character action.

Space Quest I now joins *King's Quest I*, *Mixed-Up Mother Goose*, and *Leisure Suit Lar-*

ry and becomes the newest Sierra original to be released in VGA. The game has been redesigned to emulate a 1950s sci-fi flick—campy space creatures and all—without changing the story's essence.

However, along with the arrival of a new-and-improved lifelike Roger Wilco, a dynamic soundtrack based on the original *Space Quest* theme, and dramatic new background illustrations, Sierra warns experienced players who *think* they know the game that creators

Scott Murphy and Mark Crowe have whipped up some brand new space magic. *Space Quest I* VGA is available now for a suggested retail price of \$59.95. Look for VGA versions of *Police Quest I* and *Quest for Glory I* to come soon. For more information, contact Sierra On-Line, P.O. Box 485, Coarsegold, California 93614; (209) 683-4468.

JILL CHAMPION

Politically Correct Laser Printing

If you work for a politically correct, environmentally aware "green" office, you've already begun recycling aluminum soft drink cans and used paper, and you've stopped using Styrofoam coffee cups.

You can help reduce the load on overflowing landfills even more by recycling the toner cartridges used in laser printers, thanks to a free cartridge-recycling program from Lexmark, a worldwide manufacturer and marketer of desktop and personal printers, typewriters, keyboards, and supplies.

By providing special prepaid return postage mailers, Operation Resource, as the new program is known, encourages IBM LaserPrinter customers in the U.S. to return used cartridges to Lexmark. The cartridges are then disassembled and sent to various recycling centers.

IBM LaserPrinter customers with questions about Operation Resource can call (800) 848-9894 for additional details.

Helpful Mouse Pads

The Microref SmartPad from Educational Systems is a full-

size mouse pad that comes equipped with a transparent plastic cover into which a variety of template sheets can be inserted for at-a-glance keyboard and mouse operating commands.

Templates, available for *Windows 3.0*, *WordPerfect 5.1*, *Excel for Windows 3.0*, *Lotus 1-2-3* release 3.1, *PC/MS-DOS 2.1-4.1*, and *Word for Windows* (and there's one you can customize yourself), sell for \$9.95 to \$14.95 each. Suggested retail price for the pad alone is \$12.95. A special mouse pad kit, including the mouse pad, one template, and an eight-page booklet on mouse use and care is available for \$19.95.

Educational Systems says the SmartPad is actually one of the best pads going and would be even without templates. Its hardtop surface provides a blend of low friction for high-speed mouse control and texture to ensure traction. The SmartPad could only be better if the mouse could read the template!

For more information, contact Educational Systems, 706 Landwehr Road, Northbrook, Illinois 60062; (708) 498-3780.

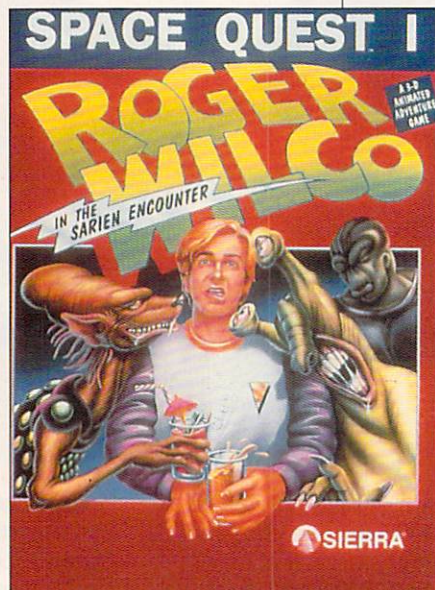
ALAN BECHTOLD

GeoWorks in Progress

The folks at GeoWorks were busy in 1991. Last summer, they released a much-improved *GeoWorks Ensemble* version 1.2 package. The new release builds on *Ensemble's* high performance and ease of use by providing a range of additional features, including a spelling checker for *GeoWrite*, support for more than 300 additional printers, the popular game *Tetris*, numerous templates, and more. Version 1.2 is sent free to all registered owners of version 1.0.

Early in the fall, GeoWorks released three new add-on, easy-to-install font libraries—*Fun*

Space Quest I fans can expect lifelike characters, stereo sound, and some spacey new twists in the classic game's redesign.



ry and becomes the newest Sierra original to be released in VGA. The game has been redesigned to emulate a 1950s sci-fi flick—campy space creatures and all—without changing the story's essence.

However, along with the arrival of a new-and-improved lifelike Roger Wilco, a dynamic soundtrack based on the original *Space Quest* theme, and dramatic new background illustrations, Sierra warns experienced players who *think* they know the game that creators

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"I can't believe how easy it was to look this good. You see, before I discovered GeoWorks Designer,™ my posters were pathetic. But now, wow! Everything I do looks gorgeous. It has style! Energy! It's red hot, a whole new me. And I did it

all myself on my first day with GeoWorks Designer.

Skeptical? Well, GeoWorks Designer comes with over 70 templates for everything from banners to flyers, greeting cards to newsletters. And it includes scads of clip art! Believe me, I'm no artist. All I did was pop my words into a template. Then, voila. C'est tres chic!! It was even WYSIWYG so there was no time-wasting surprises. What I saw on my screen was what came out looking laser printed on my little dot matrix printer. With no ugly jaggies!

Yes, GeoWorks Designer is the graphics program for people who want more than a Print Shop.™ It makes fast work of small

projects, but has all the features you need to get fancy... even its own award-winning* graphical environment that makes using it as easy as clicking a mouse. And if you think it's super alone, just wait until you see it working with the rest of the Personal Office Series team.

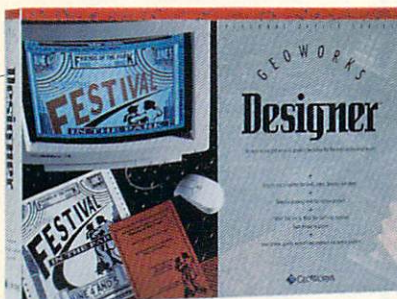
So if you're tired of anemic artwork, make a change. Go for GeoWorks.™ If it can make *me* look this good, imagine what it will do for you."

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NEWS & NOTES

Fonts, Newsletter Fonts, and Business Fonts. Art Library, released at the same time, contains a great collection of clip art. The font libraries and the art library retail for \$49.95 each but can be purchased directly from GeoWorks for \$39.95 each or \$99.95 for all four libraries.

GeoWorks had even more surprises in store with the October release of stand-alone versions of *GeoWrite*, *GeoDraw*, and *GeoManager*. Those wanting WYSIWYG applications without purchasing *GeoWorks Ensemble* can now buy *GeoWorks Writer*, *GeoWorks Designer*, or *GeoWorks Desktop* for around \$69.95 each.

As if one new GeoWorks product weren't enough, *GeoWorks Pro* is now available for \$199.99. *GeoWorks Pro* adds Borland's *Quattro Pro SE* spreadsheet to *Ensemble's GeoWrite*, *GeoDraw*, *GeoComm*, and *GeoManager*. Using the *GeoWorks Pro Viewer*, you can remain inside the *GeoWorks Pro* environment while working with spreadsheet files and charts created in *Quattro Pro SE*.

GeoWorks Pro users can navigate through a spreadsheet or cut, paste, drag, and drop any portion of a *Quattro Pro* spreadsheet or chart directly into *GeoWrite* or *GeoDraw*.

If you purchased *GeoWorks Ensemble* after September 22, 1991, you'll receive a free upgrade. Other registered owners will receive a special upgrade offer.

For more information, contact GeoWorks, 2150 Shattuck Avenue, Berkeley, California 94704; (415) 644-0883. STEPHEN LEVY

Brother's PowerNote

Brother International's new PowerNote shouldn't be confused with a laptop PC or word processor. It's not a mere data manager, either. In fact, it's a notebook-sized replacement for the average businessperson's calculator, address and telephone directory, calendar, and portable fax machine—all rolled into one. It's like an electronic notebook loaded with paper and a lot more.

Weighing just five pounds, the PowerNote displays a menu screen that allows easy access to all of its fully integrated features. It can be used to create spreadsheets, perform math functions,

arrange schedules, and store addresses and phone numbers. With an optional fax/modem, it can also exchange ASCII files with PCs and send and receive fax transmissions.

The electronic notebook features 32K of built-in text memory and comes with a built-in 3½-inch 240K disk drive for data storage. Its two-way switchable 14-line x 80-character LCD screen provides optimal viewing in any type of lighting situation, and it can be used with virtually any PC-compatible printer—from dot-matrix to laser. The PowerNote operates with an included AC adapter and also can run up to eight hours by using an optional rechargeable battery. It even comes with a version of the hit arcade game *Tetris* for the busy executive who needs an occasional break.

For more information, contact Brother, 200 Cottontail Lane, Somerset, New Jersey 08875; (908) 356-8880.

ALAN BECHTOLD

Desktop Laptop

Until now, laptop users have had to sacrifice *something* for convenience. While size and portability of laptop and notebook PCs have always been appealing, the best black-and-white VGA displays and fastest microprocessors usually available for these machines have always compromised their computing power. NEC's newest laptop could signal the turning point.

The new NEC ProSpeed 486SX/C color laptop PC offers more power than a 386 33-MHz computer and includes a Super VGA thin film transistor (TFT) active matrix color screen and an EISA expansion slot. NEC says it's the lightest laptop on the market with those specifications.

The ProSpeed 486SX/C laptop supports 256 colors in 640 x 480 resolution and has a built-in 32-bit EISA slot that provides optimal expansion for networking, imaging, and engineering applications. Other features include 2MB of memory expandable to 20MB, a 120MB hard disk drive, an 8K-cache memory, and *Windows* and *DOS 5.0* installed. Suggested retail price is \$8,999.

For more information, contact NEC Technologies, 1255 Michael Drive, Wood Dale, Illinois 60191; (800) 366-3632.

ALAN BECHTOLD

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ments, addresses, the works. GeoWorks Desktop makes using a computer so easy, even I can do it. So of course, my wife and kids have no trouble at all.

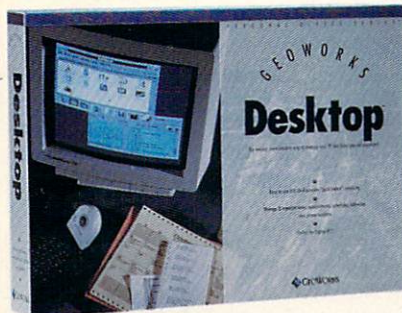
Impossible? Well, GeoWorks Desktop replaces that cryptic DOS C> prompt with an award-winning* graphical environment of menus and buttons that you just point at with a mouse to get things done. For example, one click launches Lotus or any DOS program. And because it turns DOS directories into pictures of file folders, GeoWorks Desktop can organize your hard disk in a flash. Just delete files you don't need by placing them in a "wastebasket," and organize the rest in neat, easy-to-see folders.

Yes, now I can find addresses, notes, appointments, and phone numbers fast. Because GeoWorks Desktop comes with a computerized calendar, notepad, address book and more. All of which are easier, faster, and smarter than my old paper versions. And if you think it's easy alone, just wait until you see it working with the rest of the Personal Office Series team.

So don't waste time with chaos, make a change. Go for GeoWorks.™ If it can organize *me*, imagine what it can do for you."

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Circle Reader Service Number 157

Learn the subtleties of program installation, publish from your desktop, count scientifically in Latin, and more.

Better Installation

Allow me to comment on your review of our product *Strategic Video Poker* (COMPUTE, June 1991), in which you refer to our installation, stating, "An unfriendly installation procedure may cause problems for novices."

The program will install even if you don't specify a subdirectory. However, we decided not to have the installation program create its own subdirectory to avoid conflicts on the user's hard disk.

The user has the option of copying the information verbatim from page 15 of the manual or substituting a subdirectory name after typing INSTALL at the A: prompt. The installation program detects the graphics adapter, installs the appropriate graphics files, and creates a directory.

Thank you for your feedback. Every day we obtain more users who are COMPUTE readers, many of whom mention reading your review. We are continuously enhancing our support for different video modes.

WENDY WEINER, PRESIDENT
LWS SOFTWARE
HAVERTOWN, PA

Stop the Presses

We have a small weekly newspaper that's in need of being brought into the computer age. We're cutting and pasting by hand to generate the newspaper.

The newspaper is 11 x 16 inches in size and has a total of 16 pages. We do have photos and advertising in the paper.

Can you recommend a complete computer system—printer, software, and peripherals—that would allow this paper to enter the modern age of computers? The people who put the newspaper together aren't very computer literate.

RAYMOND PEPIN
FITZBURG, MA

That's a pretty tall order, perhaps better filled by a local computer retailer or consultant, since the person who puts the system together will also have to train your staff in its use.

Probably the minimum configuration would require a 286 or 386 PC for each of your staff members (these are fairly standard, so go for low price), a flatbed scanner (Hewlett-Packard is one of many reputable manufacturers), a laser printer capable of printing typeset-quality output on large format paper (LaserMaster is the only manufacturer that springs to mind), and word processing and desktop publishing software.

We'd recommend XyWrite or Microsoft Word as the word processor (though there are dozens of good ones) and Ventura Publisher as the desktop publishing software (but take a look at PageMaker, too). You'll also want a graphics package, perhaps Aldus Photostyler or ImageIn, for dealing with scanned photographic images.

Total cash outlay? Since you didn't mention your cost requirement, we'll assume that the sky's the limit. Depending on the number of people who require PCs, you could outfit the office for around \$12,000-\$20,000.

These figures assume that you'll use only monochrome equipment. The rule of thumb in desktop publishing is that you can spend as much money as you have—and more—and still find yourself lusting after unattainable equipment and software.

Besides sticking to monochrome, you might save money by investigating resellers of discontinued equipment, dealers in used equipment, and advertising-for-equipment exchanges with local dealers and consultants.

Since "Feedback" is always under attack for infrequently mentioning minority computers, we can also recommend that you consider the Macintosh, the Amiga, and the Atari as desktop publishing machines. Microsoft Word, Ventura Publisher, and PageMaker are all available for the Macintosh, as is the highly regarded QuarkXPress. Adobe PhotoShop and ColorStudio are powerful Mac graphics packages. ProWrite and WordPerfect are two top-of-the-line word processors for the Amiga. PageStream is a leading Amiga desktop publishing package. Good graphics packages for the Amiga are too numerous to mention, since it's primarily a graphics machine. Atari offers a desktop publishing package.

As hardware, each of these computers is excellent. The problem is in dealer availability. If you have questions of a technical nature (and as a beginner, you will surely have lots of them), PC and Mac expertise is far more readily available than Amiga or Atari expertise.

Handbook Redux

As author of *The Computer Buyer's Handbook*, I was very pleased with Mike Hubbart's review of my book (COMPUTE, July 1991). However, I want to respond to two small points he raised.

The most difficult thing about a book of this sort is keeping it current in a fast-changing market. Mr. Hubbart is correct in stating that pricing information (which appeared for comparative purposes on a single page) was out of date six months after printing. However, this kind of detailed information (which is better obtained from periodicals, anyway) plays little part in my narrative and, in any event, will

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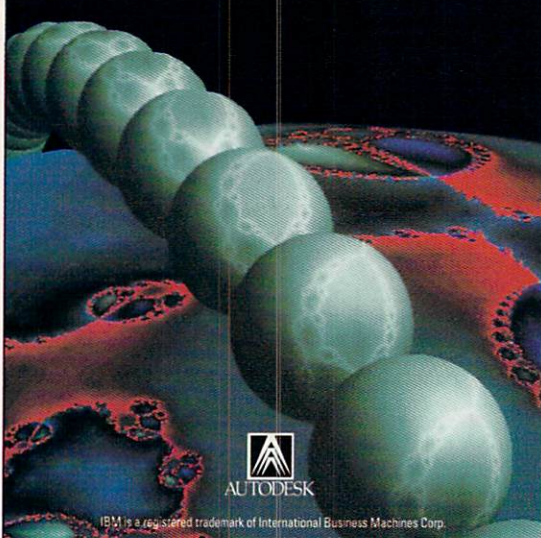
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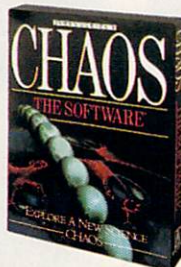


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continue to be updated with every printing of the book.

Because of deadlines, the first edition of the book was released without an index. Although the logical arrangement of the book would seem to make an index unnecessary, one will be included in the second edition, scheduled for release in early 1992.

R. WAYNE PARKER
SEATTLE, WA

By the Numbers

In computers we use binary, octal, decimal, hexadecimal, and now base 32 number systems. I know the names of the systems from 2 to 20, but I don't know the names of the systems above 20. I especially would like to know the name of the base 32 system.

Here are the ones I already know: Binary is base 2, Octal is base 8, Decimal is base 10, Duodecimal is base 12, Hexadecimal is base 16, and Bidecimal is base 20.

E. O. ZEAGLER
BAYTOWN, TX

A call to a university math department yielded this response from a gentleman purporting to be a professor: "A number system based on 32? I'd call it a base 32 number system."

Realizing that this answer was far

too simple, we came up with this response: *Base 21 would be unibidecimal; base 32 would be duotridecimal. Base 40 would logically be called quadradecimal. Incidentally, the Latin for fourteen is quattuordecim; for forty, quadraginta; for twenty, viginti; and for twenty-one, viginti unus.*

Our thanks to Betty Bixby, who is fluent in Latin, for her help with this reply.

New Math

One of the sentences in the October Test Lab sidebar "Choosing an Interface" (page 38) should have read, "SCSI interfaces [rather than proprietary interfaces] are commonly sold separately, adding to the cost of the drive (typically \$100-\$150 more)."

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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COMPUTE/NET: COMPUTE on GENie or America Online

What computer(s) do you own or use?

- 8088/8086 (IBM PC, XT, or compatible), brand _____
- 80286 (IBM AT or compatible), brand _____
- 80386, brand _____
- Notebook/laptop, brand _____
- Macintosh _____
- Game system, brand _____
- Other _____
- I don't own a computer.

Which video display system(s) do you use?

- Monochrome
- Hercules
- CGA
- EGA
- VGA
- Super VGA

Which peripheral(s) do you own or use with your computer?

- 5¼-inch disk drive
- 3½-inch disk drive
- CD-ROM drive
- Dot-matrix printer
- Hard disk
- Joystick
- Laser printer
- Letter quality printer
- MIDI device
- Modem
- Mouse
- PostScript printer
- Sound card

How much memory does your computer have?

- 512K or less
- 640K
- Extended memory _____
- Expanded memory _____

Which language do you prefer for programming?

- BASIC
- C
- Pascal
- Assembly language
- Other _____
- I don't program on the PC.

Which DOS do you use?

- MS-DOS version _____
- DR DOS version _____

Which graphical user interface do you use?

- Microsoft Windows
- GeoWorks Ensemble
- Tandy DeskMate
- Other _____
- I don't use a graphical user interface.

Which columns do you like the most?

- Arts & Letters
- COMPUTE/NET
- Disk Update
- Editorial License
- Feedback
- GamePlay
- Hardware Clinic
- IntroDOS

- Multimedia PC
- News & Notes
- On Disk
- PathWays
- Point & Click
- Programming Power
- SharePak
- Tips & Tools
- WorkPlace

Which of the following computer-related topics do you like to read about?

- Databases
- Desktop publishing
- Disk management and MS-DOS
- Education
- Games and entertainment
- Graphics (paint, draw, or CAD)
- How to upgrade your PC
- Integrated software
- Money management
- Multimedia
- Local area networks
- New computer technologies
- New hardware
- Pen computing
- Programming
- Spreadsheets
- Telecommunications
- Windows
- Word processing

Where do you use your PC?

- Home
- Work
- School

Where did you get this copy of COMPUTE?

- Subscription
- Newsstand
- Other _____

Which COMPUTE disk(s) do you subscribe to?

- Amiga Resource Disk
- COMPUTE's PC Disk
- Gazette Disk
- SharePak

Have you used COMPUTE/NET?

- Yes
- No



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SHAREPAK

Richard C. Leinecker

FOUR PROGRAMS TO PLEASE

The four programs packed on this month's *SharePak* disk are sure to delight just about everyone. There's *Hi-Lo Joker Poker*, an old game with a new twist; *LINEWARS*, an arcade-style game that lets you blast away, zapping aliens as you go; *ZipZap 7.0*, a useful disk utility for editing files; and *FormGen*, a formatting utility for creating text-based forms and files ready to fill out.

January offers a mix of games and utilities sure to delight just about everyone.



In *Hi-Lo Joker Poker* you need a winning hand to stay alive.



View and modify files and sectors in ASCII or hex with *ZipZap*.

We spend many man-hours putting our *SharePak* disks together. We download hundreds of files from the online services. We select programs with reader appeal, then test them, and pick only the very best. If there's an important feature that should be added or a bug, we contact the authors and get things worked out. Finally we check for viruses and assemble the programs on a disk with documentation and a menu program for the easiest possible installation.

If you're a shareware author, now's your chance to submit programs for 1992. You can send submissions through the mail to COMPUTE's *SharePak* Submissions, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. But there's an even better way: Upload files to COMPUTE/NET on GEnie or America Online.

And if you enjoy *SharePak*, now's a good time to send suggestions and your 1992 wish lists. With your input, we can better serve you by collecting the kinds of programs you want. Just write to me at the above address, or send E-mail to RLEINECKER on GEnie, Rick CL on America Online, or user 75300,2104 on CompuServe.

Hi-Lo Joker Poker

This takes the game of draw poker in a new direction. You start off with ten credits, and each time you don't get a winning hand, you lose one. But for every winning hand, you get credits. The better the hand, the more credits. With skillful play you can amass a pile of credits. And if you're lucky enough to get a joker, it's wild.

The CGA graphics are detailed and tastefully done. You don't have to read a documentation file; all of the instructions can be read while you're playing. You might not need them, though, since the screen has all of the keypresses displayed. But for the ultimate in easy play, use your mouse and just click on the buttons to play the game.

LINEWARS

Jump into your Cobra Mark IV multipurpose general contract vehicle and blast off into intergalactic space in *LINEWARS*. Once in the deep dark void, you'll have to clear out the ali-

en ships in your vicinity. If you don't, it might cost you your life. Your mighty arsenal contains missiles, beam lasers, and an energy shield.

This game is fun—and even more fun if you connect with another player via modems. Then the action really heats up because you're fighting a living person while zapping the unknowns. The game runs in CGA, EGA, and VGA.

ZipZap 7.0

ZipZap lets you view and modify files and disk sectors. The data is displayed as ASCII or hex. That's good because straight hex looks like Greek to most people. Why would you want to modify a file or disk sector? One of the most common uses is to change the volume labels of disks. I've also had to change text within programs when the source code is unavailable.

Sometimes, though, I just want to look through a disk file to see what's there. You can often see what language the program was written in. And you can even see text strings that indicate features that you're not aware of. This handy utility has helped me in a variety of situations, and I wouldn't be without it.

FormGen

Dressing up batch files is a good idea, especially if you're preparing a file for use by someone who is new to computing. This utility lets you create text files that can be displayed from a batch file or your program. It's easy to use, too. Some simple keypresses let you draw lines, boxes, and lots more.

You'll learn the keypresses quickly using the clear, concise documentation file included with the program. It's full of charts and explanations that'll have you creating masterpieces in no time. □

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disk
\$1.19
per program!

Back Issues Available

DEC 89: *Hearts*, play your computer in hearts; *Bass Tour*, super fishing simulation; *MahJongg*, match and stack colorful tiles; *Ed's Chess*, full-featured chess game. (#CDSK1289)

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; *Meal*Master*, 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; *EARTH-WATCH*, 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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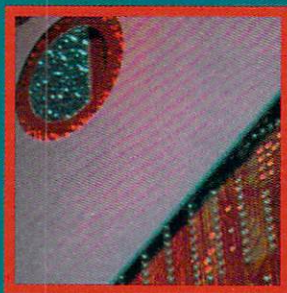
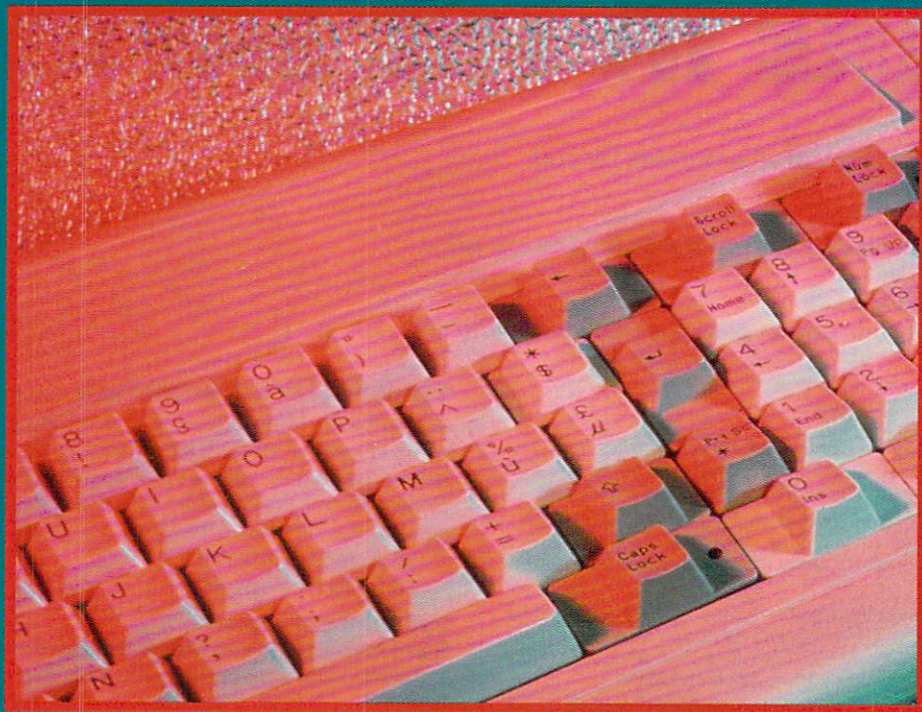
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THE
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AWARDS



A TOAST TO THE BEST SOFTWARE OF 1991

This is the fourth year *COMPUTE* has presented awards for the best hardware and the best home office, discovery, and entertainment software. There were more contenders than ever in this year's competition—all with more to offer as the standards (and stakes) rise ever higher. Many of the products listed here were reviewed in *COMPUTE*. These reviews can be accessed through *COMPUTE/NET* on *Genie* and *America Online*.

HOME OFFICE

Small Business

Excel 3.0

Right off the bat you'll notice that *Excel* 3.0 looks different. Its most impressive new feature is the Toolbar, a horizontal bar underneath the menu bar that contains groups of push buttons that are shortcuts for commonly used commands. An example of how the Toolbar can save you work is the Autosum button. Research showed that adding up rows and columns of figures was the most repetitive task in a spreadsheet, so an Autosum button was created to replace all the clicking, dragging, and menu access. *Excel* 3.0 gives you unlimited access to your installed fonts. *Excel* also has outlining that allows you to collapse long columns of figures into a single cell, redisplaying them on command, but normally keeping them hidden and out of the way. *Excel* has superior graphics, including presentation-quality charts that can be enhanced with on-board drawing tools.

CLIFTON KARNES

Word Processing

Ami Pro 2.0

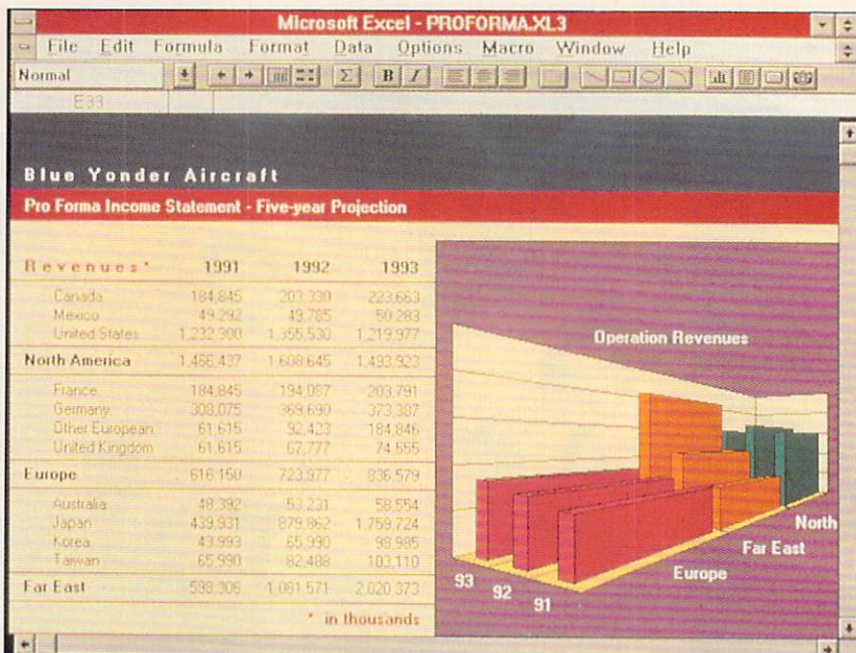
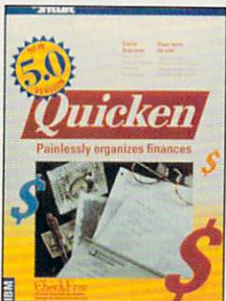
The company that showed the world how *Windows* word processing should be done, *Sama* (now part of Lotus Development) brings out the next generation of its much-vaunted *Ami Pro* before *WordPerfect* can even get its first product to market. The SmartIcons are smarter, the text and image handling are more adept, and the power features—macros, power fields, notes, and more—put *Ami Pro 2.0* at the technological forefront.

ROBERT BIXBY

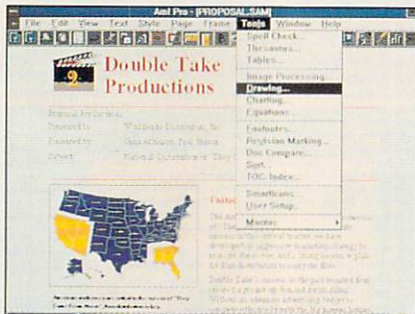
Finance

Quicken 5.0

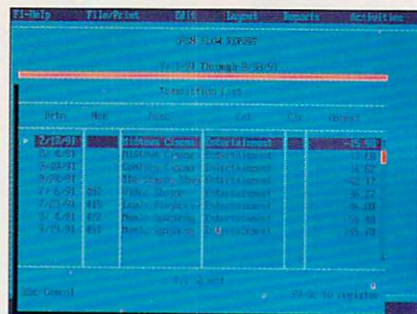
Worry no more about where your money is hiding. With *Quicken* 5.0, you'll know exactly where every penny is being spent and invested. With its pull-down menus and hot-key calculator, *Quicken* is a real timesaver. Practically anyone can set up the software and use it. *Quicken's* checking and budgeting features are so well integrated that you can



Microsoft Excel 3.0



Ami Pro 2.0



Quicken 5.0

easily generate reports indicating whether your cash flow is in balance. *Quicken* can even remind you when it's time to pay your bills. If you need accounting software, *Quicken* can handle that, too. With *Quicken*, you'll also be able to complete your tax accounting chores with ease. Even your accountant will be impressed with the precise expenditure reports you'll be able to provide at the end of the year.

PAM PLAUT

Desktop Presentation/Video

DCTV

Digital Creations' DCTV adds a lot of power to any Amiga. It's a graphics enhancer, paintbox, image processor, and full-color digitizer all in one package. Imagine realtime—not frame-by-frame—animation in 4 million colors. DCTV displays to a composite monitor, so the signal can be taped directly by a VCR. You can create images using the bundled paint software or use the built-in still-frame digitizer to digitize images from a color video source. Images can be fine-tuned using the includ-

ed image-processing program or saved in 24-bit IFF format for use with other software. DCTV's street price is less than \$400, and it can be used with any Amiga from the 500 to the 3000T, bringing desktop video power to folks who can't afford a full-blown Video Toaster system.

DENNY ATKIN

Desktop Publishing/Graphics

Micrografx Picture Publisher

A PC darkroom for photo editing or any kind of raster graphics work, *Micrografx Picture Publisher* puts the emphasis on friendliness and ease of use, but not at the expense of speed. Available in both gray-scale and color versions, the package is designed for high-end desktop publishing and presentation work but priced so that most serious PC graphics users can afford it. It allows masking, transparent effects, posterization, airbrush and smearing, textures, and smart features that recognize ranges of colors for editing instead of just a single color.

ROBERT BIXBY

25 Miles of Terror!

Ultima[®] Underworld[™] The Stygian Abyss[™]

The first continuous-movement, 3D-dungeon, action fantasy!

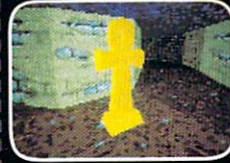
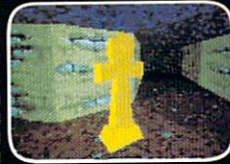
You never have to stop walking, swimming, jumping or fighting in this continuous-motion, virtual-reality epic!

Every wall, precipice, bridge, object and character in the dungeon is painstakingly modeled in 3D space!

Look down, straight ahead or up to find clues, solve puzzles, avoid traps, and battle fearsome monsters!

You won't believe your eyes.

Some games can't be showcased with a few screen shots and some descriptive text. *Ultima Underworld: The Stygian Abyss* – a game of action, motion and movement – is one of them. We hope this attempt to capture the excitement of the Underworld sends you running to a software store for a look at our demo. Because only there can you truly experience this incredible journey.



Full screen view

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If your favorite retailer doesn't have an *Ultima Underworld* demo yet, ask them to call ORIGIN. We'll send one out right away.

Arcade

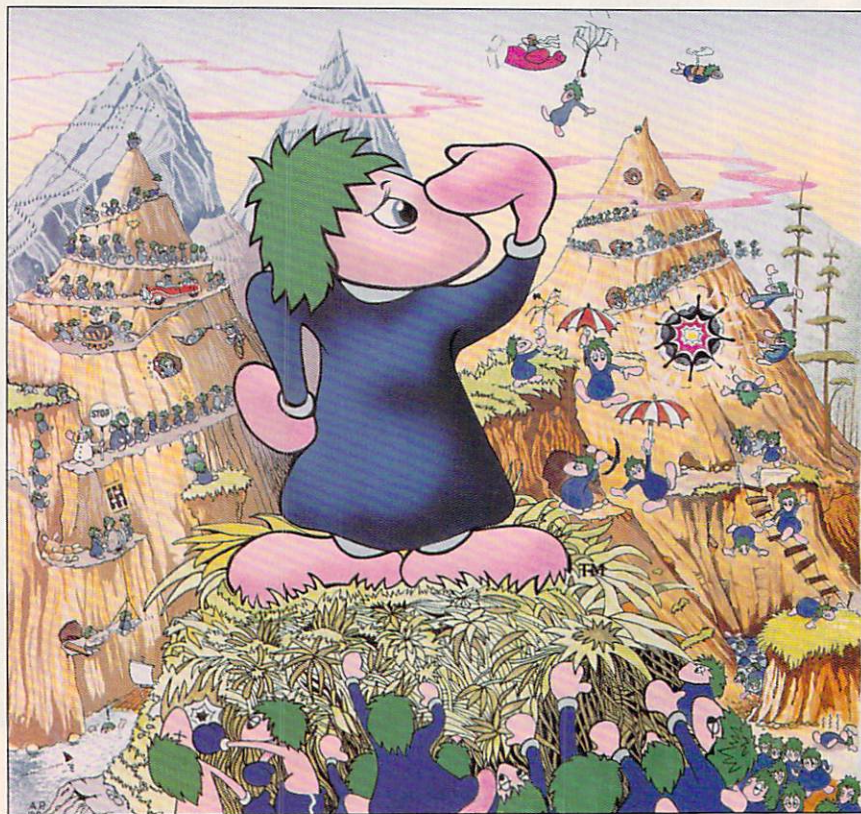
Lemmings

Psygnosis has tapped into the instinct for survival in formulating *Lemmings*, a perfect blend of puzzle, strategy, and action.

As the primary controller for all the characters in *Lemmings*, you must not only plan a mass exodus from each perilous level but also learn the personality traits of your charges, who possess the brain power of common hamsters. Though not the most graphically detailed creatures, the lemmings are flawlessly animated, and when they combust, explode, drown, or grind themselves into hamburger, you'll be quite aware of what they go through. With a sound card, *Lemmings* supplies a satisfactory array of thuds and chirps and—while not traditional Psygnosis disco by any stretch—a charming soundtrack.

Lemmings provides a number of metaphors ideal for conversation among the sociologically minded. When you draw comparisons between *Lemmings* and the me-first, me-now generation, your friends will marvel at your insight and follow you blindly into the world of video gaming.

DAVID SEARS



Lemmings



Red Baron

Simulation

Red Baron

Red Baron, from Dynamix, lets you climb into the sky on wings of fabric and bamboo to soar with the early legends of aviation warfare. It strives for realism successfully, overlooking no opportunity to re-create the actual flying conditions early pilots encountered, extending even to midair collisions, blackouts from oxygen deprivation, and diminishing consciousness from bleeding wounds. In addition to the giant hydrogen-filled Zeppelin gasbags (used as floating observation towers and guaranteed deathtraps), *Red Baron* offers you your choice of 18 historic planes to pilot, including Germany's Fokker and Albatross models and Britain's Sopwiths and Spads. Overall, Dynamix deserves high praise for a superb job of researching and documenting anti-

quoted aircraft, tactics, and tales.
HOWARD MILLMAN

War/Strategy

The Perfect General

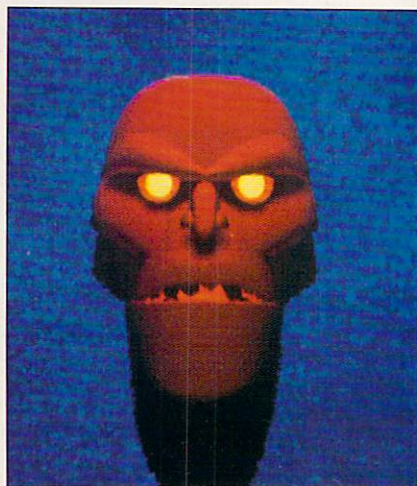
If you need to get work done with your computer, lock this game away in a safe place. From the fiendish minds of Mark Baldwin and Bob Rakosky, creators of the highly addictive classic *Empire*, comes the war game for the rest of us. Splendid graphics, digitized sound, and a delightfully simple user interface keep away the drudgery often associated with older hex-based war games. Twelve built-in scenarios range from small battles to full-fledged ground wars. If you beat the other player, you can switch sides and try the battle from his or her perspective. You can play against another player on the same computer or over a modem connection, or you can play against computer players of varying intelligence. It's available for MS-DOS and Amiga, and Amiga players can battle MS-DOS users over the modem—perhaps the ultimate computer war.

DENNY ATKIN

Fantasy Role-playing/Adventure

Ultima VII: The Black Gate

The latest in the venerable Ultima series, *Ultima VII: The Black Gate* takes you and your 386 PC right to the edge

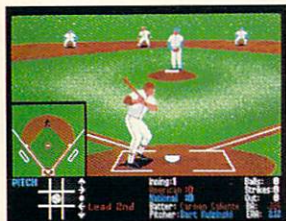


The Black Gate

CRITICS CHOICE

The Best PC Games You Can Buy

HARDBALL II™



"Until recently there have been few baseball simulations worth \$50. I've changed my mind after playing HardBall II ... it hits a grand slam." — Boston Herald

Test Drive III™

THE PASSION™



Rating: 10.0 "The most exciting and realistic automobile road racing simulation available. As much fun for adults as it is for kids." — Chicago Sun Times

STAR CONTROL™

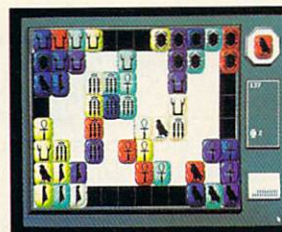


"Best Computer Science-Fiction Game" — Video Games & Computer Entertainment

"This is not just another space game... it's a space game with everything done right." — Compute Magazine

ISHIDO™

The Way of Stones



Named one of the 1991 Games 100. "A stimulating mental challenge of rare beauty and quality." — Games Magazine

"Five stars, magnetic... well worth the money." — Boston Herald

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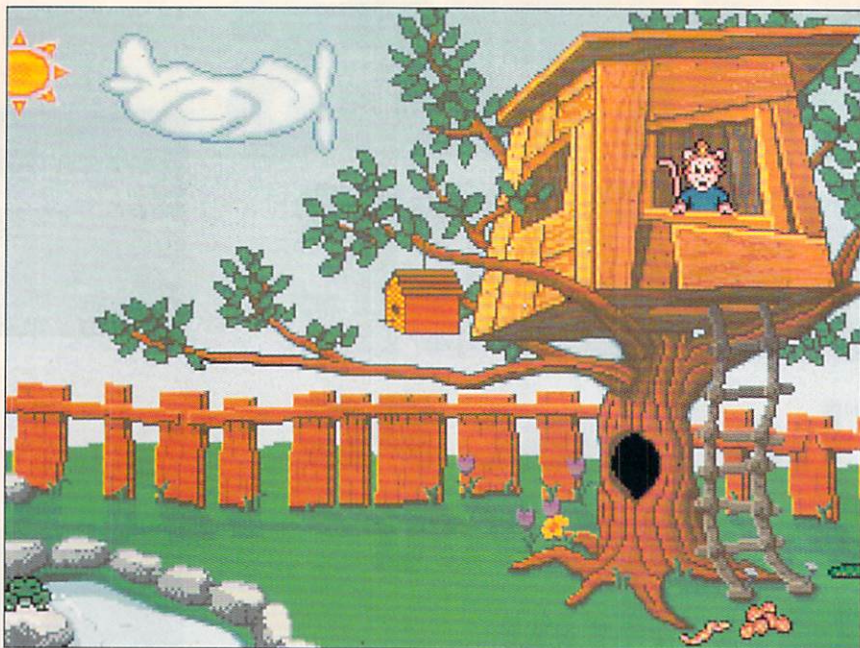
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The Perfect General



4-D Boxing



The Treehouse

of role-playing. Forget the tile-based graphics of earlier Ultimas; this smooth scroller brings gorgeous Britannia to vivid, nearly three-dimensional VGA life. As always, the soundtrack is topnotch, and this version even features sampled speech.

Don't expect an easy time, avatar. You've been away for centuries. Protector of Britannia you may be, but there's new evil afoot that might just be your match. At any rate, the involving and ominous plot will enthrall both Ultima veterans and newcomers to fantasy role-playing. Adeptly crafted nonplayer characters and a superb interface ensure that this visit to Britannia is destined to be the most epic yet.

DAVID SEARS

Sports

4-D Boxing

Almost every element of professional boxing is captured in *4-D Boxing* for you to experience at your PC (except for the lacerations and brain swelling).

The boxers themselves are shaped like some kind of weird cyborg fighters, not the smooth bitmapped figures adopted by most sport games. But once you see them in motion, all negative assumptions about the figures vanish. These guys move like real fighters, bobbing and weaving, throwing the jabs, uppercuts, rabbit punches, and roundhouses that wreak havoc on the head and body of the opponent. This is the most realistic boxing game—and one of the most realistic sports games, period—to come along in some time.

PETER SCISCO

DISCOVERY

Children

The Treehouse

Once your child encounters *The Treehouse*, the fun and learning start right away. An interactive chalkboard boasts six-color click-and-drag drawing capability. A small clock tells time. *Treehouse's* music synthesizer screen displays an orchestra pit with illustrations and simple descriptions of the instruments. The program also plays a sample note from each instrument.

Treehouse includes a very clever music maze game that plays simple musical phrases (two or three notes) and then requires you to pick the correct one out of four options. A correct choice earns a note, and completion of the maze is rewarded with a song. Another *Treehouse* game teaches counting, with chips or cash as options. An animal guessing game teaches deductive reasoning, and an animated puppet theater encourages storytelling, all with excellent graphics and sound.

BETH ANN MURRAY

Young Adult

PC Globe 4.0

Better than a geography book or atlas for its instant visual representations and detailed library of information for 190 countries and dependencies, *PC Globe* will turn any apprentice into a budding world geography expert.

The program starts by quickly drawing a flat map of the world. To begin

your cerebral exploration of countries, you hunt through any of five pull-down menus and choose a continent, region, country, city, or even grouping of countries, such as NATO. Online help is easily accessed with a pull-down menu. Once you've made a choice, the area is highlighted on the map. Choosing it again will bring a closeup view of the region.

The real gem of this program is what comes next. Make a choice in the Database menu, and you'll find everything you ever wanted to know about a place—and more. What's the per capita income, the growth rate, the nation's major product? Learn a country's population breakdown by age, language, ethnic group, religion, and even literacy rate. Find out physical features such as elevations, major city locations, climate, latitude and longitude, and time zones. Get detailed health statistics—life expectancy, infant mortality rate, birth rate, and death rate. Is it a developing country? Industrialized? Part of OPEC? Learn the most current national leaders and the area's political parties. You'll find the major tourist attractions, water potability, visa and health conditions, telex and ham radio prefixes, currency exchange rate, international telephone codes, point-to-point distances and bearings, and much, much more. You can even see a country's flag and hear its anthem.

Maps can be imported to *PC Paintbrush*, *WordPerfect*, *Ventura Publisher*, *Lotus 1-2-3*, and *PageMaker* for printing. Data can be output to ASCII or *Lotus 1-2-3* files for printing. Annual updates are available.

JILL CHAMPION

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and Talks!

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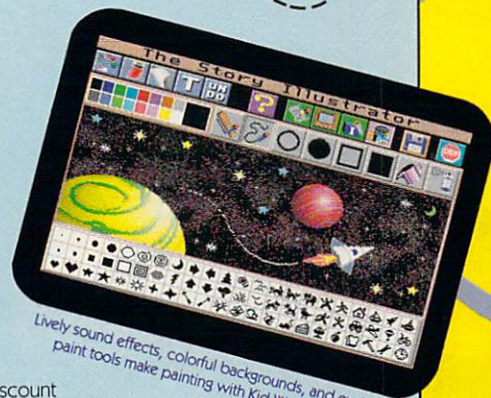
(800) 545-7677 or
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Compatibles - \$49.95

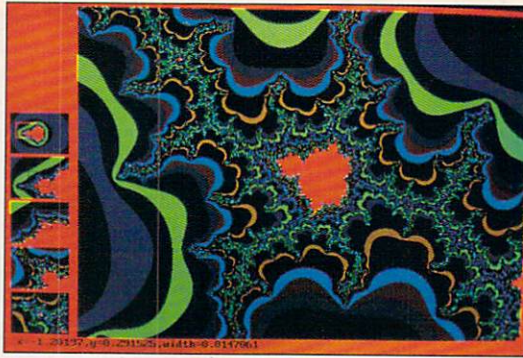
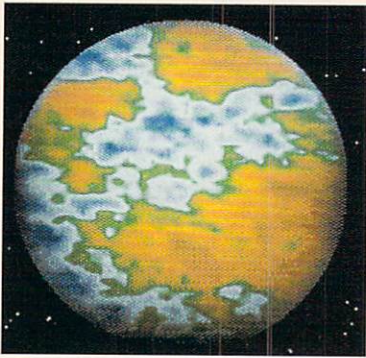
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256-
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VGA Graphics



Lively sound effects, colorful backgrounds, and exciting
paint tools make painting with Kid Works a blast!



Adult

James Gleick's *CHAOS: The Software*

If you're curious about how things work, you'll love James Gleick's *CHAOS: The Software*. With it, you can explore the strange new science of chaos. Create your own fractal graphics; explore the fascinating world of strange attractors; experiment with the complex motions of magnets and pendulums; witness the evolution of order and disorder as you set up your own toy universes; fabricate artificial mountains, clouds, and planets; and more. In short, you can play with the mysterious new phenomena you read about in Gleick's best-selling book, *CHAOS: Making a New Science*. Even without the book, the software program can bring hours of fun to any amateur scientist.

DAVID ENGLISH

Reference

CDTV
bundled with *The New Grolier Electronic Encyclopedia*

Thinking of plunking down \$1,000 for a nice set of encyclopedias? With the current pace of world events, they're likely to be outdated in two or three years, and your shelf full of bulky books will be a nostalgic curiosity instead of a useful reference source. For the same amount of money, you can pick up Commodore's CDTV multimedia player, which comes bundled with *The New Grolier Electronic Encyclopedia* on a CD-ROM disc. The Grolier CD-ROM contains the same information as the printed version and adds digitized quotations, musical samples, and animated sequences. The encyclopedia's sophisticated search engine will help your kids find cross references they

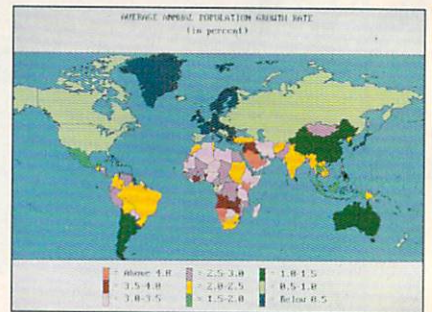
would never have located if they'd had to page through multiple volumes of a paper encyclopedia. And if the information on the disc becomes outdated, you can simply upgrade to the latest version of the encyclopedia disc.

The CDTV player is designed for average consumers, rather than computerphiles, so it can be used by the whole family. Unlike Philips' competing CD-I unit, CDTV can be expanded into a full-blown computer that has thousands of compatible software titles readily available—with the addition of a keyboard and floppy disk drive, CDTV can run Amiga software. Along with the electronic encyclopedia, the unit also ships with a tutorial disc and the CDTV version of *Lemmings*. Approximately 100 discs are already available for the unit, and about half of these are reference and educational titles.

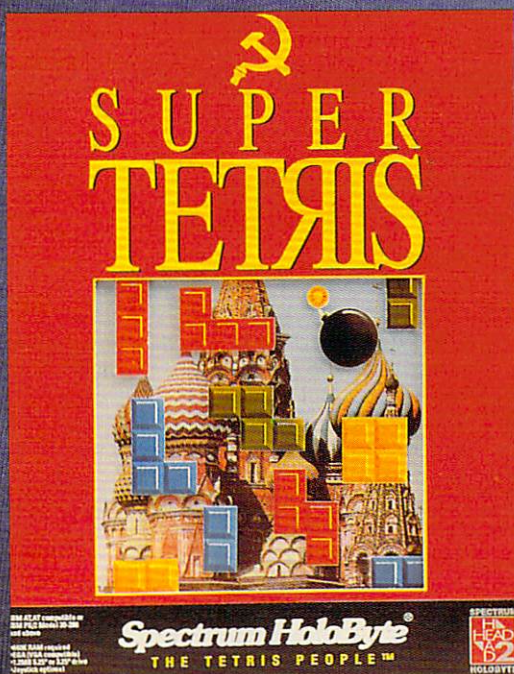
DENNY ATKIN



CDTV



The New Grolier Electronic Encyclopedia



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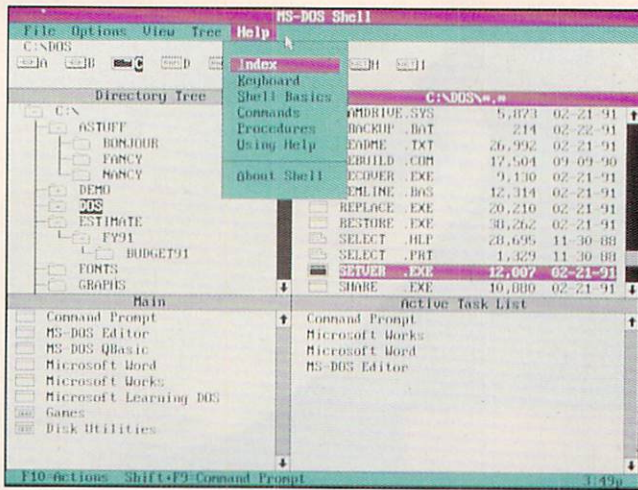
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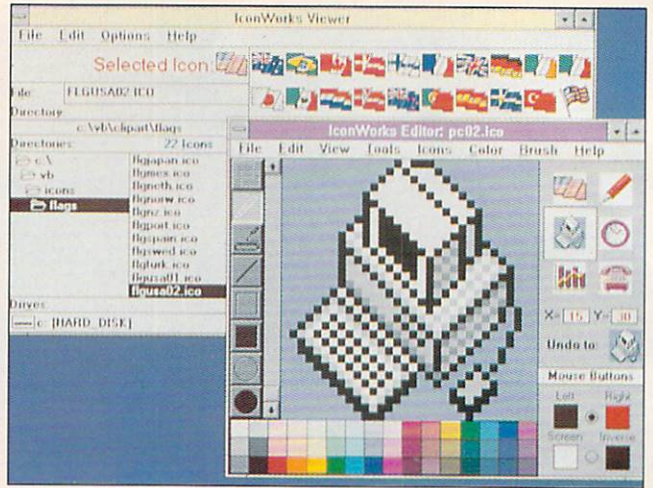
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Circle Reader Service Number 108



MS-DOS 5.0



Visual Basic

TECHNOLOGY

Operating System/ Operating Environment

MS-DOS 5.0

Microsoft's release last June of MS-DOS 5.0 isn't just important news for command line addicts; it's significant for GUI aficionados, too. Just a few minutes with 5.0 will convince you it's the wave of the future. It has impressive memory management facilities that allow you to load DOS itself into high memory on 286 and 386 machines and load device drivers and TSRs into high memory on 386 computers. When you're running a DOS application from *Windows* or *GeoWorks Ensemble*, you'll have more room for your programs. Programmers will be glad to find that an interpreter-only version of *Microsoft QuickBASIC* has replaced *GW-BASIC*. *EDLIN* is superseded by *EDIT*, an excellent text editor with pull-down menus and full mouse support. MS-DOS 5.0's *DIR* command comes with an array of switches that allow you to display directory information in almost any shape or form. *DOSKEY*, a new command line retriever, stores your most recently used commands in a buffer for quick recall. This kind of program is necessary for extensive command line work, and it's great that DOS finally has it. MS-DOS 5.0 is very impressive. No matter which GUI you're running, 5.0 will give it more elbow room and make the time you spend at the command line more pro-

ductive and enjoyable.
CLIFTON KARNES

Utility

Stacker

Until recently, a larger hard disk was the only way to garner more magnetic real estate. But *Stacker*, a hardware-software combo from *Stac Electronics*, changes all that. With it, you can literally double the capacity of your hard disk without paying a performance penalty. When you want to write something to disk, *Stacker* compresses the data before it's written. When you need to access the data again, *Stacker* decompresses the information and sends it to you. *Stacker* works flawlessly and nearly transparently. On a 60MB disk, *Stacker* took about 25 minutes to compress 50MB of files. When the installation

was finished, I had a 120MB hard disk with about 70MB free. Not bad. I ran a large number of benchmarks comparing my *Stacker* and non-*Stacker* volumes and found some surprising results. Using a set of database benchmarks that read and write sequential and random records, I found overall performance of *Stacker* and non-*Stacker* volumes using the coprocessor to be nearly identical. When reading and writing sequential information, *Stacker* is faster than my native hard disk. When reading and writing random information, it is slower.

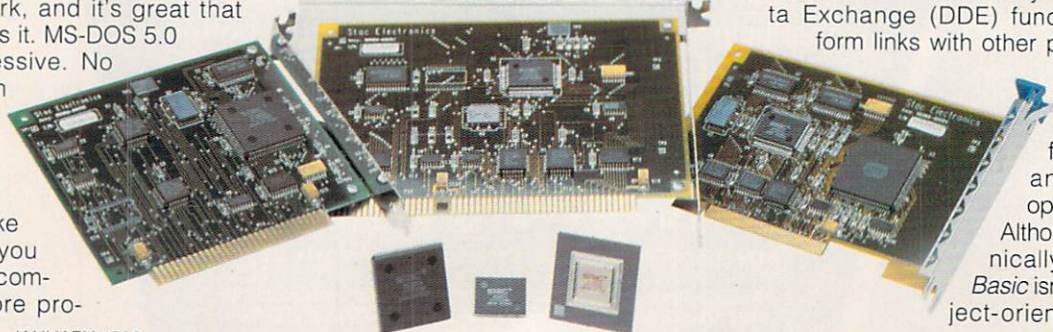
CLIFTON KARNES

Programming Language

Visual Basic

Until now writing software for *Windows* was difficult, to say the least. With the introduction of *Visual Basic*, Microsoft has made it easy for anyone with *BASIC* programming experience to create software for *Windows 3.0*. An interactive tutorial takes you through the first phases of programming, and lots of examples make learning quick and simple. *Visual Basic* can create *EXE* files, unlike *ToolBook* or other comparable authoring systems. Since any *Visual Basic* program uses all the *Windows 3.0* facilities, you don't have to worry about printer or display availability. You can also use the *Windows Dynamic Data Exchange (DDE)* functions to form links with other programs or call on *Clipboard* for cut-and-paste operations. Although technically *Visual Basic* isn't an object-oriented lan-

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guage, it does deal with objects. For example, the familiar old PRINT command must be preceded by the name of the object. To print to the printer, the command Printer.Print is used. To print to a text box object, the command would be Text1.Print. It's easy to get used to this new syntax, however.

GEORGE CAMPBELL

Best Personal Computer

Tandy MPC

First off the starting block to move PC-compatible multimedia into the home is Tandy, which introduced its exciting Tandy MPC (for Multimedia Personal Computer) at the end of September 1991. The computer meets all of the requirements of the multimedia standards. The lowest priced MPC, offering a 16-MHz 386SX processor, 2MB of RAM, and a 40MB hard disk, is only \$2,799. MPC is more than a single machine, however. Besides this attractive entry-level product, Tandy's new MPC computers range all the way up to a 33-MHz 386DX with 4MB of RAM and a

105MB hard disk for \$5,499.

Each of the machines is shipped with MS-DOS 5.0, *Windows with Multimedia*, Tandy CDR-1000 CD-ROM, an advanced sound board, and either VGA or Super VGA graphics. Tandy is also offering upgrade kits with either internal or external CD-ROM drives that will allow basic PCs to become multimedia PCs. If multimedia is the wave of the future, Tandy has a lock on it as a founding member of the Multimedia PC Marketing Council. With its broad support and marketing savvy, Tandy is perfectly positioned to make its MPC-computer the multimedia platform of choice.

ROBERT BIXBY



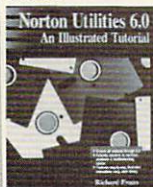
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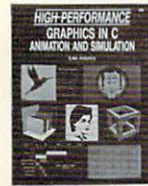
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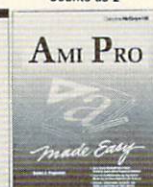
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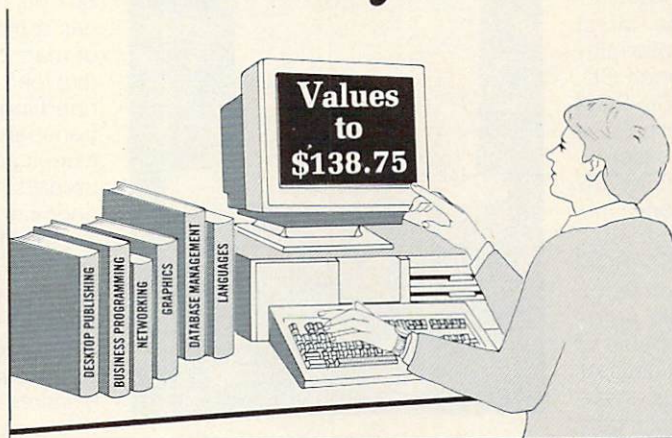
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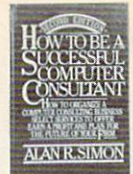


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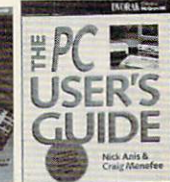
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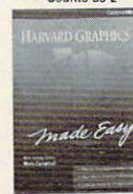
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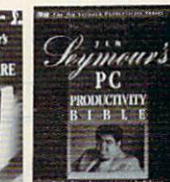
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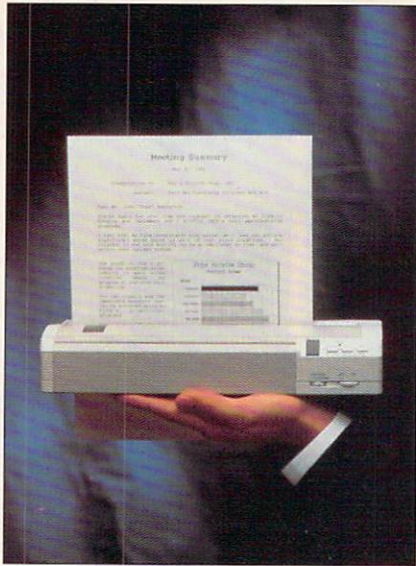
Best Peripheral

Laser Library

The year 1992 might well be the year of the CD-ROM, as consumer electronics companies and computer manufacturers rush to embrace the latest means of information and entertainment presentation—the five-inch CD. There is no better sign that CD-ROM has arrived than the introduction of a CD-ROM system—the Sony Laser Library—designed for consumers by the consumer electronics giant Sony.

This system has everything you'll need to enter the world of CD-ROM from your PC. And if you do move on to *Windows*-based multimedia products in the future, it's quite capable of meeting the basic specifications. At the heart of the Laser Library is an external Sony CD-ROM drive, a solid performer that meets all current demands for CD-ROM use. If you're contemplating adding a CD-ROM drive to your home computer system, you'll have plenty of models and types to choose from this year. The Sony Laser Library isn't the least expensive, but its superior design and engineering, menu interface, easy installation, and high-quality CD-ROM applications provide solid value for your investment.

PETER SCISCO



Citizen PN48 Notebook Printer

Best Printer

Citizen PN48 Notebook Printer

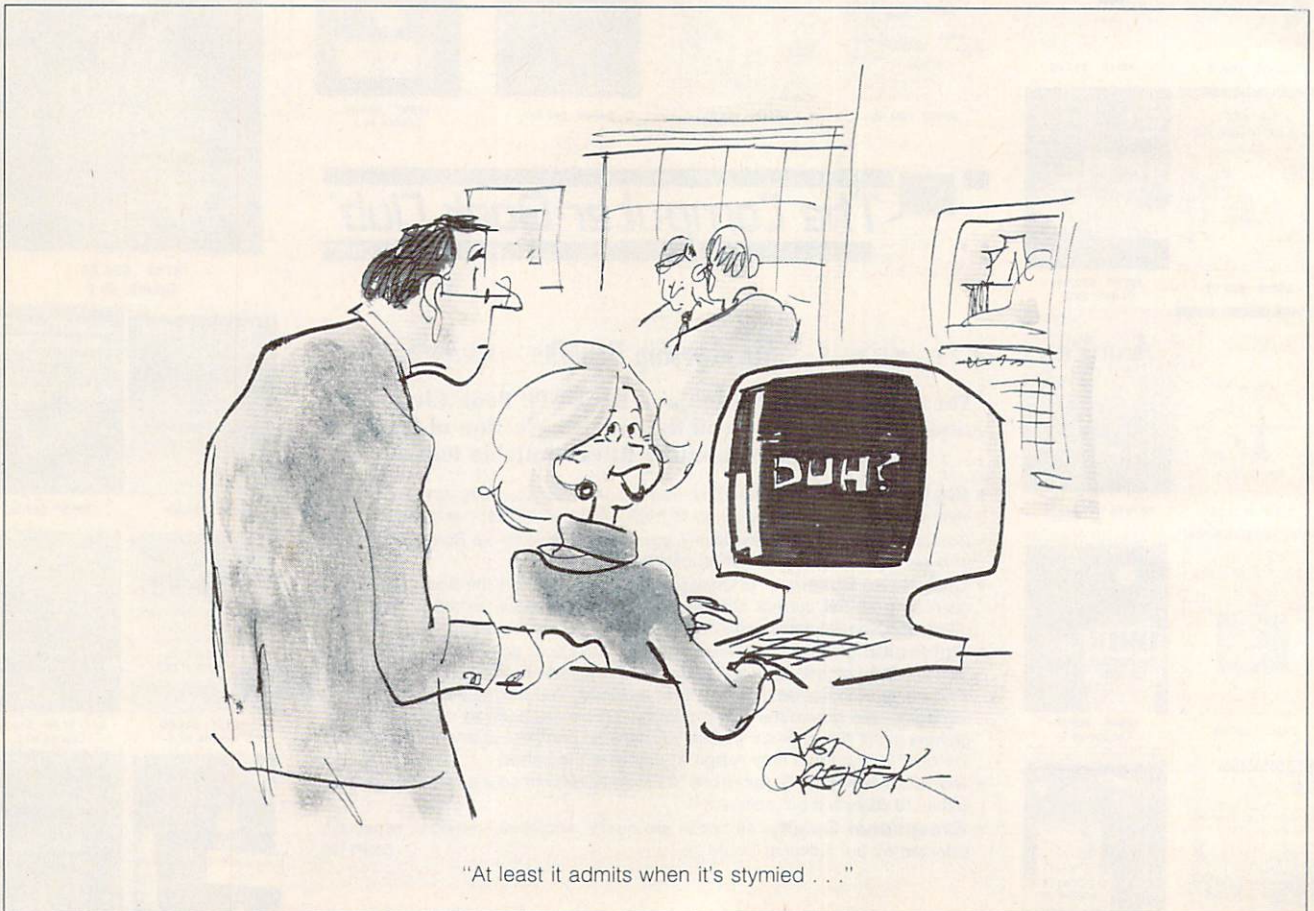
For printing on the go, Citizen's tiny PN48 Professional notebook printer will do the job and do it well. Touted as the world's smallest laser quality printer, it's small enough and light enough (only 2½ pounds, including the battery pack) to carry in a briefcase with a laptop PC. It will quietly print just about any-

thing—envelopes, stationery, labels, transparencies.

There's no compromise on features, either. The PN48 uses thermal fusion printing for laser quality at a speed of 80 cps, or about a page per minute. It has a friction-feed lever for automatic or manual paper loading, and the bottom feed allows straight-through paper handling for envelopes, labels, and transparencies. The control panel includes an LED display of the print status and a menu selection button for choosing customized print settings. These settings include Roman and Courier fonts; from 2.8 to 20 characters per inch (cpi) or proportional spacing; and a variety of typestyles (bold, italic, outline, shadow, underline, emphasized, superscript, and subscript, in any combination).

You can choose between form-feed or line-space paper adjustment to begin printing anywhere on a page, and darkness and contrast can be adjusted for printing on different paper widths. A rechargeable ni-cad battery pack gives about 25 pages of printing per charge and can take as little as three hours to recharge. When plugged into a power source, the PN48 Notebook Printer will recharge the battery while you print.

JILL CHAMPION



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Darklands™

Heroic Adventures in Medieval Germany

TEST LAB

Scanners have won their rightful place on the desktop. Publishers no longer have to make do with clip art from third parties, artists are able to transfer their work instantly to electronic formats, and writers can import text from printed sources almost as easily as cutting and pasting it from another application.

The strong demand for low-cost scanning alternatives has resulted in a crowded field of manufacturers and marketers, each trying to outdo the rest by offering convenience and high-powered applications as premiums with the purchase of a hand scanner.

This month's Test Lab covers hand scanners with a focus on graphics. Today's scanner manufacturers offer a wide variety of prices, capabilities, and bundles. Some might include low-cost DOS software; others take advantage of the *Windows* environment. Some scanners even work with OCR (Optical Character Recognition) software. If you see a package here that looks attractive, check with the manufacturer for additional options.

Few peripheral devices place such heavy processing demands on a personal computer as scanners do, and you may discover that installation is not as simple as slipping in a card. Editors found themselves reading installation manuals carefully (for some it was the first time they'd ever had to read one), trying *Windows* in different modes, editing PIF files, and in one case, trying different computers to make their scanners operate properly. Although scanners are, in the main, user-friendly after installation, more work needs to be done to make them easier to install. Fortunately, most scanners come with free technical support and friendly, helpful support personnel.

Whether you're a teacher, an artist, a writer, or a desktop publisher, if you're in the market for a hand scanner, you've never had more choices or lower costs.

THE COMPLETE PC
1983 Concourse Dr.
San Jose, CA 95131
(800) 229-1753
List price: \$349
Warranty: 2 years, replace or repair

THE COMPLETE HALF-PAGE SCANNER/GS

Steady-handed I'm definitely not, as the family photo album will clearly show. However, I found that the Complete Half-Page Scanner/GS offers smooth, dependable scanning—and up to 256 shades of gray.

I approached this product evaluation with a combination of eager anticipation and trepidation. On the one hand, I was eager to see how this unimposing device could scan line art for a newsletter or photos for a family history. On the other, I had struggled enough with interrupt and address conflicts to know that I could be letting myself in for some tedious tinkering with DIP switches, jumpers, and software settings. The installation proved to be reasonably easy—default settings worked on one computer but not on another.

This scanner comes with its own special version of *Image-In*, a *Windows* program used for both image scanning and image enhancement. Unfortunately, my first attempts at scanning with this product left members of my family looking like the Coneheads, owing to an intermittent blurring effect. Line art I scanned also came out with odd intermittent blurs or "garbage." Some experimenting with *Windows* settings revealed that this odd effect occurred on my computer only with *Windows* operating in Standard and Enhanced modes. Running the program in Real mode solved the problem, and my family looked as normal as possible—



at least without any appearance of cranial abnormalities.

In combination with the *Image-In* software, this scanner gives you a number of attractive features. You can scan images with resolutions up to 400 dots per inch or with up to 256 shades of gray, adjust brightness, and manipulate the scanned image in a number of ways. Edit the gray-map; enhance edges; and sharpen, blur, rotate, or flip the image. You can save your scanned images in a number of popular formats, including PCX, TIFF, BMP, and PostScript EPS.

The scanner itself performed well. I found the design comfortable and the controls workable. In addition to the button that initiates the scan, the scanner includes a brightness control, a gray-levels switch, and a resolution switch. For optimal scanning, the resolution and gray levels must be set in concert: To scan at 256 gray scales required that the scanner be set for 100 dpi; to scan at 16 gray scales, 200 dpi; and to scan in monochrome, 300 or 400 dpi.

I found the documentation very good for the most part, offering helpful illustrations, tips, coverage of the available features, and even a short course. Particularly useful to me were the examples of images modified with the program's various features. A section devoted to troubleshooting

would be a welcome addition to the next version of the program.

As I managed to use the scanner only in Real mode with my PC, I found it a disadvantage to move from *Image-In* to a program like *WinRix*, which requires Enhanced mode. However, I can live with this limitation, and the folks at The Complete PC assure me that this package is designed to work in Enhanced mode.

The smooth operation, numerous software features, and reliability of The Complete Half-Page Scanner/GS make up for the limitations I experienced. And as I'm not involved in heavy-duty desktop publishing, the price and features suit me well and make this an attractive package.

MIKE HUDNALL

Circle Reader Service Number 301

DFI CHS-4000 COLOR HANDY SCANNER

Are you an aspiring desktop publisher looking for color scanning capabilities, but you don't want to shell out a pile of money for a color flatbed scanner? Take heart. The CHS-4000 Color Handy Scanner from DFI offers full-color desktop scanning capabilities as well as superb black-and-white scanning. It's easy to use and flexible in its operation.

Installation of this scanner is reasonably uncomplicated. The Handy Scanner's bus board plugs into an empty 16-bit slot in your PC. Attach the scanner to the board, and then use the scanner's *Exerciser* software to scan images and save them in PCX format. The *Exerciser* program is bare-bones—a simple menu with options for setting the scan mode, vertical and horizontal resolutions, brightness, hue, contrast, dither pattern, gamma correction, and display mode (monochrome, EGA, or VGA). You can

also save and load PCX files from the menu, as well as start your scan.

Although very simple compared with full-blown imaging software, the *Exerciser* software will let you get started with your Handy Scanner right away. And because you can save your files as PCX files, you can import them later into most desktop publishing and illustration programs or convert them to different file formats like TIFF or EPS.

In addition, the Handy Scanner package includes a copy of *PC Paintbrush IV Plus*, which you can use instead of the scanner's *Exercise* program; however, you should be aware that *PC Paintbrush IV Plus* requires an expanded memory driver to work properly. If you're running extended memory in a 386-class PC, you can create expanded memory support by using the EMM386.SYS driver from your DOS directory.

Other system requirements include one megabyte of memory and four megabytes of available hard disk space. You should also have a VGA display capable of 256 colors at 640 x 400 resolution to view the results.

With practice and patience, you'll soon be producing high-quality color scans with the Handy Scanner. The unit itself provides plenty of constructive feedback during operation through its use of LED indicators. And though the software is without frills, it's suitable for grabbing images that can later be enhanced.

PETER SCISCO

Circle Reader Service Number 302

DFI
2544 Port St.
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(916) 568-1234
List price: \$695
Warranty: 1 year, replace or repair

NASA PHOTOS ONLINE

NASA has supplied COMPUTE with some pretty spectacular photos, which have been scanned so that you can see them online and download them if you like. Simply log on to COMPUTE/NET on America Online or GENie. You'll see just how well a scanner can perform. We've uploaded tons of Super VGA NASA pictures. There's also a shareware viewing program called *VPIC*. When you download these files to take a look, you'll be surprised at their quality, and you might decide to go ahead and get a scanner after all. To find COMPUTE/NET, just log on to America Online or GENie and use the keyword *COMPUTE*.

To capture the pictures and convert them to GIF files, we used a Howtek color flatbed scanner. It's a terrific piece of hardware that helped us get professional results.

KYE GENISCAN GS-B105G PLUS

Take a quick image-grabbing safari with the GS-B105G, stalking new *Windows* wallpaper or newspaper articles for the family newsletter. You'll see the merits of a multipurpose scanner.

The GS-B105G scanner will scan in resolutions from 100 to 400 dpi, and in the self-explanatory modes of black-and-white, low dither, high dither, and VGA-



TEST LAB



KYE INTERNATIONAL
2605 E. Cedar St.
Ontario, CA 91761
(714) 923-3510
List price: \$399
Warranty: 1 year, parts and labor

true 256 gray scale. You adjust these settings via switches on either side of the scanner. A thumb wheel controls contrast, and an astutely placed start button rounds out the physical controls.

Manipulating images couldn't be simpler, using the included *iPhoto* software. This *Windows* application concentrates on processing your raw data through a number of filters. Although color or black-and-white photographs already scan with remarkable clarity and speed thanks to the hardware when set for 256 gray scale, you reserve the right to enhance, average, sharpen, or blur your scanned image. These effects turn your PC into a photo-processing lab.

Most people don't run *Windows* under true 256-color mode for the sake of speed. To see fair reproductions of your stunning full-gray images, convert them to 16-color BMP files with *iPhoto*. A nifty *iPhoto* option makes the step down in quality less noticeable with choices of gray, pseudo color, and fire-light (red and yellow scale) remapped palettes. Toy with the Hue and Saturation sliders to tweak the colors into acceptability.

You'll find a second scanning program—a gray-scale version of *Color Maestro*—bundled with the GS-B105G. This software offers more features common to paint programs and doesn't require *Windows* to run. I found *Color Maestro* less satisfactory, though, because of its extreme slowness and constant disk accessing.

How many times have you found yourself with only hardcop-

ies of a document after a terrible hard-drive crash? Install the included optical character reader (OCR) software, *CAT OCR*, and replace your files with a few passes of the GS-B105G. Output your OCR work in *WordStar*, *WordPerfect*, and ASCII formats. If *CAT OCR*'s reasonably effective reference font doesn't meet your standards for speed or accuracy, you can build your own specialized font-recognition library. This process takes only minutes.

Windows veterans will need the concise manuals only for advanced work; neophytes will be scanning everything in sight just moments after a cursory reading. A marvel of simplicity and winning design, the speedy GS-B105G software and hardware bundle makes scanning as effortless as using a mouse.

DAVID SEARS

Circle Reader Service Number 303

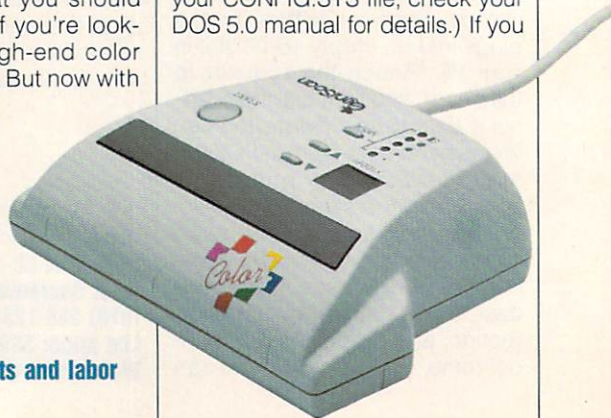
KYE GENISCAN GS-C105 PLUS

Does anyone really need a color hand scanner? A year or two ago, I would've said that you should consider one only if you're looking to dabble in high-end color desktop publishing. But now with

Windows and multimedia playing a larger part in our software lives and high-resolution monitors multiplying like rabbits, we have more ways than ever to use scanned color images.

KYE International offers two inexpensive color-hand scanner packages that let you enter the age of color without having to take out a second mortgage on your house. The \$649 GS-C105 package includes a 256-color hand scanner, the DOS-based *Color Maestro* program, and an interface card. The GS-C105 Plus package costs just \$50 more and adds two programs: *CAT OCR* for OCR text scanning and the *Windows*-based *iPhoto* for sophisticated gray-scale and color image manipulation (including support for 24-bit display adapters). While only a masochist would want to do a lot of OCR work with a graphics-based hand scanner, *iPhoto* adds extra file formats, editing tools, and image-processing capabilities that you might want to take advantage of.

But be warned—you must have expanded memory (also known as EMS or LIM memory) in order to perform 256-color scans. If you don't have expanded memory but you do have DOS 5.0, you can use DOS's built-in expanded memory manager, EMM386, to convert your extended memory to expanded memory. (Put a RAM switch after DEVICE=C:\DOS\EMM386.EXE in your CONFIG.SYS file; check your DOS 5.0 manual for details.) If you



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Warranty: 1 year, parts and labor



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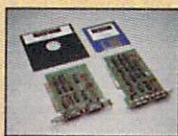
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don't have DOS 5.0, you can use *QEMM-386*, *386Max*, *BlueMax*, *Turbo EMS*, or another expanded memory manager to convert your extended memory to expanded. Without expanded memory, you'll only be able to capture 2- and 16-color images. In addition, *Color Maestro* supports many of the higher-resolution modes of the popular Super VGA cards, and *iPhoto* supports any resolution that's supported by *Windows*.

Despite uneven documentation and the occasional software glitch, the GeniScan GS-C105 Plus will reward the patient user with excellent-quality color images. For frequent use, consider a \$1,200-\$2,000 flatbed color scanner. But for occasional use and a relatively inexpensive introduction to color scanning, take a good look at either of KYE's color-scanner bundles.

DAVID ENGLISH

Circle Reader Service Number 304

LOGITECH SCANMAN MODEL 256

Plug a scanner into your computer, and you plug into a whole new level of versatility. I've had no regrets since hooking up a

LOGITECH
6505 Kaiser Dr.
Fremont, CA 94555
(510) 795-8500
List price: \$449
Warranty: limited lifetime hardware warranty

Logitech ScanMan Model 256 gray-scale scanner as part of a desktop publishing setup.

Scanning materials for publication is not easy, but Logitech's scanner sports excellent controls and includes *Ansel*, an outstanding image editor.

ScanMan installs easily, with the only stumbling block being possible conflicts with I/O base addresses and IRQs. The ScanMan adapter board fits in either an 8-bit or a 16-bit slot, but using the latter is preferred because it permits the ScanMan to use IRQ 11 or 12. This ensures you'll avoid conflicts with mouse and COM ports, but if trouble arises, you'll find plenty of help in the manual.

Once you have installed the system, fire up *Windows*, run *Ansel*, calibrate your scanner, and start scanning.

Scanner controls include a resolution switch, to select resolu-



tions ranging from 100 to 400 dpi; an image mode switch, to choose either black-and-white mode or 16-, 64-, or 256-gray-scale modes; and a contrast dial, to minimize problems in your original. ScanMan also includes a scan speed indicator to help you avoid losing data by scanning too fast.

Working with black-and-white line art is less difficult than working with gray-scale images, but the image-editing software provides excellent tools for both.

Once an image is scanned, *Ansel* permits you to enlarge the image and modify it pixel by pixel. A black-and-white logo scanned for use in a newsletter or brochure cleans up nicely with *Ansel*.

Ansel also allows you to rotate, flip, and crop images; and the software includes a "deskew" option that helps you straighten an imperfectly scanned image. Gray-scale images can be lightened, darkened, sharpened, smoothed, or equalized. By working with a combination of these tools, you can produce images that look beautiful—on your computer monitor. Transferring these images to the printed page with satisfactory contrast and clarity takes experimentation.

Printing controls are extensive. If your printer allows it, you can print the gray scales, or you have the option of using dithering or error diffusion to simulate gray shades. You have full control over output size, and you can select from a series of borders if you'd like your artwork framed.

A HAND-HELD SCANNER FOR TEXT

Typist is the hand scanner from Caere, the OCR people. It's designed for entering short sections of text from printed sources. When I used it, Typist was somewhat slower than Caere's claim of 250 words per minute on a 386SX-based PC but still much faster than typing. Typist can scan line art and 256 gray scales as well as read text in any of four directions. You can set the direction for it to read, or you can leave it to Typist to determine which direction is best. In column text you can set the OCR to pay attention to only the first, middle, or last column of text. Typist can scan a wide page of text in a series of horizontal bands, detect the overlap, and zip the text together.

Typist requires 4MB of memory because OCR work is incredibly difficult. Typist, like almost every other OCR system, stumbles when it runs across italic text (or any other unusual type style). It can't make out one italic letter in ten, which is not intended as a knock against Typist—it's practically an industry standard. Likewise, a contrast setting that is too dark or too light will result in a bad reading. There's little chance of experiencing problems from a crooked scan because Typist's head is outfitted with wide rubber rollers that keep your scans straight.

—ROBERT BIXBY

Circle Reader Service Number 311

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Exporting to other applications is easily accomplished. Files can be saved in TIFF, EPS, PCX, and BMP formats. In saving your files, you can control the resulting document's dpi and image size.

Although ScanMan's scanning window is only four inches wide, larger documents can be accommodated using *Ansel's* stitch feature, which permits you to scan items in segments and match the segments up onscreen. It's not easy, but with a steady hand and some practice, you can put together seamless images.

The ScanMan 256 gray-scale scanner hardware/software combination is a solid value and a worthy desktop publishing tool.

TONY ROBERTS

Circle Reader Service Number 305

MARSTEK M-800W

For black-and-white scanning, this Marstek model provides adequate, if not exceptional, capabilities. It boasts several good features, such as easy installation and sound software support. But those features must be balanced against weak documentation and unimpressive use of the *Windows* environment.

The M-800W will scan at 800-dpi resolution, an impressive capability for desktop publishers and others looking for high-quality images to enhance their documents and publications. The size

MARSTEK
17795 Skypark Blvd., #F
Irvine, CA 92714
(714) 833-7740
List price: \$299
Warranty: 1 year, parts and labor

of the image to be scanned is limited by your computer's memory—I recommend at least four megabytes of system memory. If you run an expanded memory driver, the size of the images can be somewhat larger than if you're running extended memory.

Other system requirements include *Windows*, but here, too, there are limits. You can run the scanner software only in Real or Standard mode, which defeats the purpose of a multitasking environment (unless you limit yourself to running only *Windows* applications—perhaps a possibility for desktop publishers who might live exclusively in the *Windows* environment).

Although the installation process is rather straightforward (insert a bus card into your computer, plug the scanner into the card, and then install the *Image-In* software), the overall documentation isn't nearly clear or complete enough.

The manual covering the hardware runs a brief seven pages. There is no troubleshooting section, nor is there any clear indication of how interrupts or DMA conflicts are to be resolved. I experienced parity errors on my system until I managed to reconfigure the hardware by trial and error—not exactly the way you want to ap-

MIGRAPH
200 S. 333 St., Ste. 220
Federal Way, WA 98003
(206) 838-4677
List price: \$895
Warranty: 6 months, repair or replace (hardware)

proach a problem involving high-tech hardware such as a hand scanner. The *Image-In* software documentation is little better, apparently having been either translated or written outside of the United States.

As for performance, the M-800W produces well-defined black-and-white halftones from color originals and produces very good images of line art. The scanner also can import text, provided you have software like *Perceive Personal*, available from Marstek for \$695 (a coupon included with the M-800W allows you to purchase the OCR software for \$129).

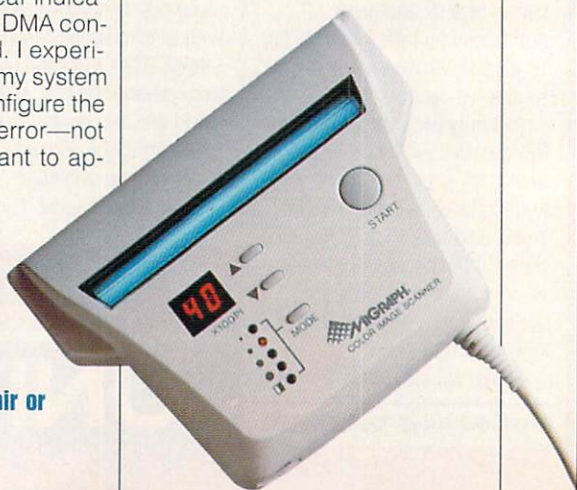
If you don't require a top-of-the-line scanner for your black-and-white images or line art or if your budget excludes the top-end scanners from your system, the Marstek M-800W may suit your needs. You'll have to live within some limitations, but if you can accept the boundaries, this scanner will expand your graphic horizons.

PETER SCISCO

Circle Reader Service Number 306

MIGRAPH CS-4096

Are you looking for great color capabilities in a hand-held scanner? Migraph's color scanner goes so far above and beyond what most hand scanner users would want or need, delivering a 4096-color scan at 200 dpi (fixed), that it's a



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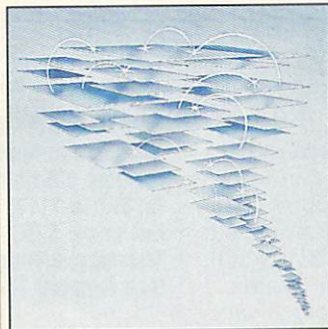
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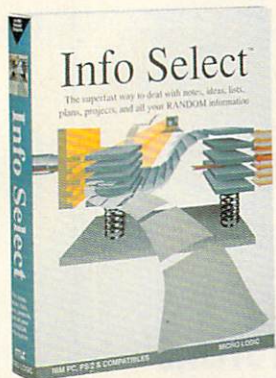
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little disappointing to discover that the second-best scan is 8 colors at 400 dpi (you can set the scanner to any multiple of 10 dpi between 100 and 400 for all scan levels but the 4096-color scan).

This 8-color scan is called color line art. The scanner is capable of scanning monochrome line art, also. There are settings for color and monochrome dithered graphics as well, but these didn't work properly on my machine, and technical support was at a loss to speculate as to why. The 4096-color images can be saved as 256-color images to save some space.

The software that accepts and displays the scanned image is a very simple *Windows* program that does little more than give you access to the necessary software settings for the different levels of scanning. You can set resolution and adjust your color settings to make the scanned image more realistic.

The scanner is shipped with *Picture Publisher*, which used to be published by Astral but is now a Micrografx program. Unfortunately, drivers are not available that would allow the scanner to scan directly into *Picture Publisher*. In order to transfer the image between the two programs, you

SCANNING FORMATS

Many of the file formats used to store scanned information are raster formats. These include PCX (used in *PC Paintbrush*), BMP (used in *Windows* wallpaper), and TIFF (Tagged Information File Format). A raster format maps out, or codes, the dots of an image. Sometimes it's also called a bitmap format. A vector format, on the other hand, describes an image not in terms of dots but in terms of mathematical-shape descriptions. Some of the vector formats are CGM (*Harvard Graphics*, *Lotus Freelance*, *Pixie*), PostScript (actually a language), and WPG (*WordPerfect*—these files can be either raster or vector).

MOUSE SYSTEMS
47505 Seabridge Dr.
Fremont, CA 94538
(510) 656-1117
List price: \$795
Warranty: 2 years (lifetime
tech support)

must store it on disk or transfer it via the *Clipboard* (*Picture Publisher* is also a *Windows* program). I found this to be a terrific bother and was often presented with insufficient memory and insufficient disk space messages while trying to effect the transfer. The CS-4096 also ships with *ImagePrep*, a screen-capture, file-conversion and -compression, and image-processing program.

The CS-4096 blinks its lights if you scan too rapidly. This is one enhancement I'd like to see added to all hand scanners. Most give so little feedback that hand scanning is pure trial and error. The installation is simple and straightforward, and (though this experience may be unique to me) for once I didn't have to change jumpers to make a board work. Somehow Migraph had set the jumpers to work perfectly with the IRQs and DMAs in even my fully packed computer.

The principal use of this scanner (particularly its 4096-color scan) would be preparing images and backgrounds for presentations on the computer screen. The lesser levels are useful and provided clear images, but the software used to capture these images can be cumbersome, and you must use more than one software package to create things like 256 gray scales. By the time you read this, the product will probably be shipping with the new, award-winning version of *Picture Publisher*. I hope that a driver will also be available that will capture images into that program so that they will be immediately useful.

ROBERT BIXBY

Circle Reader Service Number 307



MOUSE SYSTEMS PAGEBRUSH/COLOR

The PageBrush/Color hand scanner puts full-color desktop scanning within reach of PC publishers and desktop graphic artists. Supporting both 24-bit color scanning and 8-bit black-and-white scanning, this unit proves itself both versatile and easy to operate.

Installation consists of plugging a bus board into an empty 16-bit slot in your PC. Attach the scanner to the board; then install the *ImageQuest* scanner software. Using the PageBrush/Color requires *Windows 3.0*, which simplifies the installation process. Other system requirements include one megabyte of memory, a VGA display capable of 256 colors at 640 x 400 resolution (for best results, your video board should have a *Windows* driver, and *Windows* should be set to 256-color mode), and a hard disk with a minimum of four megabytes of free space.

An LED indicating the scanner's resolution flashes when the scanner is activated. It stops flashing when the scanner is warmed up.

Welcome feedback is supplied as you operate this device. If you happen to move the scanner too quickly, the top Mode light blinks. The light will go off if you have lost any part of the image data because of unsure or too-quick movements. If this happens, you'll have to begin the scanning process again.

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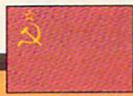
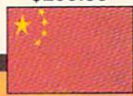
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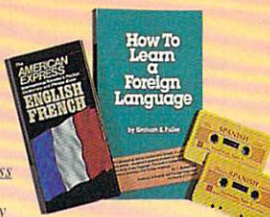
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If you create a black-and-white scan, you can select from five levels of resolution—from pure black-and-white and four modes of dithered gray scales. Experimenting with the setting will let you translate color images into clear black-and-white images for simple desktop publishing chores. Color images are scanned in 12-bit color, which can be saved as 24- or 12-bit color or TIFF files or as MAC files.

Effective image capture and processing requires not just a good scanner and software but also flexibility in processing the scanned images. To that end, Mouse Systems includes a copy of *ImagePrep* from Computer Presentations with the PageBrush/Color scanner. This software package allows you to process your images professionally. Using *ImagePrep* in conjunction with the scanning software allows you to enhance and fine-tune scanned images and save those images in a variety of formats—including EPS, PCX, CPI, TIFF, and others.

The PageBrush/Color scanner produces adequate scanned images for use in a variety of applications. Its ease-of-use is enhanced by solid image-processing software. With practice, you can soon be creating full-color images for business presentations, desktop publishing, graphic illustration, or multimedia applications.

PETER SCISCO

Circle Reader Service Number 308

NISCA NISCAN/GS

I had the good fortune to be assigned the NISCAN/GS gray-scale hand scanner for this review. A very workmanlike product, this scanner was comfortable in the hand and generated images of high quality at up to 256 gray scales.

The NISCAN/GS ships with *Image-In*, a software product with which I have had a love-hate relationship for some time. It's ex-

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tremely powerful software that (to me, anyway) seems dedicated to preventing me from doing what I want to do. Although I've worked with it for some time, I still find myself saving images and working with them in another program simply because the other program is easier to use.

This difficulty doesn't extend to the scanning tools in *Image-In*, however. The scanning tools, including a very useful preview window, are designed perfectly to allow you to make settings, capture an image in one of several resolutions, save it, and then work with it in another program. I regret spending so much space talking about the software that accompanies the scanner, but so much of the scanning experience is directly related to the usability of the software that you simply can't ignore it. And this is particularly true of the Nisca product because the scanner has only one control on it: a push button to hold down while actively scanning. Beyond saying that the scanner is comfortable and looks solidly built, there is little to say about the product itself.

Image-In allows you to set the horizontal and vertical resolutions independently, between 100 and 400 dpi, providing for some interesting distortions. It provides for monochrome (purely black-and-white), three different kinds of dithering, and 4- and 8-bit gray-scale scanning (16 and 256 shades of gray, respectively). You can adjust brightness and contrast. The preview was my favorite feature, however. Seeing a



bad scan as it's happening is a great help in learning to hold your hand steady and pull the scanner across the image smoothly and at the right speed.

The software allows you to save the image in several different formats, including PCX, TIFF, Windows bitmap, MacPaint, EPS, Microsoft Paint, EyeStar, and GEM Paint. You can save images at any resolution and at any scaled size. If the file format supports compression, *Image-In* will compress the saved image.

Installation was simple, and I had little trouble operating the NISCAN/GS, thanks to *Image-In*.

ROBERT BIXBY

Circle Reader Service Number 309

SHARP JX-100

Sharp's JX-100 is neither a flatbed scanner nor a hand-held scanner but a marriage of the two, inheriting both strengths and weaknesses in the bargain.

With its 3.93 x 6.29 inch scanning area, the JX-100 almost fills a VGA screen with vibrant 256-

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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TEST LAB

SCANNER OUTPUT TEST PROCEDURES

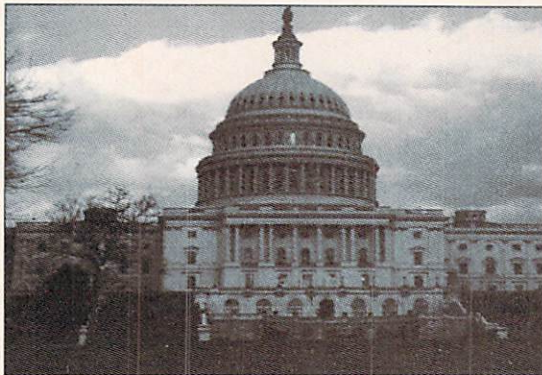
The scanner output samples for both the line-art and the photo images were generated using a setting of 200 dpi (dots per inch). We set light/dark controls on all scanners for the midrange point. For all line-art scans, we used the black-and-white or line-art setting, where available; for all photo scans, we used the photo or gray-scale setting. When storing scanned images, we used PCX files where possible.

Output width was set at five inches for all images to make comparisons equal. The images received no retouching, alteration, or cleanup of any kind—they were outputted exactly as they were scanned. Incomplete or "clipped" images reflect a scanner's maximum capture area at 200 dpi in a single-pass scan.

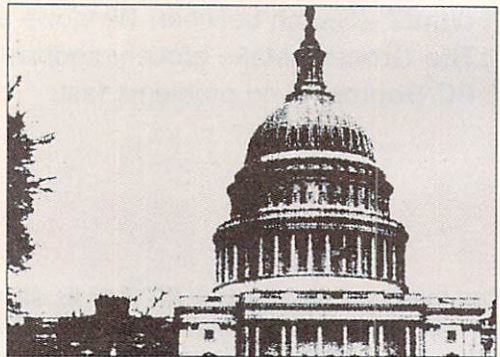
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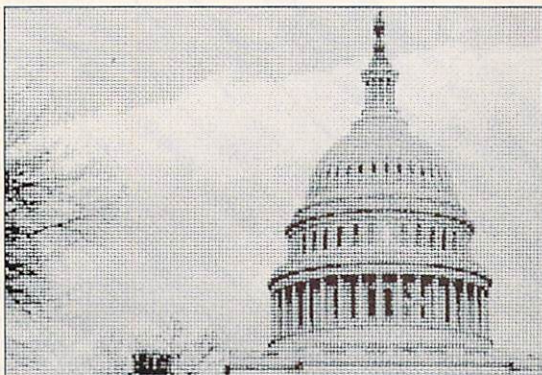
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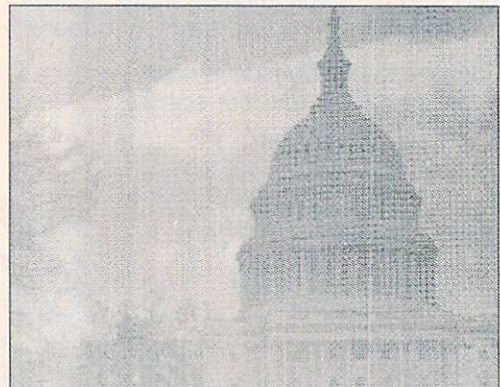
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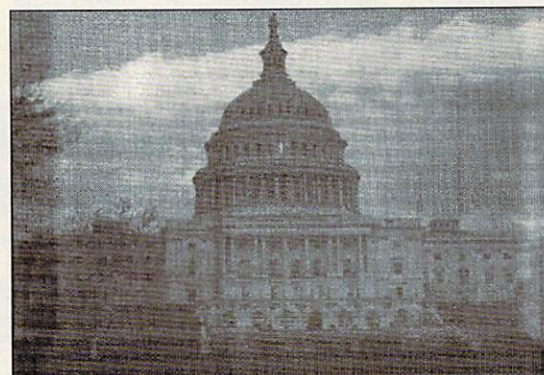
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EQUIPMENT AND MATERIALS USED FOR OUTPUT SAMPLES

To produce the output samples you see here, we used a 25-MHz 80386-DX computer with 4MB of RAM, a 1MB Super VGA video adapter (Tseng chip set), an analog color monitor, and a Microsoft mouse. For image capture, we used the scanning software supplied with each scanner. To ensure accurate and even scanning, we used SCAN:ALIGN from SCAN:ALIGN, Inc.

A cartoon, measuring 4 x 4 inches, of a girl at a computer served as the master image for black-and-white line-art scanning. The source for this image was *Dover Clip Art* from Alde Publishing's *Spectrum* CD-ROM. A borderless color photograph, measuring 3½ x 5 inches, of the nation's Capitol served as the master photo image for gray-scale/halftone scanning.

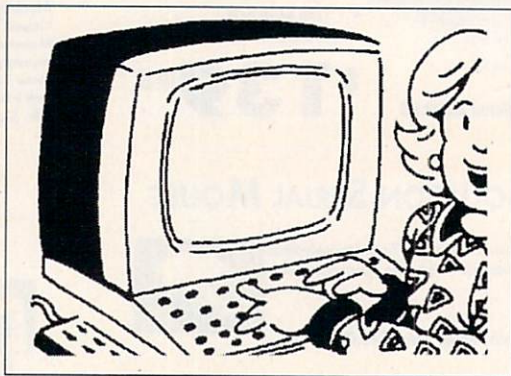
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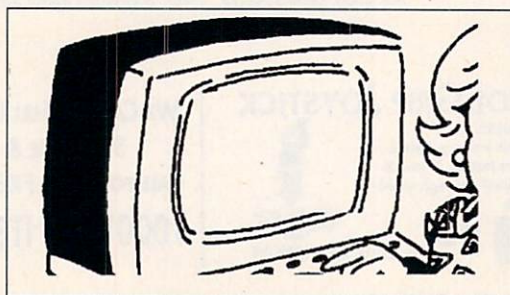
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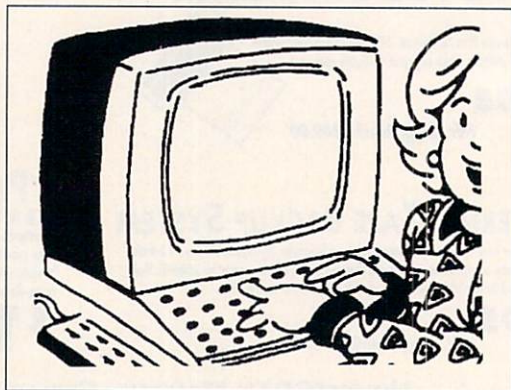
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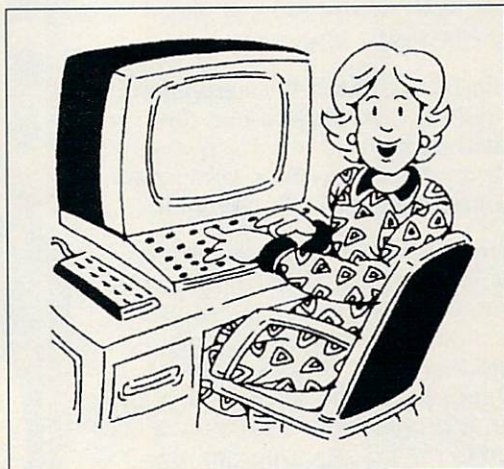
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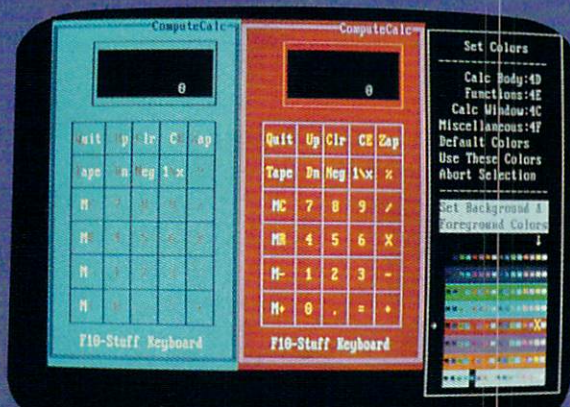
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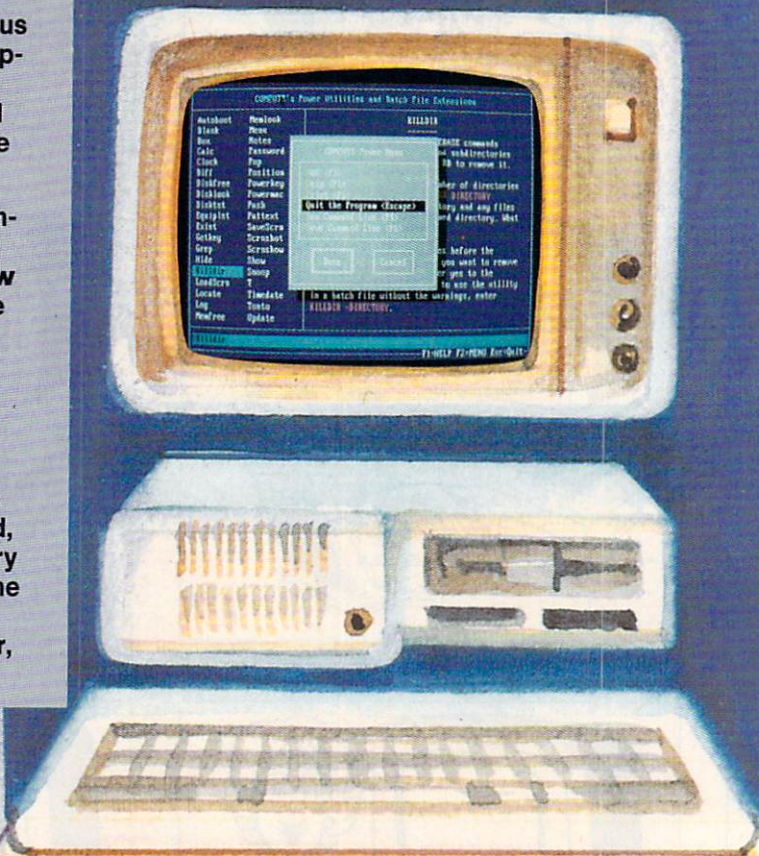
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color after you issue a single command. Like full-size flatbed scanners, the JX-100 requires time to work its magic—sometimes several minutes' and several passes'

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worth. For this reason, you'll want to take advantage of the prescan option that can display the image to be scanned in speedier gray scale or black-and-white. Or better yet, just peer through the transparent acrylic view port in the top of the scanner.

For documents too small or too awkward to comfortably accommodate the scanner, though, you'll need to turn the JX-100 face up and rely on the prescan

mode to position the subject for proper scanning.

Unlike a hand scanner, the JX-100 scans neatly every time. You don't have to drag the scanner over the image, so it's impossible for the scanner to slip and make annoying errors.

This color scanner doesn't take up any of your computer's valuable expansion slots, but if you don't have a PS/2 mouse or an extra serial port, you'll have to do your scanning with no mouse at all—the JX-100 uses a serial port. Thankfully, *ColorLab*, the bundled *Windows*-based scanning software, provides for just such situations with reasonable keyboard support. You might miss using your mouse, but the fun of color scanning offers some compensation.

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DAVID SEARS

Circle Reader Service Number 310

For further information about this month's Test Lab, see the COMPUTE area on GENie and America Online. In addition to regular Test Lab information, you'll find our HDBENCH.EXE, proprietary benchmark software developed especially for the Test Lab.

Next month:
Color
Printers

FURTHER INFORMATION

THE COMPLETE HALF-PAGE SCANNER/GS

Type: black-and-white
Scan width: 4.1 inches
Max dpi: 400
Settings: line art, halftone, gray scale
Max shades of gray: 256
Environment: *Windows*
Output formats: EPS, GEM, MSP, PCX, TIFF

DFI CHS-4000

Type: black-and-white, color
Scan width: 4.13 inches
Max dpi: 400
Settings: gray scale, dithered monochrome
Max shades of gray: 64
Environment: DOS
Output formats: PCX

KYE GENISCAN GS-B105G PLUS

Type: black-and-white
Scan width: 4.0 inches
Max dpi: 400
Settings: line art, halftone, gray scale
Max shades of gray: 256
Environment: DOS
Output formats: CUT, IMG, MSP, PCX, TIFF

KYE GENISCAN GS-C105 PLUS

Type: black-and-white, color
Scan width: 4.13 inches
Max dpi: 400
Settings: halftone, gray scale
Max shades of gray: 64
Platform: DOS
Output formats: CUT, IMG, MSP, PCX, PIC, TIFF, TXT

LOGITECH SCANMAN MODEL 256

Type: black-and-white
Scan width: 4.13 inches
Max dpi: 400
Settings: line art, halftone, gray scale
Max shades of gray: 256
Environment: DOS, *Windows*
Output formats: IMG, PCX, TIFF

MARSTEK M-800W

Type: black-and-white
Scan width: 4.13 inches
Max dpi: 800
Settings: line art, halftone, gray scale
Max shades of gray: 64
Platform: *Windows*
Output formats: IMG, MSP, PCX, PNT, TIFF

MIGRAPH CS-4096

Type: black-and-white, color
Scan width: 4.0 inches
Max dpi: 400
Settings: line art, halftone, gray scale
Max shades of gray: 256
Environment: *Windows*
Output formats: PCX, TIFF

MOUSE SYSTEMS PAGEBRUSH/COLOR

Type: black-and-white, color
Scan width: 4.13 inches
Max dpi: 400
Settings: dithered
Max shades of gray: 64
Environment: *Windows*
Output formats: TIFF

NISCA NISCAN/GS

Type: black-and-white
Scan width: 4.2 inches
Max dpi: 400
Settings: line art, halftone, gray scale
Max shades of gray: 256
Environment: *Windows*
Output formats: EPS, IMG, MSP, PCX, TIFF

SHARP JX-100

Type: black-and-white, color
Scan width: 3.39 inches
Max dpi: 400
Settings: line art, halftone, gray scale
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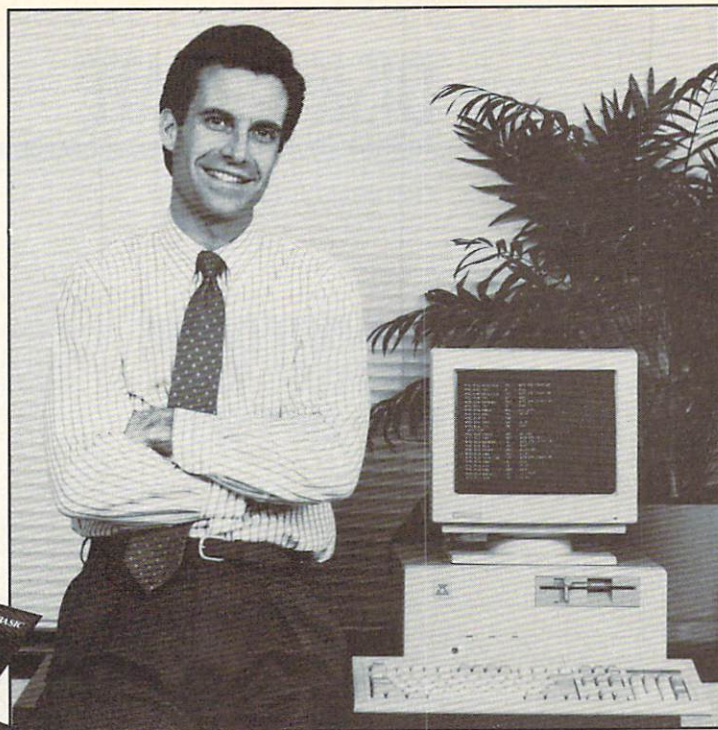
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DISK UPDATE

Richard C. Leinecker

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On the GENie bulletin board, there's a section called Talk to the Editors. Just leave a note with your question or comment, and we'll answer you as soon as possible. You can give feedback to the sysop from the main COMPUTE/NET menu or even send E-mail to RLEINECKER.

On America Online, you can leave a note addressed to screen name Rick CL in the message area called Talk to the Editors. You can also send E-mail addressed to screen name Rick CL.

In your message, be sure to describe the problem thoroughly, tell us your DOS version, and list your computer equipment (CPU, hard drive type, floppy drives, graphics card, and so on).

COMPUTE/NET gives you the flexibility to drop us a line anytime it's convenient for you without having to call our offices during business hours. It's also probably less expensive to contact us online than to call during the day.

The Other Side

We've had some calls about the program *AltPage* that was published on our August *PC Disk*.

The reports we've received indicate that many times the output seems to break pages

at odd times or sometimes not until more than a single page has been printed.

The result might be pages that are short, maybe 20 or 30 lines. Alternately, there might be run-on pages.

All of the programs on the disk were tested carefully, and we never experienced these problems. It took some time, but we eventually re-created the circumstances that led to these situations.

We found that a text file with embedded form feeds would produce short pages in unpredictable patterns.

With other formatting and control codes, we found that there could be run-on pages.

In the documentation, the author explicitly instructs you to remove any formatting and control codes, including form feeds. He even provides a special program called *Strip* that cleans up your text file in preparation for *AltPage*.

If you're experiencing any difficulties similar to these, make sure your text files are clean, straight ASCII files. Running the *Strip* program is a good idea if there's any doubt in your mind.

MicroText Extras

Our August disk has a program called *MicroText* that may not run properly on your system. That's because there are two files the program creates when you first run it that were included on the distribution disks. They should've been left off so that *MicroText* could create them when you first run the program.

The files are *COLORS.DAT* and *PRINTER.DAT*. If you're not having any problems, don't do anything.

If you are having problems, you'll need to delete these files. Make sure you're in the directory that contains the *MicroText* files. If you use the default installation path, it will be

`C:\COMPUTE\AUG91\MICROTXT`. Next, delete the two files named *COLORS.DAT* and *PRINTER.DAT*.

The next time you run *MicroText*, it will prompt you for information it needs to create these files for your system.

CMOS to Floppy

There is a small problem with our *CMOS* menu program if you install the programs to a floppy disk. If you type a drive letter, a colon, and maybe a backslash (for example, `A:\`) when you enter the installation path, you'll get an error message saying that the path could not be created.

The problem is fixed now, but unfortunately, for the August and October disks, you'll have to use a work-around to solve the problem.

Instead of installing to `A:\` or `B:\`, you'll need to specify a directory. You might try `A:\COMPUTE` or `B:\COMPUTE`. Then the program will install to the directory without any problem.

Go Directly to the Source

Here at COMPUTE, we're very happy to help you with any problems you're having with the programs on our *PC Disk*. But there might be a way for you to get faster and more personal service.

You can contact the shareware author directly and cut us out of the loop.

Many times we call the authors to get answers to your questions. While we're glad to do this, something may get lost in the translation.

If you call or write the author, he or she can interact with you directly, and your question might be more effectively answered.

I've written letters to many shareware authors, and they usually respond within a couple of days. They're usually very eager to please. □

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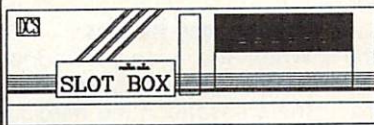
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PROGRAMMING POWER

Tom Campbell

WITH WINDOWS, THE MESSAGE IS THE MEDIUM

I've been involved with *Windows* on and off since before version 1 was released, although not as a programmer until recently. My first encounter was on the technical team of a Macintosh database project that was considering a port. We had a state-of-the-art IBM XT, with a stunning 512K of memory, a giant 10MB hard disk, and the still-acceptable Hercules card for graphics.

The *Windows* development system was everyone's first brush with C, and we were shocked at how crude the programming environment was compared to the Mac's truly elegant Pascal development system. We were also among the very few people even to this day who weren't shocked and dismayed at how complex a programming challenge it was. Yet I've never seen an overview article that described—from a programming standpoint—just how staggering a change *Windows* is compared with DOS.

Messages, Medium Rare

The message is the medium: If you've read it once, you've read it a million times. GUIs are the wave of the future. GUIs, like Macintosh System 7 and *Windows* 3.0, are object oriented. Well, that's not quite true. Let's get some terms straight and cut to the heart of the programming matter while we're at it.

First, remember that there are something like 50 million DOS machines out there. Second, note that while about 4 million copies of *Windows* have been distributed, that doesn't mean they're in daily use. Many of these copies came free with new ma-

chines. Finally, keep in mind that DOS does the job for millions of people and spending \$2,000 to upgrade their machines to the 386SX and four megs that *Windows* requires won't give them a commensurate increase in productivity.

And it might just do the opposite, since those few applications that exist in both DOS and *Windows* incarnations almost always look like completely different programs. That means that retraining poses a time-consuming and expensive problem. Yes, GUIs may be the wave of the future, but for now, DOS is a firmly entrenched standard.

As far as object orientation goes, the press has confused the nearly tangible feel of the user interface (menus, file folders, and so on) with the programming techniques used to write applications for it. This probably goes back to *Smalltalk* (well known as the granddaddy of *Windows*) and the Mac *Finder*, which was indeed both a visually oriented graphical user interface and the archetypal object-oriented programming system.

Learning Curves

Nonetheless, programming and using *Windows* is fun. If you plan to do it in a "real" language such as C, C++, or *Turbo Pascal*, you've got to know up front that you'll spend at least six months becoming familiar with *Windows* programming issues. Maybe even a year.

You could program in *Tool-Book* or *Visual Basic*, but neither of these languages has what it takes to be a complete *Windows* language. If you choose an object-oriented language like *Turbo Pascal* or C++, chances are overwhelming that you'll need to know that language's object paradigms even before you read the *Windows* program-

ming tutorial. You'll also need to spend an extra \$60-\$100 on reference materials, unless you already own the *Microsoft SDK for Windows*.

No other programming system on the market has adequate *Windows* reference documentation. And unless you're either dirt poor or merely self-destructive, you'll need to meet regularly with other *Windows* programmers to learn things you missed in the manuals (or, more likely, that the manuals failed to mention). CompuServe is a good place; plan to spend a minimum of \$50 a month in online time if you join.

Pointers and Handles

When you write a *Windows* program, you must know that the message is the medium, to make the inevitable cheap joke at Marshall McLuhan's expense. Your program, if it's to look like any other program, is seldom in complete control of anything. Instead, it's constantly reacting to messages sent to it by *Windows*, other *Windows* programs, and sometimes even itself.

Your program has to be ready to quit automatically when the user shuts down *Windows*, redraw any of its screens when the user decides to resize the main window, and let go of just about any piece of memory it can get its hands on.

The simple act of writing to a dynamically allocated piece of memory (for example, copying the contents of a string into a buffer) means that you have to lock that piece of memory for only as long as it takes to write the value and then unlock the memory as soon as possible—whereupon the memory manager is free to write that piece of memory temporarily to disk so some other *Windows* program can use it.

Before you start programming in *Windows*, take a deep breath and get ready for a steep learning curve.

Think about the complications arising from doing this to a pointer. A pointer represents a fixed address in RAM. Copying it to a disk file is fine, except that the memory manager has marked it as reusable at this point and a few milliseconds later it could represent something entirely different. Trying to write the pointer now would probably mean a crash.

The fact that memory can be moved and locked this way means that memory is usually allocated as a handle, not a pointer. A pointer points to an address in memory. *Windows* doesn't want you to think of that memory as your own, so handles, which are pointers to pointers, are often used as a way to make life easier for *Windows*.

Handles are easier for *Windows* to swap to disk, but they're alien to the novice *Windows* programmer. If data abstractions in your programming system are handled correctly, as they are in *Turbo Pascal* and in some C++ class libraries, the inconvenience of using handles is limited to a very few instances of direct access to the handles, and instead is bound into procedure calls or macros that do the dirty work.

Messages aren't as easily hidden. Some class libraries, like *Turbo's* brilliant ObjectVision, manage many of them behind the scenes. Others add more messages to the confusion. So will you. Sending yourself a message might come in handy, for example, where pressing a letter key in a spreadsheet-style matrix would begin data entry, whereas most other keys would be ignored. An alphabetic letter message over an empty cell would be preceded by an enter edit mode message, exactly as if you'd double-clicked with the mouse.

Printers and Fonts

One of the nasty rumors spread about *Windows* is that you don't have to worry about making printer and screen images match up anymore. That's hype. *Windows* works with jillions of printers; you could conceivably be using a daisywheel printer as your sole hardcopy device. More typically, your printer probably doesn't come with fonts that match the *Windows* screen fonts.

If the printer does graphics, you can come close to matching, but your program is entirely responsible for getting font widths to match. Usually, thank heavens, all other graphic elements move transparently from screen to hardcopy. But you become responsible for chores that God intended the operating system to handle, not you. *Windows* gives you no assurance that the Helvetica condensed text appearing onscreen will appear condensed or even as Helvetica on the target printer.

If you've created a draw program and the text is situated snugly inside a rectangle onscreen, there is no assurance—unless your program digs deep into the font metrics of both screen and printer—that it'll still be inside when printed. Now, perhaps, you see the reason Apple and Adobe want TrueType to succeed. This isn't just feature creep. Just as much as the tens of thousands of journeyman programmers who flood these companies with plaintive tech support questions regarding mismatched screen and printer fonts, the coders who create the operating environment want to get out of the device driver business.

Windows 1 came with an abundant set of painstakingly crafted printer drivers. It was great! The output from my humble ProPrinter looked as

good as that from the Mac's Imagewriter. Microsoft didn't enjoy writing all those device drivers, though, and decreed with version 2 that they were the responsibility of the hardware manufacturers. (Understandably so. Device drivers for *Windows* are difficult enough that most programmers take the easy way out and make a pact with the devil to shorten development time.) Sure enough, I couldn't even do Helvetica on my ProPrinter when *Windows 2* came out. And sure enough, *Windows 2* went nowhere. Version 3 brought Microsoft back to its roots. Helvetica has finally returned.

Be True to Your Type

By providing an extensive set of font files with *Windows* and System 7 that will allow screen and printer fonts to be generated from the same raw material, these problems will be history. NeXT has been doing it for years now with Display PostScript. Anyone who's used a PostScript printer knows that its speed could be described as glacial on a good day, so how could it come even close to acceptable performance onscreen? Simple. Knowing that the screen (output) resolution is fixed allows the interpreter to omit tons of clipping, error-recovery, and bounds-checking code.

The *Windows* version, TrueType, is said by those in the know to be hauntingly similar to Display PostScript, and it will be licensed to developers for a pittance. What this means to you is that you'll be able to deal with text as cleanly as you now can with graphics and that *Windows* will begin to fulfill its long-overdue promise as a programming system that will actually save you time when writing for a variety of output devices. □

TIPS & TOOLS

Check your serial and parallel ports, send commands directly to your printer, and protect your computer from malicious entry.

Small Can Be Useful

They come in the mail and through COMPUTE/NET on GENie and America Online. Over the past few months I've been inundated with requests for short machine language programs that do simple tasks. I have several ready. One program sets your monitor's border color, two send printer codes, and one lists your input/output ports.

Make sure the DOS program called DEBUG is in your path or the current directory. In these examples, the italic text is what the computer prints; the roman text is what you should type. One way to be sure you get these programs exactly right is to have someone read the numbers to you as you type them in. Another way suggested by one of our readers is to read the numbers into a tape recorder and then play them back as you enter the program code.

The first program changes the screen border color.

DEBUG BORDER.COM

File not found

```
-e 100 be 81 00 2b c9 2b db ac
-e 108 3c 20 74 fb 2c 30 3c 09
-e 110 77 0b 86 c3 b1 0a f6 e1
-e 118 03 d8 ac eb ef b8 01 10
-e 120 8a fb cd 10 b4 4c cd 21
-RCX
CX 0000
:28
-W
Writing 0028 bytes
-Q
```

To use the program, just type BORDER *color*. In place of *color*, type a number from 0 to 15. Check in your GW-BASIC or other BASIC manual for the color codes. If you use the DOS CLS command, it will reset the border to the default color. To get around this, you can create a batch file that first clears the screen and then sets the border color.

Here's what my file called CLEAR.BAT looks like. It would help if the program were in your DOS directory or somewhere else in your path.

```
ECHO OFF
CLS
BORDER 4
```

The next program, FF.COM, sends a form feed to the printer to eject the current sheet of paper. Once again, type the text that's in roman, and the computer will print the text that's in italic.

DEBUG FF.COM

File not found

```
-e 100 be 81 00 2b d2 ac 3c 20
-e 108 74 fb 2c 30 3c 09 77 0b
-e 110 86 c2 b1 0a f6 e1 03 d0
-e 118 ac eb ef b8 0c 00 cd 17
-e 120 b4 4c cd 21
-RCX
CX 0000
:24
-W
Writing 0024 bytes
-Q
```

To use the program, just type FF *printerport*. It will send a form feed to the printer connected to the port you specify. Make sure the printer port has a value between 0 and 2. If you don't specify a printer port, it will output to printer port 0.

The following program is similar, but it sends a linefeed rather than a form feed to the printer port specified.

DEBUG LF.COM

File not found

```
-e 100 be 81 00 2b d2 ac 3c 20
-e 108 74 fb 2c 30 3c 09 77 0b
-e 110 86 c2 b1 0a f6 e1 03 d0
-e 118 ac eb ef b8 0a 00 cd 17
-e 120 b4 4c cd 21
-RCX
CX 0000
:24
-W
Writing 0024 bytes
-Q
```

To use the program, just type LF *printerport*. It will send a linefeed to your printer. Make sure the printer port has a value between 0 and 2. If you don't specify a printer port, it will output to printer port 0.

The next program tells you what ports your computer has available to you.

DEBUG PORTS.COM

File not found

```
-e 100 e4 21 50 2a c0 e6 21 e4
-e 108 21 8a d8 be e8 01 2b c0
-e 110 8e c0 bf 00 04 b7 10 bd
-e 118 04 00 ba de 01 e8 5a 00
-e 120 bf 08 04 b7 80 bd 03 00
-e 128 ba e3 01 e8 4c 00 ba e8
-e 130 01 2b c0 8e c0 26 a1 cc
-e 138 00 26 0b 06 ce 00 0b c0
-e 140 74 29 2b c9 b8 24 00 cd
-e 148 33 0b c9 74 1e ba eb 01
-e 150 0a c9 74 14 80 c1 30 88
-e 158 0e f9 01 80 f9 34 74 06
-e 160 c6 06 f4 01 32 90 eb 03
-e 168 ba fb 01 b4 09 cd 21 ba
-e 170 e8 01 b4 09 cd 21 b4 4c
-e 178 cd 21 8b cd 26 83 3d 00
-e 180 74 42 53 8b da 8b c5 2b
-e 188 c1 04 31 88 47 03 5b b4
-e 190 09 cd 21 84 df 75 25 52
-e 198 ba d7 01 c6 06 dc 01 33
-e 1a0 90 f6 c1 01 75 06 c6 06
-e 1a8 dc 01 34 90 83 fd 03 75
-e 1b0 06 c6 06 dc 01 37 90 b4
-e 1b8 09 cd 21 5a 87 d6 b4 09
-e 1c0 cd 21 87 d6 83 c7 02 83
-e 1c8 fd 04 75 06 80 f7 18 e2
-e 1d0 ab c3 2a ff e2 a6 c3 2d
-e 1d8 49 52 51 20 33 24 43 4f
-e 1e0 4d 31 24 4c 50 54 31 24
-e 1e8 0d 0a 24 4d 6f 75 73 65
-e 1f0 20 43 4f 4d 31 2d 49 52
-e 1f8 51 34 24 50 53 2f 32 20
-e 200 4d 6f 75 73 65 24
-RCX
CX 0000
:106
-W
Writing 0106 bytes
-Q
```

To use the program, just type PORTS. It will show you which serial and parallel ports are installed. It will also tell you which IRQs are assigned to each port. If you

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don't see an IRQ number after a port, there's no IRQ assigned to the port. Normally you'll see something like this: COM1, IRQ4. But if there's no IRQ assigned to COM1, you'll see COM1. The program also tells you what COM port and IRQ your mouse is on.

You can find all of these programs, including source code, on COMPUTE/NET. Just connect to America On-line or GENie and use the keyword to find us. Then look for the software section and download these files.

RICHARD C. LEINECKER
REIDSVILLE, NC

Perfect Views

Sometimes when I'm working on a page in *WordPerfect* 5.1, especially after placing a graphic, I want to see what that page will look like—without printing the entire document. *WordPerfect* allows you to print a single page, but doing so requires several keystrokes. I have reduced the several-keystroke process to a single-keystroke macro.

Follow these steps to create a macro that will print a single page in *WordPerfect* 5.1 with one keystroke: Beginning at the *WordPerfect* document screen, turn on Macro Define by pressing Ctrl-F10. At the *Define macro*: prompt, press Alt-P. If no Alt-P macro exists, *WordPerfect* will ask you to describe the macro. Type *Print a single page* and press Enter. If a macro named Alt-P already exists, *WordPerfect* will ask if you want to replace it. Press 1 for Replace and Y for yes; then type *Print a single page*. (Note: If you don't want to replace the Alt-P macro, you can define this macro with any Alt-letter combination you want.) The flashing *Macro Def* tells you that *WordPerfect* is now recording your keystrokes. Press Shift-F7 for Print; then press 2 for Page.

Turn off Macro Define by pressing Ctrl-F10. Now, each time you press the Alt-P combination, the page on which the cursor lies will print.

I have shortened the process for using some of *WordPerfect*'s other features also. Alt-F takes me to Base Font for a quick font change and Alt-L turns off Justification Full and left-aligns my letters.

WILLIAM HARREL
VENTURA, CA

Easier Formatting

Using the undocumented /h parameter with the FORMAT command disables the *Insert new diskette for drive* prompt and thereby speeds up the tedious process. Make sure, though, that the right disk is in the drive before you type this command because the format will start immediately.

VINCENT A. LAPOINT
MOUNTLAKE TERRACE, WA

Protect Yourself

Here's a four-line protection scheme that doesn't require typing in a password. What it does require is that a floppy disk with a named file (called KEY.BAT in this example) be in a certain disk drive (drive B: in this example). Place these lines at the beginning of your AUTOEXEC.BAT file.

```
:START  
IF EXIST B:KEY.BAT GOTO END  
GOTO START  
:END
```

Make sure that you have a file on a floppy called KEY.BAT in drive B: when you boot. Otherwise, it'll stay in an infinite loop. It's not foolproof, but it works for casual users.

WILLIAM M. SHOCKLEY
RIVERSIDE, CA

Small and Useful

Typing a file and using Ctrl-S to pause is a pain, so I use L.BAT to list files.

ECHO OFF TYPE %1 MORE

With DOS 5.0's useful DOSKEY utility I've converted my batch file to a DOSKEY macro, which follows.

DOSKEY 1=TYPE \$1 \$B MORE.

To use either one, just type L filename.

Another batch file I've been using to speed up my keyboard is S.BAT.

ECHO OFF MODE CON: RATE=32 DELAY=1

RICHARD C. LEINECKER
REIDSVILLE, NC

Conserving Memory

Add the line DOS=HIGH to your CONFIG.SYS file, and DOS 5.0 will load into the first 64K of extended memory, freeing conventional memory for applications.

If you have a 386 or better you can add the UMB command (DOS=HIGH,UMB) so that programs such as device drivers and TSRs can run in upper memory as well. First you need to install the EMM386.EXE memory manager and you need to direct your drivers and TSRs to high memory by using the DEVICEHIGH command in CONFIG.SYS and LOADHIGH in AUTOEXEC.BAT.

TONY ROBERTS
GREENSBORO, NC

If you have an interesting tip that you think would help other PC users, send it along with your name, address, and Social Security number to COMPUTE's Tips & Tools, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. For each tip we publish, we'll pay you \$25-\$50 and send you a COMPUTE's PC clock radio while supplies last. □

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- IBM compatible.
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- Advanced paper parking "parks" continuous paper in tractor while printing cut sheets. • Adjustable push tractor for continuous forms paper.
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- Friction feed for cut sheets. • Handles paper 4"W to 10".
- Built-in parallel interface.
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- Intel 386-SX micro-processor, operating at 16 MHz with zero wait state.
- Selectable turbo/normal 8MHz/16MHz speeds.
- 40MB hard drive.
- 1MB RAM.
- 5 expansion sockets.
- One 3.5" 1.44MB floppy disk drive & one 5.25" 1.2MB floppy disk drive.
- IBM compatible.
- 14" VGA color monitor, res: 640x480, .41m dot pitch.
- 1 parallel and 2 serial ports.



- 101-key keyboard.
- 16-bit VGA display adapter with 800x600 resolution.
- 80387 math co-processor slot.
- Includes DR-DOS 5.0, Spinnaker Eight-in-One.
- Factory New!

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INTRODOS

Tony Roberts

LEARN TO PLAY THE NAME GAME

Judging by the questions I'm asked, file naming can be a difficult task. Computer users want to know: "How should I name my files?"

There's no pat answer to this question; it's partly personal preference, partly convention, and partly dictated by the software you use.

In the MS-DOS world, filenames consist of an eight-character root name plus a three-character extension. A period is used to separate the root from the extension.

The extension part of a filename often is used to indicate the type of file and may provide a clue as to which program created the file.

The extensions EXE, COM, BAT, and SYS all indicate files that are used by DOS itself. Files ending with EXE or COM are executable or command files, and as far as you're concerned, there's no difference between them.

From a programming standpoint, these files differ in the location of the program's data segment. Also, COM files can be no larger than 64K.

Graphics programs add various extensions to files to provide information about the type of graphics contained therein. You'll see files labeled with PCX, BMP, GIF, EPS, DRW, and TIF extensions. Each of these indicates a different way of encoding graphic data.

Spreadsheets typically add extensions of their own to files to indicate work sheets, charts, macros, and so on.

Today's software is getting better at accepting and working with data created by other applications. Page layout software, for example, usually can

import graphics files from any number of sources and text files from a variety of word processors.

When naming files in your word processor, keep in mind the final destination of those files. If you're just writing and printing a few letters in *WordPerfect*, you can use any extension that suits you. But if you're writing a document you intend to import into *PageMaker*, you'll want to use a WP5 extension, which tells *PageMaker* how to decode and interpret your *WordPerfect* file.

Enough about extensions. What about the first eight characters of the filename? This is a matter of personal, or perhaps company, choice. In any case, you'll find that adopting some uniform system for file naming will help you and your cohorts figure out what's stored on your disks.

DOS is often criticized for its short filenames, but I wouldn't look for a change in filename length anytime soon. Here's how I make the best of the situation.

First, I invent client codes and project codes. I do a bit of work for Electrical South, which repairs circuit boards and electronic controllers. Every document I produce that relates to Electrical South, begins with the two-letter client code ES.

Taking this first step makes it easy for me to find all the files associated with Electrical South—no matter where they happen to be scattered across my hard disk. Using a file-find utility, I just search for ES*.*.

Running the search turns up such files as ESSKED.XLS, an *Excel* spreadsheet in which I set up a newsletter production schedule; ESBACKUP.SET, a *PC Tools* control file created when I last backed up all of my ES files;

ESNL0891.PM4, a *PageMaker* document containing the "Electrical South Newsletter" for August 1991; ESBULL.EPS, an encapsulated PostScript file of a bull's eye that was used in the newsletter; ESRASH.XY3, a *XyWrite* document about Ken Rash (which also appeared in the newsletter); and ES0715.MEM, a memo to the Electrical South president (written on July 15).

I can remember what's in each of these files without having to open it up. I add date codes to my filenames especially when I create letters and memos and when I create issues of periodic projects such as newsletters.

I try to pack as much information as possible into every filename. The system works as long as you're willing to follow it, and it sure beats ending up with a disk full of files with names such as REPORT1.DOC, REPORT2.DOC, and REPORT3.DOC.

If your filenames include a numbering scheme such as chapter numbers or dates, here's another tip. For numbers less than 10, remember to add a leading 0 so your files will alphabetize properly in a directory.

Use CHAP05.TXT rather than CHAP5.TXT, or TR0925.LTR instead of TR925.LTR. If you fail to add the 0, your files will appear to be out of order in an alphabetized listing.

You'll find CHAP5.TXT sandwiched between CHAP49.TXT and CHAP50.TXT in your directory. This occurs because the computer treats all characters in a filename as text and alphabetizes them accordingly. When you alphabetize, CHAP49 is placed before CHAP5.

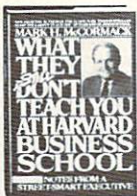
With these simple file-naming tricks, you can by-pass DOS's file-length limitations and create an efficient file retrieval system for your hard drive. □

Follow just a few simple rules, and you'll be able to find any file on your hard disk.

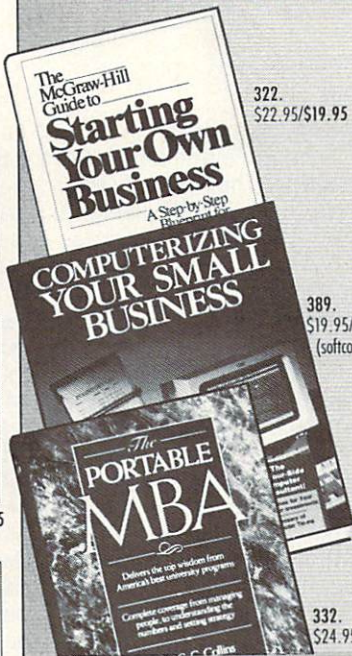
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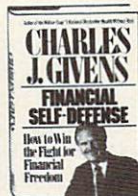
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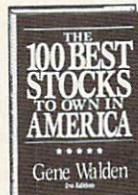
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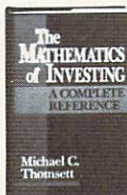
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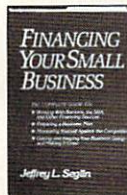
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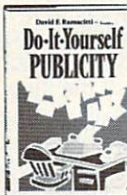
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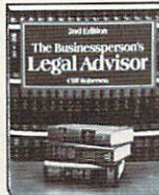
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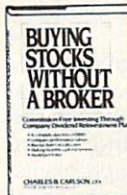
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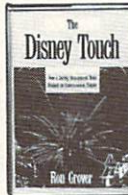
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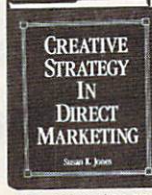
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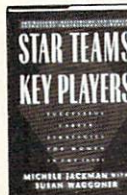
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HARDWARE CLINIC

Mark Minasi

YOU LOOK MARVELOUS

I just finished developing my new course on fixing laser printers, so I've got printers on the brain.

Lasers are no longer something owned only by the rich and powerful. An HP LaserJet series IIP can be had for about \$800—not much more than I paid for an Okidata 93 dot-matrix printer back in 1983. And the IIP/IIIP line is well worth considering. The IIIP actually prints graphics faster than the III. The HP printers are reliable and produce high-quality output. But sometimes problems can creep in, and sometimes we do things that invite problems.

How a Laser Printer Works

Laser printing is a multistep process. Understanding the process is more than just a techie exercise; it's essential to understanding what can go wrong and how to fix it.

I'll explain this in detail later, but here's basically how it works. First, the printing drum is cleaned, and an image is painted onto it with electrostatic charges. Then print toner moves to the charged areas, and the toner is transferred to a piece of paper. Finally, the toner is permanently fixed onto the paper with a heated metal roller.

The heart of the print process is the photosensitive drum, an aluminum cylinder coated with a photosensitive material. The drum's job is to pick up laser printer toner—a ink black dust that's the ink of the laser printing process—and deposit it on the paper. The drum turns during the printing process. As it touches the paper, it transfers the toner (and therefore the desired image) onto the paper.

Before that can happen, how-

ever, the drum has to be physically and electrostatically cleaned. There's a metal blade called the cleaning blade that gently scrapes across the drum, removing any stray toner particles. Then a bright light called an erase lamp shines on the drum, essentially blanking the drum and erasing any prior images. A uniform negative charge of -600 volts is then applied to the drum, preparing it for the new image to come.

That -600-volt charge is applied by a very important thin wire called the primary corona located in the disposable laser cartridge. The corona must actually emit a -6000-volt charge in order to get the -600 volts applied to the drum. The drum is now clean and ready to receive the image. The image is drawn on the drum with a mirror that directs a narrow laser beam across the drum. Anywhere the laser touches the drum changes in voltage from -600 volts to -100 volts. The drum then rotates past a fine layer of toner particles. The toner particles are attracted to the -100-volt areas; they prefer more positive voltages, and -100 is more positive than -600. By the way, the voltage can be adjusted at this point with the toner density control inside your laser. More or less voltage makes for a darker or lighter image.

The desired image now exists on the drum in the form of fine toner particles. Toner is about 50 percent iron oxide and 50 percent plastic. You can actually get toner out of materials by rubbing a powerful magnet across the material. Next, the laser printer transfers the toner to paper by giving the paper a strong positive charge (+600 volts). That charge is applied by the transfer corona, another important thin wire permanently mounted

in the printer. The toner then jumps from the drum to the paper. Once the toner is on the paper, the paper runs past the static charge eliminator, which reduces the paper's charge.

Now the image is on the paper. But it's only rendered as dusty black toner on a page—touch it, and it'll smear. That's why there's one more step: fusing. The paper moves past a heated metal roller called the fusing roller that melts the toner onto the paper, fixing it in place. The fuser is kept at 180 degrees Celsius (356 degrees Fahrenheit), explaining why the paper is so hot when it comes out of the laser printer. By the way, it's the fusing roller that makes you wait when you turn your laser printer on. The system doesn't call itself ready until the fuser has reached at least 160 degrees Celsius.

Symptoms and Solutions

Now that you know how a laser printer works, you can see what can go wrong. There are lots of potential problems, but I only have room to cover the most common ones.

- Symptom: vertical white streaks on the page. Since the paper is transported from top to bottom through the laser printer, the paper also passes the coronas from top to bottom. If a part of the corona is covered with toner, it can't transmit all of its charge, leaving either the drum (if it's the main corona) or the paper (if it's the transfer corona) with insufficient charge. That leads to a vertical stripe with little or no charge, thereby leaving no toner—or a white stripe on the paper. The solution is to clean the coronas.

As I mentioned earlier, the main corona is in the toner cartridge, so if you're lazy, you can simply change the cartridge. Otherwise, you can use the brush that's located inside your laser printer (at least, HPs

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HARDWARE CLINIC

have them) to clean your corona. Take a look inside your HP manual for details.

The transfer corona sits in a metal trench inside the laser printer. To see it, open your laser printer (I'm talking II, IID, III, or IIID here—you can't get directly at the transfer corona on a IIP or IIIP). Fairly close to the front of the printer, there's a metal trench that runs the width of the printer. It's protected with a webbing of monofilament threads. Shine a flashlight into the trench, and you'll see a hair-thin wire. That's the transfer corona. Dip a Q-Tip into some rubbing alcohol and carefully clean it end to end. (As my friend Brock Meeks says, "Once you clean the Corona, it's Miller time.")

- Symptom: smearing on the page. What keeps the toner from smearing? The fusing roller. It's covered with a Teflon-like coating to keep stuff from sticking to it, but it can become scratched, or junk can become baked onto it. In either case, the heat doesn't get transferred to the page. Try cleaning the roller with a soft cloth and some alcohol, but let the thing cool down before you mess with it!

You can also get smears when you try to print double-sided on lasers that are designed only to print single-sided. It's tempting to create double-sided documents by running paper through the laser twice, but it's not a good idea. For one thing, there are rubber rollers that grip the paper in order to pull it through the printer. Ordinarily, they grip the underside of the paper and cause no trouble. But if you're printing on both sides, they end up gripping the underside of the paper—even though the underside of the paper has printing on it. The rubber rollers smear the already-printed side.

- Symptom: horizontal streaks on the page. If you see a regular horizontal line on your output, it's probably caused by an irregularity in one of the many rollers that the paper must pass by on its journey from the paper cartridge to the output bin.

To identify the roller, you'll need to measure the distance between the lines. If the horizontal lines are always spaced the same distance apart, then that distance is the circumference of the bad roller.

Use the following numbers as a handy-dandy key. Just measure the distance between the regular horizontal lines with a ruler, and then read off the name of the bad roller. Whether or not you want to try to replace the problem child is up to you; getting to some of those rollers is a bit hairy. In my experience, however, the most common distance is 3.75 inches: the circumference of the photosensitive drum.

Repeating Horizontal Problem Guide

Distance in inches between defects, and roller
--

0.50 Registration assembly transfer roller
1.50 Upper registration transfer roller
1.75 Lower registration transfer roller
2.00 Developer roller (in cartridge)
2.56 Lower fusing roller
3.16 Upper fusing roller
3.75 Photosensitive drum (in cartridge)

- Symptom: black line down the side of the page. I don't know why this happens, but you see it when the toner is low. Replace the cartridge.

- Symptom: paper jams. Trying to print double-sided can cause problems. The first time you run the paper

through the printer, the paper is given a slight curl. Turn it upside down and run it through the printer again, and that slight curl can become a paper jam. Another cause of paper jams is printing on the wrong side of the paper. There are, believe it or not, two different sides to a sheet of paper, called the wax and the wire. Paper will have a "print this side up" indication on the wrapper—pay attention to it. Paper can acquire a curl in humid environments, but the wrapper keeps the paper dry, so don't take paper out of the ream until you're ready to use it. Using cheap paper can also lead to paper jams. In addition, old laser printers can have rollers that are no longer perfectly round, leading to jams.

Looking Your Best

Now you know what to do when something goes wrong. How can you make sure that everything goes right? First, clean the coronas. And use a fresh ream of paper, not one that's been sitting in your laser printer's cartridge for the last two weeks soaking up moisture and developing a curl. Distribute the toner in the cartridge. Take the cartridge out of the printer and rotate it 15 times. Then shake it side to side 15 times. To help the laser's toner-transfer process, you can clear its throat by printing three to five totally black pages.

You can do that with a short LaserJet program. I'll be discussing laser language in an upcoming column, but for those who know how to use it, keep this command sequence handy: <esc>&10E <esc>&10L <esc>*p0x0Y <esc>*c2400a3300B <esc>*c0P <esc>E. That will print a black page.

Next time we'll learn how to speak the mystical PCL5. □

INTRODUCING

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COMPUTE NET

COMPUTE RoundTable

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with assistants
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COMPUTE/NET

Richard C. Leinecker

ABSOLUTELY FREE SOFTWARE!

I thought that would get your attention. I've picked four great, useful, and free programs found on COMPUTE/NET to feature this month. To get the programs, first connect to GENie or America Online. Use the keyword *COMPUTE* to navigate to the COMPUTE/NET area. Then go to the software library areas and download the files.

Hi-Lo Joker Poker (filename HI-LO.ZIP) is a new version of an old game that's just plain fun to play. The CGA graphics combine with a nice interface for an easy-to-learn, enjoyable experience.

ScreenEdit (filename SED-IT.ZIP) can give your batch files a professional look. It's a text-mode paint program that lets you create excellent screens that can be loaded in right from a batch file using a special program included in the SEDIT.ZIP archive. And programmers will appreciate *ScreenEdit's* ability to save screens as source code for BASIC, C, or assembly language.

Hard Drive Bench (filename HDBENCH.ZIP) gives any hard drive a real workout and lets you know how it did. Results from XTs, ATs, and 386SXs are shown so you can see just how a system's hard drive and controller compare. If you're shopping for a computer, you can use this program to help you test your next hard drive system on the showroom floor. (Make sure you ask permission before running *Hard Drive Bench*—or run the risk of getting some very surprised looks.)

PC Doctor (filename PCDOC.ZIP) shows you what's inside your system's memory and alerts you to the status of your hardware ports. You can see a list of installed

device drivers, memory-resident programs, and environment variables. You can even peer into any part of memory and change it with the built-in memory edit feature.

You can get all of these programs from COMPUTE/NET. All but *PC Doctor* are completely free—no shareware fee.

Some who are new to telecommunications might be having trouble getting things to work. With all of the memory conflicts that TSRs introduce and all of the hardware conflicts that add-on cards throw in, it's no wonder. I'll offer some advice that will help most people who are experiencing problems.

Make sure your telecommunication software is set for the right serial port. If you have trouble, try setting your software to a different COM port. You have to watch the baud rate. If your modem is only capable of 1200 baud and you try 2400 baud, you won't get any error messages. Instead it will seem as if nothing is working. So make sure you're using the correct data transmission speed. If everything looks right but you can't make a connection, try a slower rate.

Find out what port and IRQ your serial cards, mouse, and modem are using. This isn't always easy. Watch your computer's screen when it boots and note if the mouse and other drivers tell you what port and IRQ they're using. You can also consult the manuals for any cards you have installed. I strongly suggest that you run a diagnostic program like *Check-It*. It will give you a list of IRQs and ports.

Every COM port needs an IRQ. These are hardware-generated interrupts that are triggered by an external event. In the case of a modem, the IRQ is triggered when a character comes in over the line. Once the IRQ is triggered, a special

piece of code decides what to do with the incoming character. Without interrupts your serial devices couldn't communicate with the computer.

IRQs can service only one external device at a time. You can have one IRQ for two devices as long as you're not trying to use them both at the same time. For instance, IRQ4 can be used by COM1 or COM3. You can have both serial ports safely installed in your system as long as you don't try to use both of the ports simultaneously.

There's a program in this month's "Tips & Tools" column that will display a list of your serial ports, their IRQs, and your mouse configuration. If you don't want to type it in, download it from COMPUTE/NET (filename PORTS.ZIP).

Once you've identified your equipment and all of your ports and IRQs, you're ready to fix most communications problems. Mice are the biggest culprits when it comes to conflicting with serial communications. Make absolutely sure your mouse isn't trying to use the same serial port as your modem. Then, make sure that COM1 and COM3 are using IRQ4 and that COM2 and COM4 are using IRQ3.

If there's a conflict, you're going to have to get out your manuals and set the board's jumpers and DIP switches to fix the problem. It's not hard to do, and you probably can't do much damage. Just be careful when you slip the cards in and out of the slots.

I hope you're not having hardware problems. If you are, these suggestions should help. You can send questions and comments to me on GENie, address RLEINECKER; America Online, screen name Rick CL; and CompuServe, user ID 75300,2104. □

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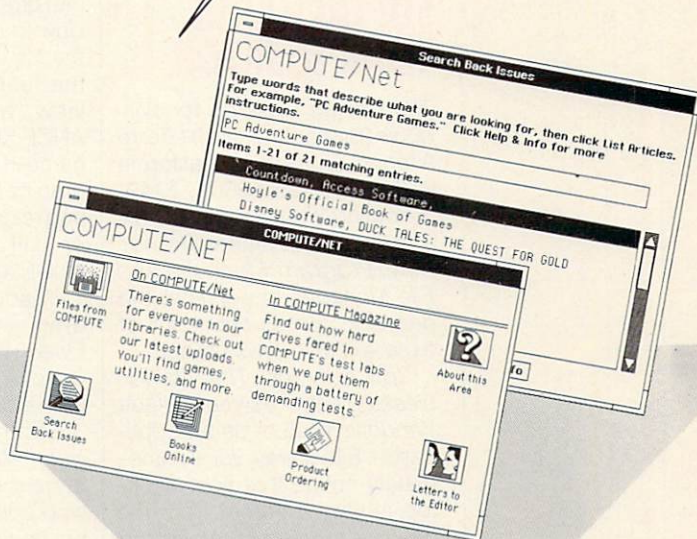
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5698/PC

POINT & CLICK

Clifton Karnes

SUPERCHARGE YOUR DESKTOP

The Norton Desktop for Windows (Symantec, 10201 Torre Avenue, Cupertino, California 95014; 408-253-9600; \$149) is nothing if not ambitious. It's a complete replacement for both *Program Manager* and *File Manager*. In addition, the package comes chock-full of excellent *Windows* utilities.

You can run *The Norton Desktop* either as your default *Windows* shell or as an application. Either way, you'll immediately notice that your desktop is very different from the one you're used to. Along the left side you'll see an icon for

can drag a file from a *Drive Window* to one of them and drop the file on the icon to activate the feature. For example, to view a file named BALANCE.XLS, you click on the filename in the *Drive Window* and drag its icon to the *Viewer* icon and release it. *The Norton Viewer* will pop up with BALANCE.XLS displayed.

In addition to being able to drag and drop files from a *Drive Window* to these icons, you can drag and drop files onto the desktop.

For those attached to *Program Manager* and its icons, there's *Quick Access*, which works like *Program Manager* but has many added features. Perhaps the most useful of

and you can use them as elements in a batch file that *SuperFind* automatically creates for you. *SuperFind* by itself is almost worth the price of the package.

Of the other utilities, most are good, and some are exceptional. One that's very useful is *KeyFinder*. With it, you can quickly find the keystrokes you need to produce all those weird characters in the extended ANSI set. You can also copy and paste these characters into your program.

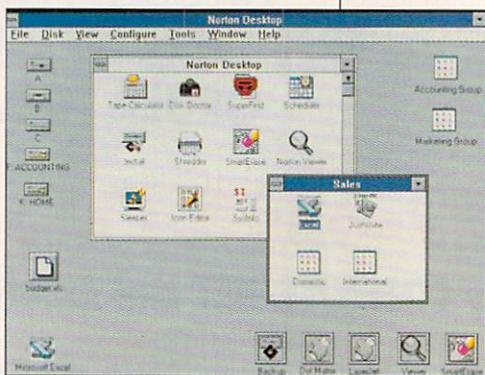
The Norton Desktop is an impressive achievement, but it has a few rough edges. The first is its extremely slow loading speed. If you find yourself moving from DOS to *Windows* several times a day, the program's sluggish boot time will become a negative. *The Norton Desktop* is also glacially slow when saving its current configuration.

When I installed *Desktop*, *Quick Access* completely ignored the icon spacing I'd set up in *Control Panel* and clumped my icons very closely together. With *Control Panel*'s easy to change icon spacing, but with *The Desktop*, you have to edit the program's INI file manually and reboot.

Another problem with icon management is that unlike *Windows*, which always lines up icons neatly beside each other, *The Norton Desktop* doesn't seem to know where any minimized program icons are, and it's continually plopping its icons on top of other ones. More than once I've tried to rerun a program because *The Desktop* had obscured its icon.

These criticisms aside, *The Norton Desktop* is an excellent product, especially considering its lowball price of \$149. Even if you don't opt to use it as your default shell, the utilities alone are well worth the package's price. □

The Norton Desktop for windows gives your system a real drag-and-drop facelift.



each drive on your system. Along the right side are icons for *Printer*, *Backup*, *Viewer*, and *SmartErase*. Across the top of your screen, you'll find *The Norton Desktop* menu bar. If you choose to run Norton's *Quick Access*, you'll also have Norton's improved version of *Program Manager*.

Clicking on a drive icon calls an instance of *Drive Window* (Norton's file manager) for the selected drive. The icons along the right side of the screen are targets for *Drive Window* files. The *Printer* icon prints a file, and the *Viewer* icon allows you to view any of 30 different file formats.

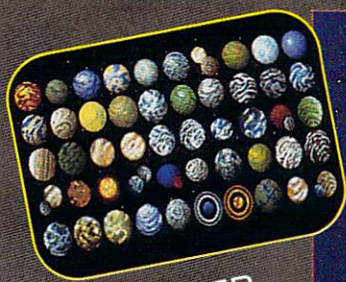
The interesting thing about these target icons is that you

these is its ability to store groups as icons on other groups. This can make organizing programs and documents much easier.

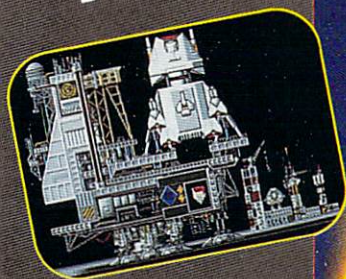
In addition to the package's two major applications (*Drive Windows* and *Quick Access*), *The Norton Desktop* is packed with a huge number of utilities including *Backup*, *Scheduler*, *SmartErase*, *Shredder*, *Sleeper*, *Launch Manager*, *SuperFind*, *System Information*, *BatchBuild*, *KeyFinder*, *Icon Editor*, and *Disk Doctor*.

There are so many useful programs here that it's hard to know where to begin. For me, the most impressive application in this group is *SuperFind*. It searches for files either by name or by text content, and it's fast. The real power of the program, however, lies in what you can do with the files you find that match your criteria. You can view, copy, move, sort, or delete them,

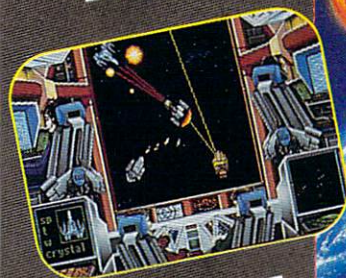
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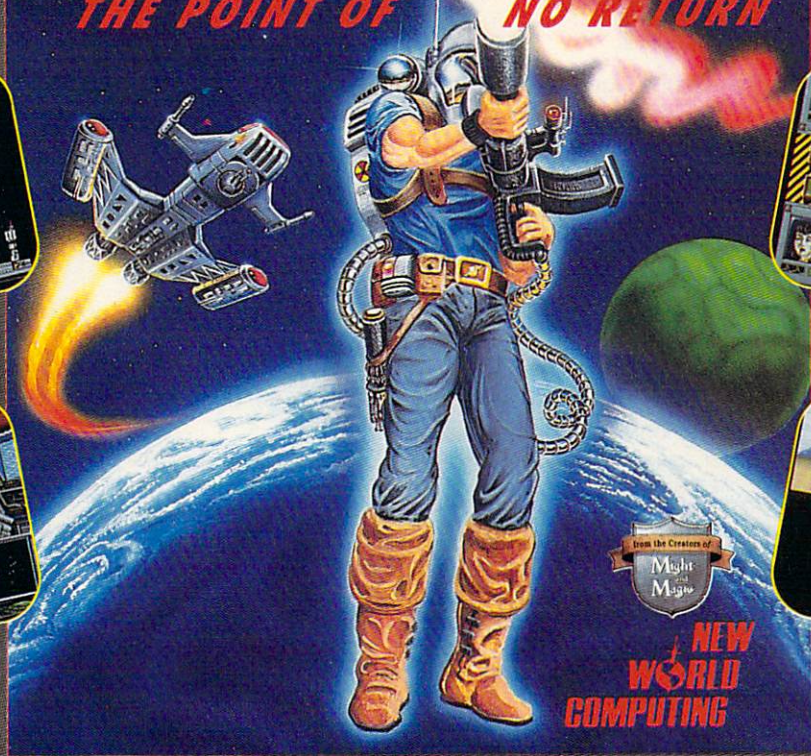
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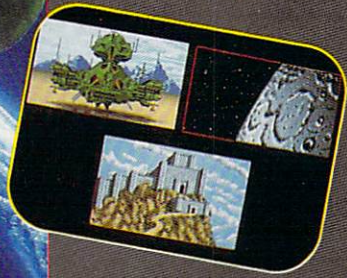
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COMPUTE CHOICE. If you're planning to add a CD-ROM drive to your home PC, look to Sony's disc-packed laser library for a solid—and entertaining—investment.

Peter Scisco

SONY LASER LIBRARY

What better sign that CD-ROM has arrived than the introduction of a CD-ROM system designed expressly for consumers by the consumer electronics giant Sony? The Sony Laser Library system has all you need to enter the world of CD-ROM from your PC. And if you do move on to *Windows*-based multimedia products in the future, it's quite capable of meeting the basic specifications.

At the heart of the Laser Library is an external Sony CD-ROM drive, a solid performer that meets all current demands for CD-ROM use. I used the drive with a variety of applications, including those that came with the system, and experienced no problems.

Unlike Tandy's low-cost CDR-1000 drive, the Laser Library employs a CD caddy for handling both audio CDs and CD-ROMs. There is some discussion in the industry as to whether a caddy is the most efficient, or even the most consumer-friendly, means of inserting discs into a CD-ROM drive. Portable audio CD players usually sport a flip-top design. Still, the Sony caddy posed no problems, even after weeks of use.

Sony deserves applause for making such a complex device as simple as possible to install, use, and upgrade. A folding Read Me First guide lays out the basic steps for installing and running the system. Sony even includes a dual-head screwdriver for installing the adapter card into your PC.

The Host Adapter card is a half-size board compatible with XT- and AT-bus personal

computers. Sony's installation guide, with its well-organized illustrations and clear instructions, leads even the most technophobic user through the process of removing the computer cover and properly inserting and setting the board. More sophisticated users will find IRQ and base address information in the System User's Guide, in case there are conflicts with other I/O devices.

Once you've installed the card and replaced your PC's cover, you're ready to hook up the CD-ROM drive. Connection is made through one of two 40-pin bus connectors; just click the supplied cable into place. Once you've plugged in the power cord, you're ready to install the Laser Library software.

The installation program is also well designed and works according to the most recent "standards." It searches your hard disk to make sure you have enough room to install the Laser Library files and then prompts you to insert one of the six CD-ROMs that come with the system. From this disc, the system creates a DOS menu for launching CD applications.



If you have *Windows* 3.0 on your system, the Install program will create a Laser Library group and assign each CD-ROM application an icon within that group.

During the setup procedure, you can specify whether you want the Library menu to appear each time you start your computer. If you skip this option, you can call the menu to the screen by typing LL at the DOS prompt. The menu itself is simply arranged and can be manipulated from the keyboard or with a mouse. The six CD-ROM applications are listed, with a scroll bar to the right. Highlight the application you want to launch and press Enter, or double-click on the application name—it's that easy. A dialog box appears onscreen to ask for the correct disc. Once you've loaded the application, using the CD caddy, it launches automatically.

The CD-ROM applications included as part of the Sony Laser Library represent a wide range of use and practicality, and they're an excellent value:

a CD-ROM drive and software valued at more than \$1,000, all for less than \$700.

Disk 1 is *Compton's Family Encyclopedia*. Though not the multimedia version, this is still an excellent electronic resource. Thousands of articles, pictures, and definitions are cross-linked. Students of all ages will appreciate the Researcher's Assistant feature, which suggests assignments on 100 different topics.

Disc 2 is *Microsoft Bookshelf: 1991 Edition*, a full-featured reference library complete with *The American Heritage Dictionary*, *Roget's Electronic Thesaurus*, *The Concise Columbia Encyclopedia*, *The World Almanac and Book of Facts 1991*, *Bartlett's Familiar Quotations* (my favorite), and *The Concise Columbia Dictionary of Quotations*.

For language students, disc 3, *Languages of the World*, allows you to pursue your avocation with electronic vigor. Translate words and phrases into 12 languages, including Chinese and Japanese. You can also search for idioms and compare word use throughout the selected languages.

Disc 4 is one of two in the library that comes close to multimedia. The program, *National Geographic Mammals*, is a database of photographs, drawings, and text related to the earth's family of mammals. Most exciting, however, especially for younger children, are the video clips of several different mammals.

Mixed-Up Mother Goose on disc 5 is a departure from the reference materials. Aimed at young children, this interactive game leads the player on a journey through the land of Mother Goose. Children will delight in meeting such favorite charac-



ters as Humpty Dumpty and Little Miss Muffett.

Sony rounds out the library on disc 6 with *Software Toolworks World Atlas*, a comprehensive database of maps and related information. You can print descriptions and maps to a file or send them to your printer, and you can import your maps into many popular word processing and desktop publishing packages.

You aren't limited to these discs when using the Laser Library. You can delete, add, or edit items on the menu as your CD library evolves. But though Sony has worked hard to make it easy to add disc titles to the menu, the process can be fraught with frustration.

As more CD-ROM publishers include automatic installation to the Laser Library as an option on their discs, adding to the menu should become simpler. Sony has done what it can to establish a menu for a system that so far has avoided standards. The company provides an 800 number for technical support. I found the technicians ready to help me sort through the variations of CD-ROM installations and launches.

Separate from the discs, Sony included one feature I thor-

oughly enjoyed while reviewing this unit—an audio CD player program. You can bring to the screen a detailed image of a Sony CD player; all of the buttons on the image are live. The play button starts the CD, the programming buttons let you set the order in which you play the CD tracks, and the eject button stops play and ejects the caddy from the CD-ROM drive.

For those who need a break from silence or office Muzak, the CD player can be run as a TSR. Having access to CD-quality audio from artists of your choosing is far better than being limited to the classic rock stations that litter the airwaves these days. The CD drive itself can be linked through a stereo amplifier to power regulation-size speakers. If you want to keep the music to yourself, Sony includes headphones.

If you're contemplating adding a CD-ROM drive to your home computer system, you'll have plenty of models and types to choose from this year. The Sony Laser Library isn't the least expensive, but its superior design and engineering, menu interface, easy installation, and high-quality CD-ROM applications provide solid value for your investment. □

IBM PC and compatibles, 512K RAM, hard disk with 1MB free space; VGA recommended—\$695

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WORKPLACE

Daniel Janal

WELL-CONNECTED TRAVEL

Nearly half of Terry Kalil's work life is spent on the road—at conventions, meetings, airports. In today's world, that isn't unusual. But it does present an interesting problem. How do you manage a staff when you've been gone 80 out of the past 200 workdays?

As public relations manager for Great Plains Software, the leading developer of accounting and business management software for small- and medium-sized businesses, Kalil spends at least 16 weeks on the road meeting with strategic partners such as Apple, Borland, and Lotus to discuss marketing opportunities and with resellers and reporters to announce new products and strategies. Technology helps.

"I could not travel as much as I do . . . without technology," she says. "The company is very skilled at taking advantage of the technology."

One of the biggest aids is a voice mail system that op-

erates on the company's personal computers. "Our company thrives on voice mail. It is a critically important tool," she says. "We use the telephone for more than 'It's Terry; call me.' We leave full messages—and get full answers in return."

Voice mail is a powerful tool for Kalil. She uses it to instruct her staff and answer their questions. She also uses voice mail to report to her manager and respond to questions coming in from the public. "I use voice mail like I use Post-it notes. I attach a note to the original message and send it off. I can delegate by forwarding. I'm not losing productivity because I have to wait to get home."

With voice mail, she can even discuss sensitive issues. Kalil was at a conference recently when she had to discuss salary adjustments for her staff. Since she was thousands of miles away and payday was the next day, she had to conduct the process entirely over the phone. Security is built into the system so that unauthorized listeners can't hear messages, by accident or on purpose.

She can save time by broadcasting messages to anyone or everyone in the company headquarters or at its 57 remote field sites in North America. For instance, when a national C.P.A. contest rated Great Plains at the top, she sent a message to all company personnel. "We played an audiotape of our announcement, complete with the company president's extemporaneous remarks. I got calls from people saying, 'I felt as if I were there. I heard the popping of the balloons.'"

By using voice mail actively, she's been able to establish positive relationships with new contacts and maintain camaraderie with office mates.

"Because we spend so much time on the road, we have adapted," she says. "If you rely on technology, you end up being a better communicator. There are people I've never met whom I've had extensive conversations with. When we meet, we feel [as if] we know each other. We are like old friends and know each other well."

Although voice mail doesn't afford you the opportunity to pick up important cues like body language, Kalil says that if you are a good listener, you'll hear the subtle cues delivered by voice inflections and other means. "If you are a good communicator, the telephone or E-mail is not a hindrance." She has this advice for voice mail users:

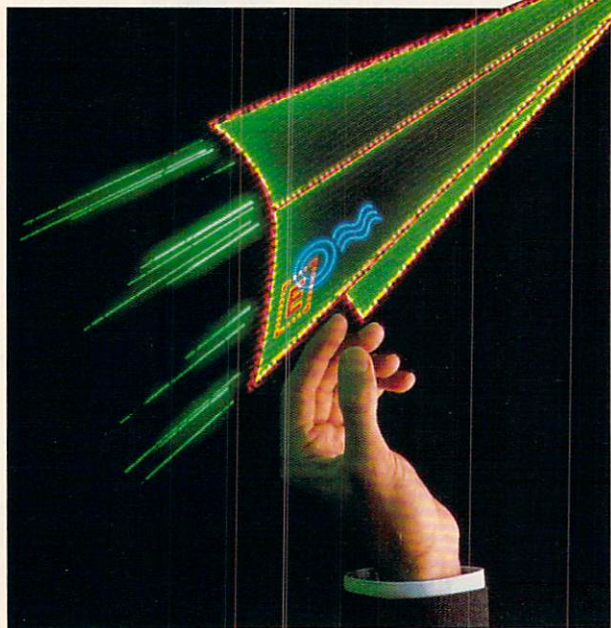
1. Be a good listener.
2. Be personable, not formal.
3. Laugh. Let them hear a smile in your voice.
4. Show empathy.
5. Use the memo approach by stating the subject up front.

Other tools in Kalil's traveling arsenal include a Compaq portable computer. "A laptop is never more than inches away from my hand," she says. Her laptop puts her in touch with the company's *cc:Mail* and MCI Mail.

"At 5:00 a.m. I can sign on and know what our daily sales figures are. I can write press releases, approve copy, and send thank-you notes to my administrative assistant to type. I type it into the system, and people at the main office get the work done."

For those times when she must actually see material for final approval of layouts or copies of articles that will appear in the media, Kalil relies on the powers of the fax machine: "How did we live without them? I feel so connected to the business with it. I'm never out of touch," she says. "Maybe I'm a communications junkie." □

Just because you're on the road doesn't mean you're out of touch: voice mail and E-mail to the rescue.



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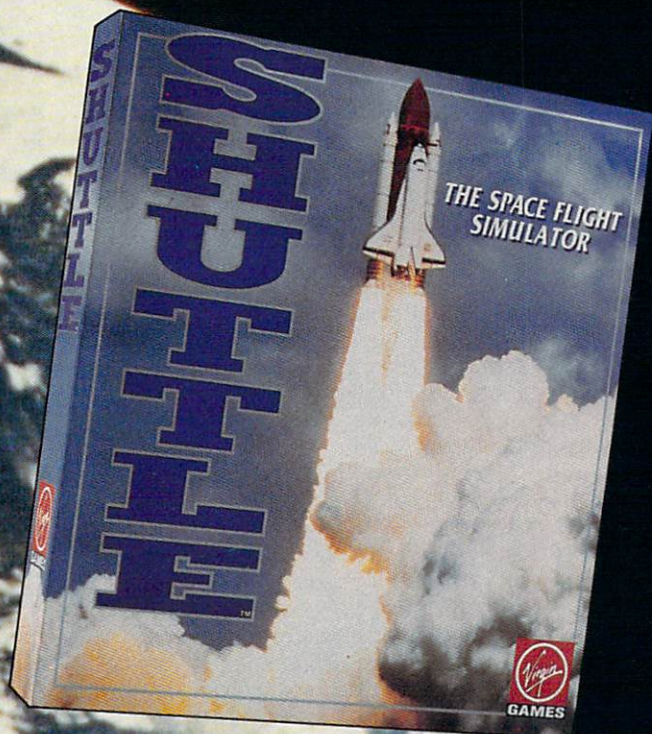
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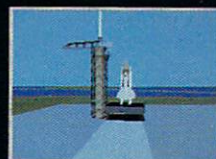
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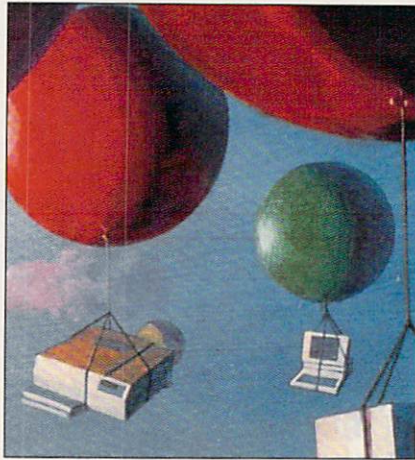
COMPUTER FLEA MARKETS

Buying computer equipment is never easy—especially when you're trying to build a home office. Salespeople are notoriously unhelpful, prices are high, and stores often have only a limited selection of hardware and software. You can spend months looking for a system that meets your particular needs and your pocketbook's limits.

Fortunately, there are alternatives. Mail-order vendors offer good prices and a variety of hardware and software. The trouble with mail order is that some people prefer not to spend their hard-earned money on something they can't examine before the sale. Most buyers are happy ordering by mail, but some people still don't like mail order, no matter how many happy endings they've heard. For these folks and everyone else, there's another way to get a good deal: computer flea markets or fairs.

Computer fairs have a long history. In the 1970s and early 1980s, personal computers were rare and exotic machines torn from the pages of *Popular Science*. It was seat-of-the-pants computing in those days. Then, computer fairs were where people with a common love for uncommon machines came together to share discoveries.

Today, user groups and entrepreneurs sponsor computer shows and flea markets for the same purpose. Amateur radio operators also host gatherings called hamfests that usually include computers and other gear.



Flea markets can be found throughout the country. Some are run at parks or drive-in theaters; others at hotels and motels. The best way to find out about them is to ask at your local user group meeting or on bulletin board systems (BBSs). Some regional computer magazines list them, and the bigger fairs advertise in newspapers and on radio. You can still find equipment and programs you haven't seen in years, as well as hardware and software at prices you won't believe.

Sound too good to be true? Well, a computer flea market is not a perfect environment; there are problems. These shows can be very crowded. If you have a touch of claustrophobia, you don't want to go to indoor shows. One I attended was closed by the state fire marshal because of over-

crowding. Though you might think that would be the end of the show, you would be wrong. Dealers just kept selling in a light spring rain as they moved their wares from the exhibition hall to their trucks.

There are other problems. Shows are not the place to go if you don't know what you're looking for. The dealers are often there because they know computers and they want to make extra money to supplement their day jobs. They may know more than the guy in the computer store who's trying to sell you a computer based on the color of its case, but they often don't have time to explain things.

If you don't know what cable you need to get your printer and computer talking, they might be able to help you. Usually, however, there's too much going on for them to do so. On the other hand, if you know specifically what you're looking for, you can probably find what you need in a hurry.

It's best to do your homework—and not just so you can confidently say that you want a serial mouse and not a bus mouse. You're going to see more computer goodies per square foot than you've ever seen in your life. You may go in planning to buy a box of floppy disks and walk out with a VGA monitor, an 80486 motherboard, and an Apple IIe. Leaving your cash at home won't help; many dealers take plastic.

You should also be careful of other traps. The folks who sell at a flea market are as honest as anyone, but they

BY STEVEN J. VAUGHAN-NICHOLS



Brain Drain.



can be hard to find if you need help. If something goes wrong with your new modem or other peripheral, you may be out of luck.

You need to be cautious of buying used, homemade, or no-name equipment. Used goods might not work as advertised. While someone with technical skill can build a perfectly fine 80386 computer in the garage, that person might not be able to help you if something goes wrong with it in a week or a month. One reason IBM can charge so much for its machines is that it stands behind its products 100 percent. The Romans had a phrase you should remember: *caveat emptor*—let the buyer beware.

Brand-name computers and components can also be found at these shows for incredible deals—40 percent below list price is not uncommon. Dealers usually can sell goods with these remarkable discounts because, in the ever-changing world of computers, yesterday's PC can be as hard to sell as yesterday's newspaper. These orphaned systems often fall into the hands of flea-market merchants, but that doesn't mean they're worthless. They're just harder to sell in sufficient volume to justify giving them room on the shelves.

When you're buying an older sys-

tem, you should bear one potential pitfall in mind: Some systems and peripherals are too slow for modern software. A real IBM XT may be a steal if all you're going to run is a word processor or a text-based spreadsheet, but you're wasting your money if you want to run desktop publishing software under *Microsoft Windows*. An older system simply doesn't have the horsepower necessary to run these programs effectively. If it will run them at all.

Conversely, you might be tempted to purchase an old version of a software product. But look it over carefully. You might discover that it can't do the job you need done.

Rules to Save By

Still want to try out the flea markets? You should. You won't find better deals anywhere. But to make sure you get your money's worth, here are a few rules you should keep in mind.

The first rule is not to buy anything at first glance. I did this the first time I attended a computer flea market, and only ten seconds later, I was sorry. I was looking for a copy of *Datastar*, an old CP/M database program, for my faithful Kaypro computer (this was in 1986, and you couldn't find CP/M software anywhere). Just inside the door

was a man selling old CP/M software for \$20 a package. I grabbed a copy of *Datastar* immediately, congratulating myself on my good fortune. There wasn't a happier person around—until I turned the corner and found another person selling every CP/M program I'd ever heard of for \$10 a pop.

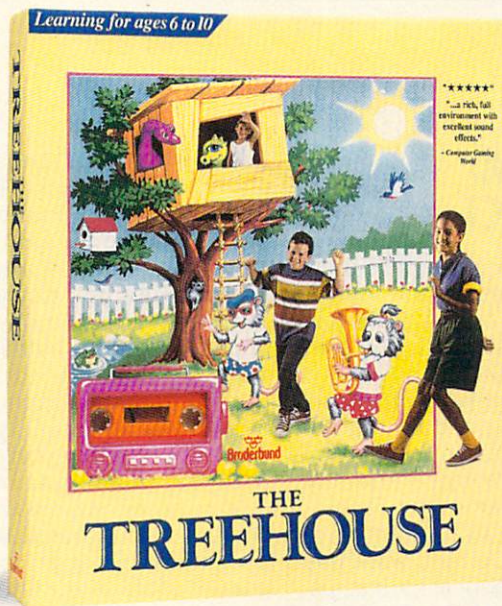
The second rule is a relative of the first. Go through the entire show before you lay money down for anything. No matter how great the deal sounds, there may be a better one on the next table. If you're looking for a part or a program for an older computer, don't grab the first thing that comes along. You'll find that flea markets are the only places where you can find a selection of things to buy, even for your senior citizen system.

Another rule is that if a vendor takes credit cards, use them. You may have to pay more for the privilege (a 5-percent premium isn't uncommon), but don't let that stop you. For a few additional dollars, you buy the opportunity to stop payment if your purchase turns out to be a dud. Some credit cards extend the manufacturer's warranty on anything you buy with them.

Whenever you're shopping for bargains, it's a good idea to get to the market early and park as close as you can

Brain Gain.

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6- to 10-year-olds their own world to explore. ¶ Both programs feature a treasure-trove of subjects. And they're both chock full of fun. So learning becomes play, not work. ¶ *The Treehouse* runs on MS-DOS (coming soon for Mac and Apple II). See it at your dealer for \$59.95 (suggested retail). **SAVE 25% Call 1-800-521-6263** ¶ And teach your child to shoot for the moon, instead of blasting aliens and UFOs.



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to the site. You stand a better chance of beating the hordes if you arrive with the morning light. Computer people aren't early birds.

You should bring along some packing materials to wedge around equipment in the rear seat. Most of the time you won't need it, but now and then you'll find a piece of used equipment that doesn't have any packaging.

Always look carefully at anything you buy. There may be a very good reason that top-of-the-line brand-name computer costs so little; it may have been dropped at the store. If you don't have a chance to see if a machine works and it shows signs of having been through hard times, don't buy it no matter how great the deal. It doesn't matter how inexpensive something is if it doesn't work.

Now Get Your Wings

I know that's a lot of things to worry about. But trust me. If you go to one of these shows, you'll go back again. Prices tend to be 20 to 40 percent less than in the stores. You'll never find more hardware and software in one place. You may even find something that you didn't know you needed.

If your computer isn't a part of the PC and Macintosh mainstream, these

shows are often the only way you can get anything for your machine. Besides, there's the adventure of the flea market experience: You never know

what you'll find when you walk through the doors. Computer treasure is waiting to be found at a flea market near you. See you at the show. □

OTHER ROADS

Flea markets aren't the only way to furnish a home office with inexpensive software and hardware. Used computers can be a real boon to entrepreneurs on a tight budget. Even systems that have only been run once by a little old lady from Pasadena should cost only 60 to 85 percent of their original price. Finding such systems can be a real headache, however, and that's where computer brokerage services come in.

Companies like the National Computer Exchange (800-622-6639) and the Boston Computer Exchange (617-542-4414) arrange for buyers and sellers of used equipment to make deals with one another. While cutting-edge systems are rarely found on the exchanges' virtual floors, older but still useful systems are easy to find.

D.A.K., C.O.M.B., and other distributors of discontinued and overstocked merchandise frequently offer brand-new hardware at far below original cost, sometimes bundled with brand-name software.

Users desperately seeking low-priced software should give shareware programs a try. This kind of software, available from

online services like CompuServe and local BBSs, can be tried on for size before you buy. If a program doesn't fit your needs, just delete it from your hard disk, and you'll owe its maker nothing.

Shareware can be both inexpensive and powerful. The staples of computing work—word processing, spreadsheets, and databases—can be handled by such shareware products as *Galaxy Lite*, *PC-Calc+*, and *Wampum*. Their names may not be as well known as *WordPerfect*, *Lotus 1-2-3*, or *dBASE*, but these and other shareware programs may be exactly what your home office needs, and they're available at a fraction of the cost of shrink-wrapped software.

You may not need to go to shareware, though, for top-quality programs. Companies like Ashton-Tate, now part of Borland, are marketing programs like their flat-file database, *RapidFile*, and their integrated software package, *Framework XE*, for less than \$150. Many other companies have followed their lead in supplying consumers with inexpensive, full-featured office software.

ARTS & LETTERS

Robert Bixby

ART AND ARTIFACT

I recently finished putting the final touches on our November feature on fine art, written by fine artist Lee Noel Jr., formerly of *COMPUTE*.

The material he provided was exciting and arresting—art that could be appreciated by anyone. In fact, you probably have had in your possession a work by one of the artists; Joni Carter's work has appeared on postage stamps.

A couple of the artists were involved in creating the soft-

ware that creates their artwork. Another was working on the hardware level, stringing together machines, sensors, and output devices to create something that would result in an experience for the viewer.

What God hath wrought:
It's difficult to separate the creative programmer from the capabilities of the code.



ware that creates their artwork. Another was working on the hardware level, stringing together machines, sensors, and output devices to create something that would result in an experience for the viewer.

At the same time I was working on the feature, I was reading a pile of science fiction books—Joe Haldeman and Larry Niven—culled from the local used-book emporium. So it

was inevitable that I began to think about pushing the limits. When Isaac Asimov created Andrew, the wood-carving robot in his classic science fiction story, there was no question in the minds of people who saw Andrew's carvings whether he was creating art. But Andrew itself was only a tool produced on an assembly line. Only because of a defective positronic brain was Andrew creative.

Many people who program—perhaps most—eventually sit down to create a graphics program. I wrote a few and enjoyed the process, and here's why. The interest in text and data files lies in their meaning, and there are only a few things you can do to words with a text editor and still have words that make sense. By contrast, you can do almost anything to a graphic, and it can still be visually interesting.

In my efforts, I created something I called a wallpaper processor. It would rotate an image 90 degrees and superimpose it on the original

image, move the image to the right a set number of pixels and then repeat the process. Depending on the original image, the result would look like the very busy wallpaper favored in the early part of this century, with intricate patterns repeating every inch or so.

I won't make a case that my wallpaper processor created art (although I managed to publish some of it in literary maga-

zines), but if it were art, would the art be *my* art? Or could a case be made that the computer created the art and my only contribution was a signature?

What if, instead of giving the computer a set of fairly complex but rigid instructions, I had informed the computer about aesthetics—showing it how to achieve balance without symmetry, to use a variety of shading techniques to provide an interesting set of textures? I might even have designed an expert system that mimics the creative processes in an artist's mind.

Alan Turing, the English computer visionary who was a member of the team that breached the codes of the German Enigma machine during World War II, devised a test to determine whether a computer was capable of thought. His test involved having a person interact via teletype with either a computer or another human being (a teletype was the only input device they had at the time). If the human operator was unable to tell whether the interaction was with a computer or a human being, then you could say the computer was capable of thought and was, in a sense, human.

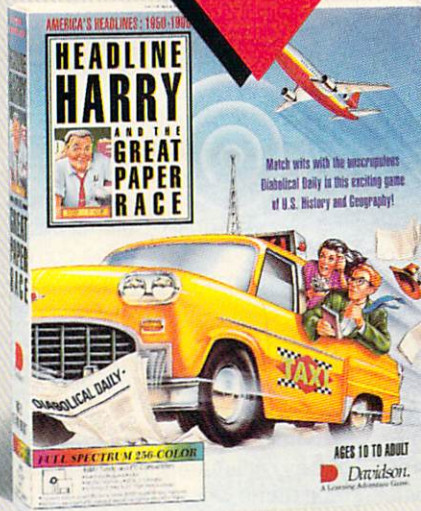
It seems to follow that a computer that can create original art indistinguishable from human art—even human art created on a computer—is an artist and human in this way.

I don't think Alan Turing considered what to make of the programmer who created the program that was capable of thought. As a creator of something indistinguishable from humanity, is the programmer elevated above the human level? As frightening as these things are to think about, they are close at hand. It's easy to tell van Gogh from his brush, but it's more difficult to distinguish the creative programmer from the capabilities of the program code. □

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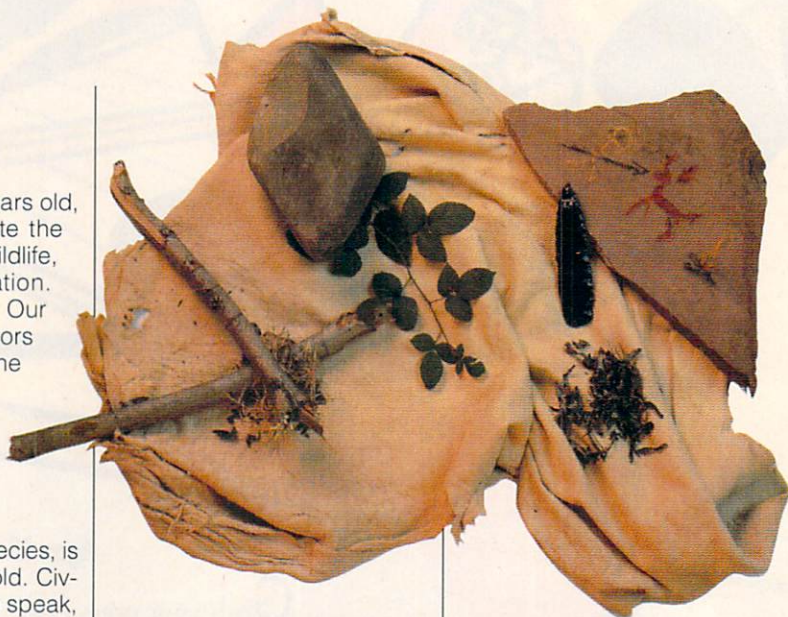
SID MEIER'S CIVILIZATION

It's less than 10,000 years old, this impulse to cultivate the land, to domesticate wildlife, to settle in one location. That's not much time. Our earliest primate ancestors appeared on the scene about 18 million years ago, with the first members of the genus *Homo* arriving 16 million years or so later. *Homo sapiens sapiens*, our subspecies, is barely 100,000 years old. Civilized humanity is, so to speak, a most modern invention.

Yet that handful of civilized millenniums represents a climb from cowering in darkness to reaching for the stars. While civilizations have risen and fallen over the past 8000 years, the impulse to civilize, to develop natural and human resources for the betterment of the population, has remained for the most part constant.

Sid Meier's Civilization gives you the opportunity to create, rule, and manage a civilization. Ruling and managing are, as players quickly discover, quite different things. As the game begins, you control a single band of settlers with little or no technology; to win the game, yours must be the first civilization to colonize a planet in another stellar system. This game has *range*.

Civilization may, in fact, be the most open-ended and flexible computer game ever developed. Each step along the pathway to a fully functioning, happy and healthy, well-managed civilization can lead in several directions. Decisions made early in the game can generate consequences that



stretch across centuries. There is no right or wrong way to play the game.

Paradoxically, this freedom imposes a greater responsibility on the player than most games would dare. There's more at stake here, or at least there seems to be. Sid Meier has done a wonderful job of creating the illusion of genuine consequence within what is, after all, interactive electronic entertainment.

Don't get me wrong—you can have quite a good time with *Civilization* by playing quickly, taking a "smash-and-grab" approach. Devote your entire attention and productive ability to cranking out military units, seeking enemies, and making war. Such an approach, though, may be foredoomed. Your opponents are likely to be craftier, more intelligent (in the context of the game, at least), and more organized than you.

Their own attention to economic and cultural development may ultimately provide them with more effective weapons of war than yours. (Bear in mind, too, that even a "quick"

game can take several hours to complete—unless your civilization is rapidly overrun by other more vibrant cultures.)

Conquest and warfare certainly play a major part in *Civilization*. This is a terrific war game, yet more. Culture and government, religion and commerce demand the same degree of attention as production of weapons and military units; they may well prove more valuable to the ultimate destiny of your civilization.

Meier's accomplishment here is, ultimately, the creation of a game whose peaceful developmental aspects can be as fulfilling as its warlike aspects, perhaps even more fulfilling. How many war games can you think of in which you have the choice between producing weapons of mass destruction or building Shakespeare's theater? The presence of that option indicates Meier's growth as a designer; that plowshares can in some ways be as fundamental to success as swords indicates the sophistication of the game.

There is a science fictional—

or perhaps fantastical—aspect to *Civilization*. The game doesn't promise to duplicate civilization as our history knows it. Rather, players have the tools for civilization and the chance to make of them what they will. While all players—you and up to six computer opponents—start at the same level, the evolution of individual civilizations does not follow parallel tracks any more than it has in our own history. Forms of government, ideologies, technologies—all can collide. I have played games wherein I constructed lovely civilizations of a roughly medieval level of technology, only to see them invaded and conquered by opponents in tanks and aircraft.

Likewise, I have found myself in control of modern technologies that provided the means for laying siege to the entire world. Sid Meier's game makes vivid the clash of cultures that dramatizes so much of human history.

Placing chariots and catapults in the path of armored personnel carriers without the confrontation seeming forced or false, in the manner of a war game construction kit, is a tribute to the game's persuasive abilities. You'll find yourself not only suspending your disbelief but also coming to care for the societies you create.

Through it all, the management aspects of a civilization will demand your attention. Infrastructure is crucial. You will provide your people with housing, food, and care, or they will let you know of their displeasure. The infrastructure requires maintenance and upgrades. Simple roads give way to highways or rail lines. Primitive sailing craft able only to hug the shore evolve into huge oceangoing transports,

battleships, carriers, and subs. You'll find libraries and universities here as well as barracks and depots. Ideas prove as crucial as ordnance to the growth and expansion of your civilization.

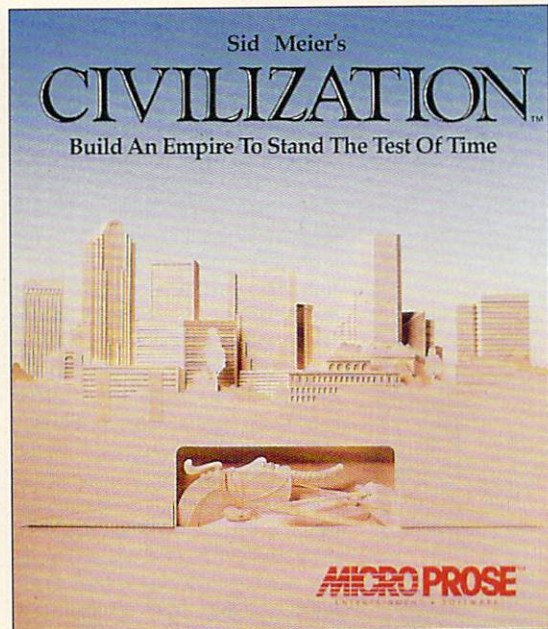
Best of all, there's a sense throughout of the interrelationship among ideas. Decisions made early in the game echo throughout its progress, both to your advantage and against it. Each path you choose both opens and closes other opportunities. You quickly learn to choose carefully.

Meier is also aware that civilizations play out their lives on planetary surfaces, often despoiling them in the process. Here, you are charged not only with exploiting the world's natural resources but also with renewing and restoring them.

There's even an interactive encyclopedia of sorts, with entries specific to the game. Design and aesthetic decisions are well supported by information resources, both within the game and in Bruce Shelley's elegantly written documentation.

Will you make the right decisions? There's no clear answer to that question. Sid Meier is as aware of the dilemma of design bias as any designer I know. It's not by accident—nor solely by marketing intent, I think—that MicroProse calls the game *Sid Meier's Civilization*. Insofar as is possible, though, Meier has minimized his overt presence in the game. You don't have to "think like Sid" in order to prosper. He has created a sort of electronic pocket universe with clearly defined rules and proscriptions. Within those limits, you're on your own, able to find your way according to your own inclinations and abilities.

While the game is primarily



intended as entertainment, it has an educational aspect that cannot be overlooked. Meier isn't teaching here—nor, except in a couple of environmental areas, is he preaching.

Rather, he provides players with a self-contained continuum to explore and lets the reasonable and realistic rules of that continuum do the teaching. You learn by experience what works and what doesn't. If the lessons learned don't directly apply to the real history of our planet, you might at least allow that they may deepen your appreciation of the intricacies of history and the odds against which civilizations have always struggled.

Civilization is a bold stroke from one of the boldest of our interactive game designers. This game challenges the worthiness of your intellect as well as your instincts and provokes interplay of ideas while providing fun. In short, it's a most civilized entertainment. □

IBM PC and compatibles with 286 microprocessor or greater; 640K RAM; EGA or VGA; hard drive; supports Ad Lib, Roland, and Sound Blaster; mouse recommended—\$69.95

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Steven Anzovin

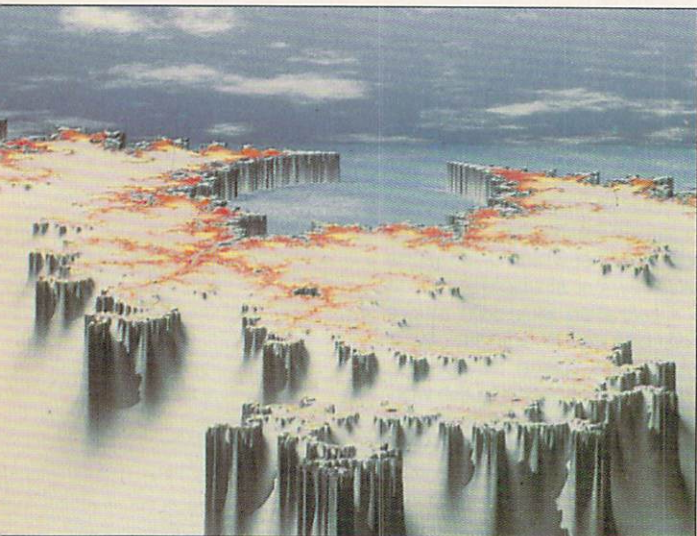
FRactal COMPACTION

As the Incredible Shrinking Man discovers at the end of the classic science fiction film, there are always new levels of wonder in the universe, no matter how small you get. Legions of computer users are discovering this truth as they play with the curious mathematical entities called fractals. Fractals, you see, are pretty much the same at every scale, from the cosmic to the miniscule.

A coastline provides a good example of fractal geometry. From space, the coast of California has a certain rough irregularity. A mile above the land, the coast has a similar roughness. Get down on the beach on your hands and knees, and the irregular boundary between sand and surf looks remarkably like the coast seen from space. That self-similarity is an essential property of fractals.

A number of software programs make it possible to explore fractal geometry on your home computer. It isn't necessary to master the mathematical mystery of IFS attractors, metric spaces, and affine transformations in the Euclidean

Monument Valley mesas or Antarctic wilderness? The wonder of fractal art lies partly in its relationship to nature.



plane to have fun with fractals (though you'll understand the theory better if you got past analytic geometry in school).

Most programs let you take a colorful image, like the well-known Mandelbrot set (kind of a mathematical black hole with an infinitely complex boundary), and simply zoom in and out at will. At any level, you can find whirling vortices, flaming dragons, Amazonian river systems, and complex Escher-like tilings. Their rhythmic, psychedelic quality is fascinating.

Two absorbing fractal exploration programs are *The Beauty of Fractals Lab* for the Macintosh, based on the book *The Beauty of Fractals* by Peitgen and Richter (Springer-Verlag, 175 Fifth Avenue, New York, New York 10010; 212-460-1500; software \$49.00, book \$39.00). The image that accompanies this column is from *The Beauty of Fractals*. For PCs and Macs there's *Desktop Fractal Design System* by Michael F. Barnsley (Academic Press, 465 South Lincoln Drive, Troy, Missouri 63379; 800-321-5068; \$49.95), companion software to Barnsley's book *Fractals Everywhere*, also by Academic Press (\$44.50). It's considered by fractal mavens to be one of the few classics in the field.

Beauty creates beautiful abstract graphics. It even has a cool 3-D option but requires a color Mac with a math coprocessor. *Desktop* has fewer options but runs on any AT-class machine with 640K and EGA or VGA. It's more of a teaching tool for using fractals to model real objects like ferns, clouds, and even human faces.

Fractals are good for more than creating calculation-intensive eye candy on your PC, however. Another essential property is that they can be described with relatively small amounts of information—as little as a single mathematical formula.

Thus any computer image

that can be described with fractal geometry can be stored in a very small amount of space. Barnsley's company, Iterated Systems (5550A Peachtree Parkway, Suite 650, Norcross, Georgia 30092; 404-840-0633), has a fractal-transform compression process called P.OEM that compresses a 768K 24-bit color image down to 10K with little loss of detail.

The weirdest, most fractal-like thing about P.OEM images is that their resolution is practically unlimited. You can even view them with more detail than in the original image. The transform process adds all the extra detail! Iterated Systems and Jones and Bartlett Publishers have copublished a 1.44MB floppy disk called *Floppy Book* (Jones and Bartlett Publishers, 20 Park Plaza, Boston, Massachusetts 02116; 800-832-0034; \$24.95) that contains 100 "pages" of full-screen 24-bit images and text. That's packing about 77MB of data onto an ordinary 3½-inch floppy.

P.OEM PC floppy books can also contain compressed video (two minutes per disk), digitized sound, and ASCII text. They might well supplant CD-ROMs as a digital publishing medium for single books rather than entire encyclopedias or databases. The floppy book is faster (you can load the P.OEM file to your hard disk for access speeds no CD-ROM player can match), it's cheaper to duplicate, and every computer has a floppy disk drive.

You don't need special hardware or software to read a P.OEM floppy book, but you need special hardware to make one. The compression development kit costs up to \$13,000, but you can have Iterated Systems or a service bureau compress your files for a low piecemeal rate, starting at \$25 per picture. □

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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.



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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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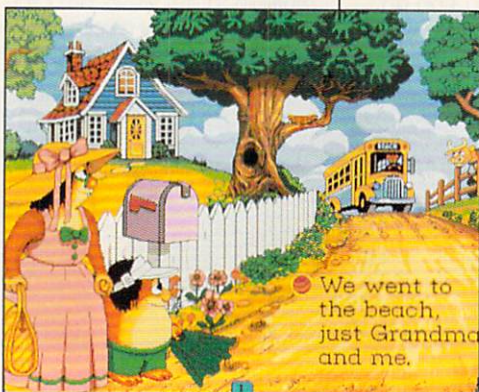
MULTIMEDIA PC

David English

SELLING THE SIZZLE

The date: October 8, 1991. The place: the Hall of Meteorites at the American Museum of Natural History in New York City. This was it, folks—the day that multimedia officially came to the PC. Now that multimedia has arrived, what does it mean for the average consumer? Will historians look back on this event as the official wedding of television and computer technologies? Or will multimedia be just another niche market for people with

Brøderbund's *Just Grandma and Me* is just one of 60 new multimedia titles.



money to burn? Maybe I'm biased, but I think we're onto something big here.

It was hard not to be impressed. The first speaker was James Burke, best known for his two rapid-fire history-of-technology series on PBS, "Connections" and "The Day the Universe Changed." With Burke comparing multimedia to Gutenberg, Martin Luther, and the American Revolution, you couldn't help but feel you were witnessing a real-life day the universe changed.

Microsoft's Bill Gates followed Burke with a more down-to-earth view. He was clearly delighted with the 60 titles on display—though most of the titles weren't quite ready to ship. (The official name for a multimedia software product is title, not

program or application.) Gates also demonstrated how you'll be able to paste a sound from a multimedia application into a *Word for Windows* document. An icon is placed on the page, and the reader can click on the icon to play back the accompanying sound.

So what kind of titles can you expect to buy for your new Multimedia PC? Brøderbund showed *Just Grandma and Me*, the first installment in the new Living Books series. It's similar to *The Playroom*, but it's structured more like a traditional book. As you would expect, it includes full digitized voices

and some very clever animation. The Voyager Company demonstrated a similar title, *Amanda Stories*, which was more free-form in its organization and more whimsical in its content. In the same vein, Sierra On-Line showed the multimedia version of its award-winning *Mixed-Up Mother Goose*.

All three titles will have young children begging in the aisles for a Multimedia PC.

For those who prefer to create their own multimedia presentations and applications, AimTech has *IconAuthor*, a high-end authoring program that lets you mix graphics, text, sound, animation, and video into a seamless whole. From Autodesk you can buy *Autodesk Animator*, *Autodesk Animation Player for Windows*, and a large selection of clips (mostly animation with some digitized audio and MIDI clips). It's all on one CD-ROM, and it's called *Autodesk Multimedia Explorer*. Midisoft is offering *Midisoft Studio for Windows*, a powerful MIDI recording/editing program that

can display standard music notation as you play.

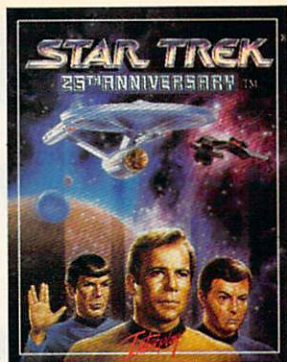
Other notable new titles include Microsoft's *Multimedia Beethoven: The Ninth Symphony*, which contains the full audio recording of the symphony, as well as the orchestral score and a detailed analysis by UCLA music professor Robert Winter; InterOptica's *Great Cities of the World, Volume 1*, which takes you on a multimedia tour of ten international cities; Metatec's *Nautilus*, the first subscription-based multimedia service available on CD-ROM; and HyperGlott's *Learn to Speak Spanish*, with 30 interactive lessons featuring the digitized voices of native Spanish speakers.

In addition, software companies have converted many of today's top programs to multimedia, including Britannica Software's *Compton's MultiMedia Encyclopedia for Windows* and *Guinness MultiMedia Disc of Records 1991*, Interplay's *Battle Chess* and *Dvorak on Typing*, Sierra's *Jones in the Fast Lane* and *King's Quest V*, Access Software's *Links*, the Software Toolworks' *World Atlas* and *Chessmaster 3000*, Passport Design's *Master Tracks Pro* and *Encore*, and Microsoft's *Works for Windows* and *Bookshelf for Windows*.

Of the software developers I talked to who are converting their programs to CD-ROM, most plan to offer their CD-ROM versions for less money than their disk-based versions. Expect to see \$59.95 programs available for as little as \$39.95 on CD-ROM. (Not only is it cheaper to supply software on CD-ROM, but it virtually eliminates the problem of illegal copying.) If the software companies can get enough titles out there at rock-bottom prices, multimedia could really take off. Fortunately, we're off to a great start. □

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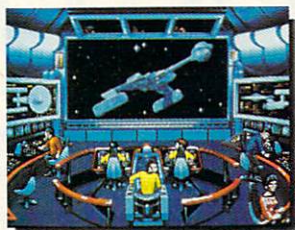


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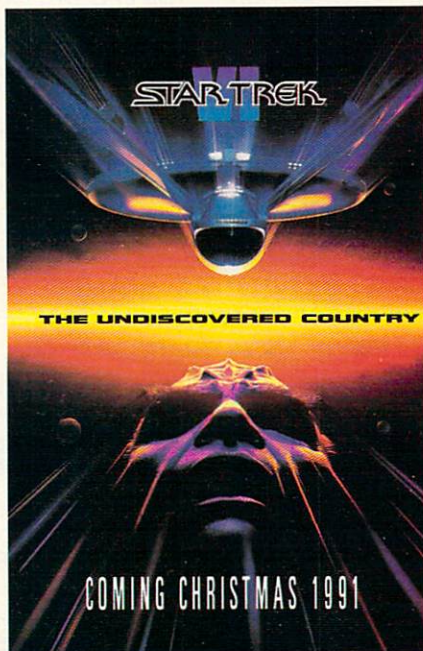
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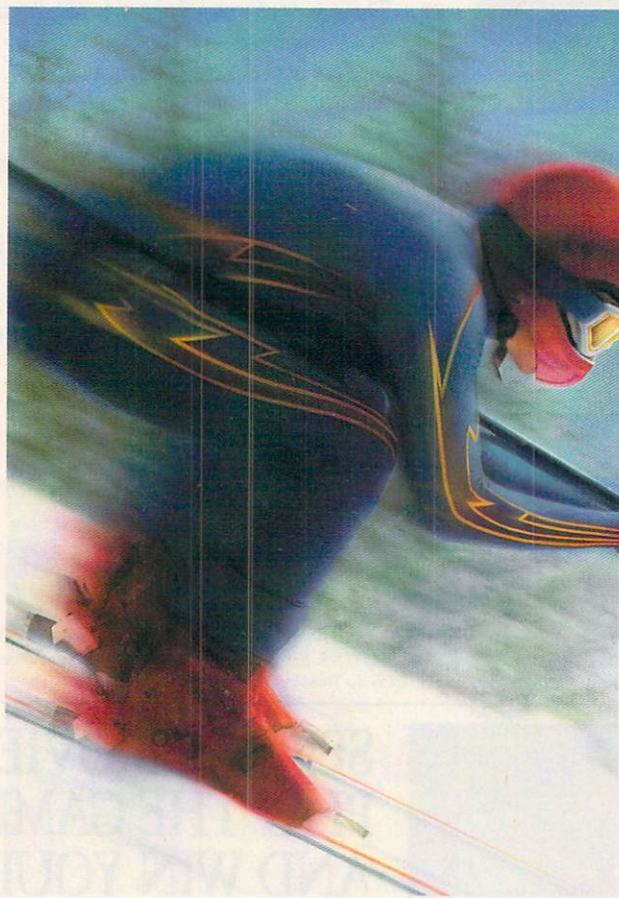


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Circle Reader Service Number 200

GAMES GONE GLOBAL

THE GAMES OF THE ELECTRONIC WORLD HAVE UNIVERSES HIDDEN INSIDE

Nations rise; kings fall. Some civilizations leave impressive relics of past glories, while others vanish without a trace. But they're all at the mercy of your PC's on/off switch. Press it, and they're only ephemeral bits of magnetic particles on a floppy disk.

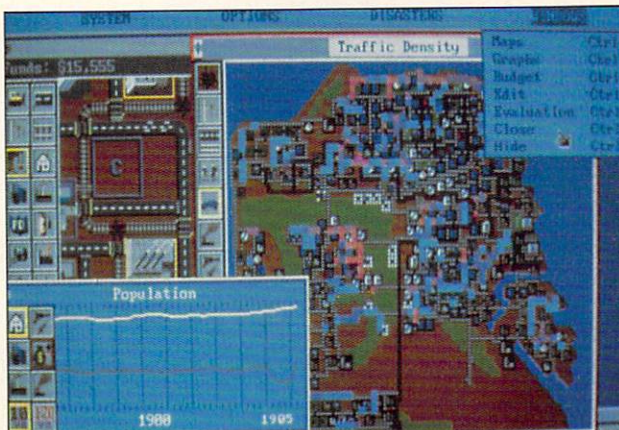
Game designers can squeeze the globe and its billions of inhabitants, along with their wars and explorations, their laws and creations, onto a piece of plastic no bigger than your hand.

We may get to play with these worlds, but they're not ours to keep. They're the children of game designers like Chris Crawford, Sid Meier, Will Wright, and others. And they act and think a lot like their parents.

Balance of Power, a geopolitical simulation where you go toe-to-toe with the Soviets, is still one of the best examples of designer hubris. Though *Balance of Power* evokes the sense of brinkmanship, few other pieces of software are so marked by their creator's hand.

Play from the American perspective, for instance, and you can find yourself going to the thermonuclear threshold because the Russians are trying to push military advisers into Mexico. Not only is it absurd that any Soviet regime would be so audacious, but when they won't back down under pressure, the situation slides to the ludicrous. The only way to survive is to be DPC, Designer Politically Correct. Don't want to play by Crawford's rules, which can quickly force you into a set piece of wimpy behavior? Too bad. All you can do is pack it in (or more likely, spark an atomic conflagration) when you try to get tough.

Crawford's not the sole example of the global game designer point of view. Will Wright, maker of the ultra-popular *SimCity* and its sequel,



SimCity from Maxis, a politically correct simulation.

SimEarth, abridged cities, then planets. In *SimCity*, where you manage urban populations, you can quell citizen complaints by simply building a sports palace, a cynical attitude that evokes images of Roman circuses. Mass transit is OK, while automobiles are an evil you need to dispose of as soon as possible. More DPC.

SimEarth, a stunning but often passive model of world building, harbors a bias against nuclear power in its advanced levels. To its credit, though, *SimEarth* lets you promote any species—even dinosaurs—to intelligence, a remarkably liberal viewpoint.

Sid Meier, MicroProse's premier designer, recently released his newest work, *Civilization*, a game in which you guide your culture from the pre-Bronze Age to the Space Age. Though your choice menu is impressively long and complex, the race to supremacy is decidedly Western and very technological.

What can you expect? Computer games, after all, are made by people. People with opinions.

Writers bring personal perspective to their work, sometimes inflamed views that are meant as much to sway as to report. All creative endeavors—and game design is just such an undertaking—begin with an opinion.

Perhaps what fools us is that

these games run on computers, which brook no shading, only blacks and whites. Or maybe it's the word *simulation* that tricks us into thinking the genre must be neutral and neutered. But game makers—and thus their games—are anything but objective.

"There's definitely a designer's perspective, but I think of it as more of a question of what you want to emphasize," says Sid Meier. "[Political and economic games] are in

the more subjective topics. When you talk about politics or history, of course there are different opinions. But dealing with another level of bias is, in some ways, more interesting."

Chris Crawford puts it more plainly. "I've never claimed that my games are free of bias. In fact, a game designer has a moral responsibility to put his perception of the world into the game. But he'd better make sure that the opinions are as broadly based as possible."

"My view of a city is what's reflected in the program [*SimCity*]," chimes in Will Wright. "It's very subjective, but . . . so is any form of entertainment. It's not something you find just in computer games. No matter how hard you try to be neutral, you still have a point of view."

It's no surprise, then, that we're not completely content with the PC worlds we borrow, especially those that explore emotional topics like politics, religion, and the environment. The key is this Chris Crawford comment: "Any good piece of art exaggerates reality."

So take Crawford, Meier, Wright, and other ambitious game designers with a grain of salt, accept what they let us play with, and argue with it if you like. Just don't expect games to be as soulless as the computers that play them.

GREGG KEIZER

PRINCIPLES OF GOOD GAME DESIGN

PLAY ENOUGH GAMES, AND YOU'LL PROBABLY DEVELOP YOUR OWN PHILOSOPHY OF GAME DESIGN

You saved up for months to buy a new game for your PC. You read the reviews, investigated the bestseller lists, asked your friends and relatives, and settled on a package.

As you lay your money down, you wonder if your diligence will be rewarded. Will the game be as incredible as everyone says? What makes a good game, anyway?

Ask game designers and they can talk for hours. Various themes surface in their answers—good games are

fun, they balance challenge with success, they tell good stories, they have whiz-bang features. Good games are simple; they help you expand your mind.

Play enough games and you'll probably develop your own philosophy of game design. Certainly it will include a few of these principles.

Fun Comes First

Name: Paul Reiche III

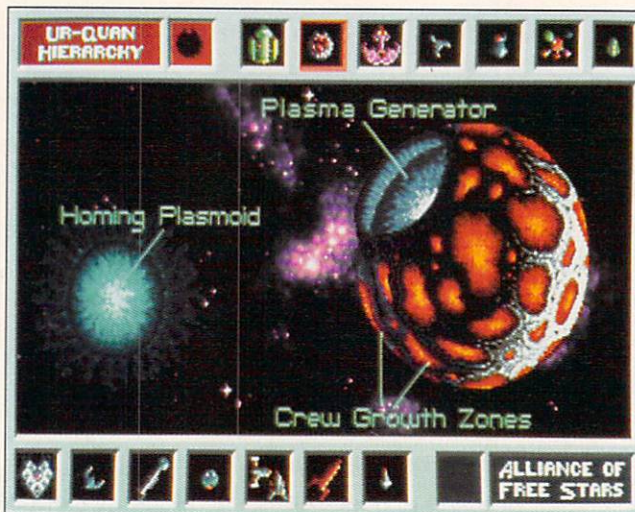
Recent Release: *Star Control* from Accolade

Other Games: *Archon* and *World Tour Golf*

For Paul Reiche III, good game design starts with good fun. "I don't have any highbrow ideas of games as statements of social change," says Reiche. "To me the litmus test of a good game is how much fun it is."

His answer may sound obvious, but Reiche goes into great depth about this basic principle. He explains that designers can describe their newest games ad nauseam but never say, "The fun part is. . ."

"Consequently," he says, "any fun in the game is completely accidental. A good game has to have a fun core, which is a one-sentence description of why it's fun."



Star Control creator Reiche designs games based on fun.

Exercising his sense of fun, Reiche spends time thinking about games we play in the real world. He picks out the fun core of the game. In hide-and-seek, for example, the fun part of being the hider is finding a good place to hide. Then he thinks about how that can translate to a computer game.

Besides looking to the real world for standards of fun, Reiche examines successful games of the past. His latest release, *Star Control*, was inspired by an old 8-bit Atari game called *Star Raiders*. Look at the graphics of *Star Raiders* and you'll smugly roll your eyes. But the game was great fun back then, and it's still fun today. "I think those games are overlooked as a source for fundamental game design," says Reiche.

He also plays games with friends. "We have a game night once a week when we play games we want to play or games that look interesting," he says. "We usually don't play computer games. We usually play board games."

Reiche's philosophy—that a good game design is simply a fun game—may seem too basic. But, as Reiche's contemporaries Brent Iverson and Dan Bunten agree, fun is the essential element of an excellent

game. Isolating that element, though, can require many hours of sifting through unnecessary game details.

Of his own design process, Bunten remarks, "We go through these designing-playing-designing-playing-type iterations to follow the thread of what's fun and build on the foundation of what we think is needed." Iverson echoes this philosophy with his admission, "There are cases where you design something that looks good on paper and there's only one small part of it that's

fun. You have to focus on that and throw the rest away."

Perhaps *fun* is too intangible a term to pin down—successful game designers can't readily define what fun is even though they continue to produce engaging games. As an old hand at designing popular games, Paul Reiche takes his "fun" seriously enough to build some of the most entertaining diversions around, with or without a working definition.

We Crave Simplicity

Name: Dave Jones

Recent Release: *Lemmings* from Psygnosis

Other Games: *Menace* and *Blood Money*

When Dave Jones and his cohorts built *Lemmings*, they decided to emphasize simplicity. They thought the best-designed games were also the least complicated.

"*Tetris* is the ultimate example of the most ultimately simple game, but it's so addictive," said Jones. "*Lemmings* is complexly simple. That's what's fun about it." He found, however, that attaining simplicity posed great difficulty. "We took a good six months to design

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Circle Reader Service Number 119

AS CONSUMERS HAVE DEVELOPED MORE SOPHISTICATED PALATES, GAME DESIGNERS HAVE SPICED UP THEIR WRITING SKILLS

this game," muses Jones. "That's an unusually long time."

Lemmings almost defies description. A group of rodents move irresistibly forward. You endow these creatures with special skills that help them overcome obstacles. Of course, the skills are limited and the solutions are not always obvious.

In the interest of good game design, Jones whittled down the skills from a collection of 20 to a group of 8. "The simpler you can make the control of the game, the more playable it is.

"We thought that with these eight skills we could throw anything at the players. When we started to take skills out, we figured they could do these things with these three skills. Can this lemming replicate what this skill can do with two or three other functions?"

The final product is a game that many designers call ingeniously simple but obsessively interesting. Origin Systems' Richard Garriott adds his opinion to the body of praise for this Psygnosis hit. "I would not have been able to predict *Lemmings* would be such a popular game, but it's slick and simple." Even the jaded Jones admits that this is the only game he has ever wanted to play after finishing the project.

Perhaps simplicity is an aspect of game design that more designers should note. Reiche extols the virtue of an uncomplicated game: "The really blisteringly original games are incredibly simple."

To Jones, however, the best game design would sprinkle glamour over innate simplicity. "The ultimate game would be one that's as playable as *Lemmings* but has the [cinematic-style] graphics of *Wing Commander*," he says. "That is something

that people have to work towards and that is very difficult to do."

The Plot's the Thing

Name: Roberta Williams

Recent Release: *King's Quest V* from Sierra On-Line

Other Games: *The Colonel's Bequest* and *Mixed-Up Mother Goose*
Roberta Williams designs games

and more, we're concentrating on plot, the characters, and proper writing technique."

Williams equates her adventure games with movies and books. Her creations aspire to be as well crafted and as absorbing as those you would find in a motion picture. Players must be able to identify with the characters. Puzzles must fit into the plot without drawing attention to themselves.

Balancing a game's plot with an acceptable amount of interactivity is one of the toughest tasks in designing a good adventure game. "In the case of an adventure game, the protagonist is controlled by the player," Williams explains. "The writer has no control over what the protagonist does. The protagonist is kind of like a wild horse that you have to catch and rein in."

The only time she can direct the protagonist is during program control sequences. These are the parts of the game

where the player is forced to find clues through overheard conversations and cutaway scenes. These sequences keep the game moving.

"It's at those points that you can rein the players in and make them dance to your tune," she says. "But then they're off and running."

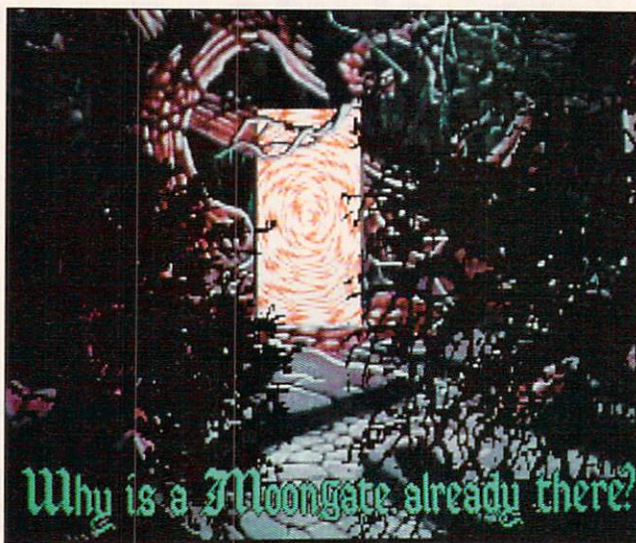
With both good plots and good writing techniques, Williams designs games that double as escape hatches from everyday life. That escape, combined with the sheer pleasure of winning, is what she finds fun in the *King's Quest* games.

Technology First

Name: Richard Garriott

Recent Release: *Ultima VII, The Black Gate* from Origin Systems

Other Games: *Ultima* series, *Martian Dreams*



Sophistication helped make Origin's *Ultima* successful.

that have a discrete, victorious end. A good game, in her view, takes you to that final victory in an interesting way.

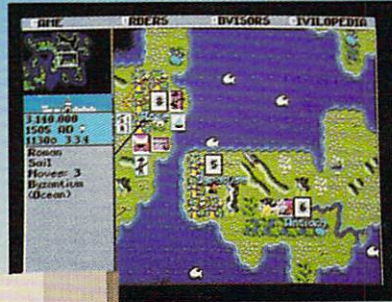
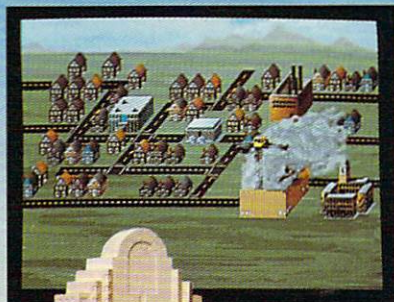
"More and more, we're thinking in terms of the plot," she says. "And is the protagonist a likable person? And who is the antagonist?"

Adventure games have changed a lot since she began her long-lived *King's Quest* series. "In the old days, when I first started designing adventure games, there wasn't much plot," Williams says. "You kind of ran around beating up trolls and gathering treasure."

As consumers have developed more sophisticated palates, game designers have spiced up their writing skills. According to Williams, "More and more, [games are] turning into interactive fiction, and more

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A GOOD COMPUTER GAME IS PRETTY MUCH THE SAME THING THAT GAMES WERE ALWAYS MEANT TO BE: SOMETHING TO WILE AWAY SOME TIME WITH

Like King's Quest, Richard Garriott's Ultima games have been around for a long time. Unlike King's Quest, however, Ultima's key to success is its technological sophistication—plot comes later.

"When I sit down to design a game, I usually have a few basic goals that I am very much aware of from the onset," Garriott says. "The message of the game and the major technological achievements I want to take on—I usually have these well in hand conceptually before I put a line of code in."

For Garriott, technological issues drive the game design process. He says he can write a good story and try to make the computer tell that story, but without close attention to the limits of the machine, he won't know how much code he'll have to write. He won't even know if the idea is possible.

"On the other hand, if you first develop the technology, then you can say, 'Okay, I can design a story that does that.' The story is well within the scope of the technology."

As he redesigns the technology for each new Ultima, Garriott carves the plot out of the new possibilities. For example, in each of the Ultima games, Garriott has been able to show the world of Britannia in more detail. By *Ultima V*, he could put furniture in the rooms, so he included a harpsichord the player could play—just because it was possible. Since he couldn't justify the harpsichord on aesthetic grounds alone, he rigged the instrument so that when players press a certain key, a secret passage opens and reveals one of the major parts of the game.

By creating more detail and more possibilities, Garriott has built a series that wraps players in the fantasy of an-

other world. He says the fun part of the Ultima series is that immersion in a separate reality, a reality that grows richer and richer with each installment.

"Ultimas are fun," Garriott says, "because everything from the moment you open the box is there to compel you to believe that you might really be going to a real place. The fiction of the whole game is there to support the reality of your escape to the world of Britannia."



Roberta Williams' King's Quest series is interactive fiction.

And Still More Fun

Name: Dan Bunten

Recent Release: *Command HQ* from MicroProse

Other Games: *M.U.L.E.* and *Robot Rascals*

Bundle up all the elements of a good game and give them a vigorous shake. What sifts through is a special kind of growth that comes from having a good time.

"Fun is not a fatuous activity," says Dan Bunten. "Fun is the meter on your emotional state. Fun is the summary feeling that you've got, but what's contributing to that are unexpected opportunities for growth."

According to Bunten, fun takes on an important role as an indispensable part of our lives. "It's a characteristic of intelligent species to engage in activities for which there seems to be no reward," he says.

"As a culture, we class those activities as play. Those are things that don't have any extrinsic reward. The reward is all intrinsic."

He explains why we need fun. "As intelligence rises, the need for stimulation also rises," he says. "For every brain, there is an optimum level of arousal that your brain wants to get to." If your brain doesn't reach that level during the day, you've got to play.

By consuming your daily quota of stimulation, you promote your psychological and spiritual growth. You can also expand your intellectual capacity. "Some things have a certain amount of depth that pushes you, makes you think a little deeper than you have, makes you study a little more, makes you connect with things outside of the game environment."

According to Bunten, when you become completely absorbed by a game that pushes you to your intellectual edges, you feel like what you've done is more deeply significant than what you would have done otherwise. He asserts, "Because of the richness of the environment, the connection to outside, real-world experiences, you come away with a more profound experience than you would have had without those elements—even if the entertainment value is equivalent."

Good games are good for you, by Bunten's account. Fun is a vitamin for the mind, essential nourishment for your intellect. Or perhaps Reiche comes closer to the truth when he says, "A good computer game is pretty much the same thing that games were always meant to be: something to wile away some time with."

But whatever your rationale, whatever your excuse, don't worry. A little fun never hurt anybody.

HEIDI E. H. AYCOCK

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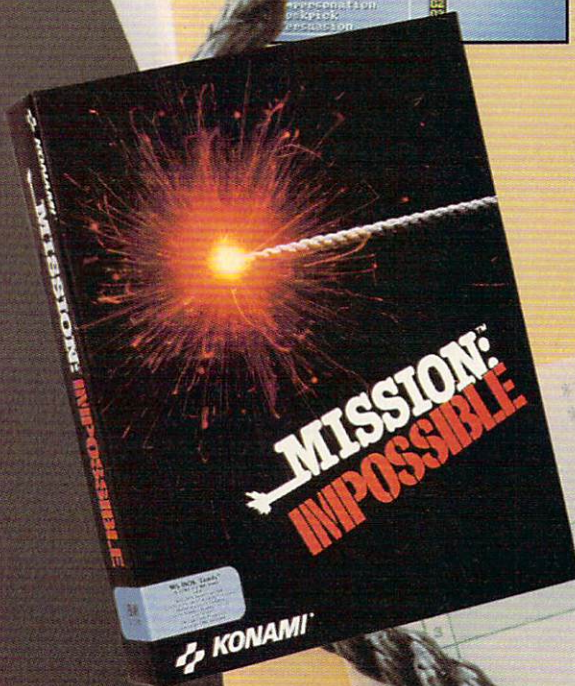
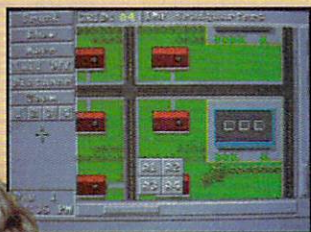
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Circle Reader Service Number 136

COMPUTER GAME ETHICS

WHAT CULTURAL VALUES DO COMPUTER GAMES COMMUNICATE TO THEIR USERS?

Consider these notes from the computer-gaming press:

In 1983, Atari seeks to halt the distribution of *Custer's Revenge*, an independently produced game in which the player's objective is to rape an Indian woman bound to a post.

In 1987, one of the most popular Macintosh programs on the market is *MacPlaymate*, an

adult-oriented game in which the player undresses an animated woman and stimulates her with a wide variety of sex toys.

In the summer of 1990, California Assemblywoman Sally Tanner introduces a bill to prohibit the depiction of alcohol and cigarettes in computer games distributed in the state. The bill is defeated in committee.

In 1991, an underground game creates a small flurry in the American computer press. The game, which is circulated on BBSs in Europe, puts players in charge of a Nazi concentration camp and rewards them for the quantity and brutality of their executions.

For game designers, software publishers, and parents who are already uneasy about their children's all-encompassing Nintendo obsessions, news items like these strike an ominous chord. As the novelty of personal computers wears off and electronic games find their way into the mainstream of American culture, thoughtful developers and consumers are starting to face the tough ethical questions. What effect do these games have on kids? Why are they so violent? And, perhaps most centrally, what cultural values do computer games communicate to their users?

The questions aren't new, but they're becoming more pressing as the market grows. The time is fast approaching when game designers and publishers must reckon with



In *Loom* from Lucas Film Games, you can't die.

the moral questions that have dogged their colleagues in other media for decades.

Is the Medium the Message?

"Computer games are definitely not value-free," asserts Chris Crawford, a veteran designer noted for the strong ethical content of his games. "We can't argue that they're mindless entertainment with zero moral value, because it's obvious that there is some form of cultural communication going on whenever someone sits down to play a game. And I think it's very appropriate for people to be concerned about what messages are being communicated."

Roberta Williams, head of development for Sierra On-Line and designer of dozens of games for both children and adults, agrees. "Computer games communicate values the same way any other medium you watch or participate in—movies, books, TV, or magazines. And I'm not convinced that we should hold games to any different moral standards than we hold the movie or TV industries to."

According to Crawford, computer games do get extra scrutiny, mainly because they're perceived as children's entertainment. "Freedom of speech is paramount when you're creating entertainment for adults, who are better able to accept or reject the values presented to them. But we've also established the legal principle that freedom is appropriately re-

strained when you're addressing children. Right now, computer games are closely associated with children, and I think that the public debate about their moral content comes largely out of that association. Our image as a 'kiddie medium' gives us increased exposure to censorship."

Death, War, and Gore

As any parent can tell you, most of the ethical concerns about computer games centers around their notoriously high levels of violence. "It's the one issue that cuts directly to the heart of the industry," says Crawford. Computer game violence comes in a variety of flavors, including the following.

Repetitive death games in which the player's character dies over and over. After each "death," you typically insert another quarter or reload the saved game and start over. (Nervous adults have expressed concern that kids who spend too much time with driving simulations might actually think you can drive that way.)

Military games that simulate (and some say glorify) war. "A goodly portion of Americans find the rather strident militarism of these games objectionable," says Crawford, who has designed several war simulations. "They often present war as an exciting adventure, a noble quest by brave men and women. In short, they tell the player that war is fun."

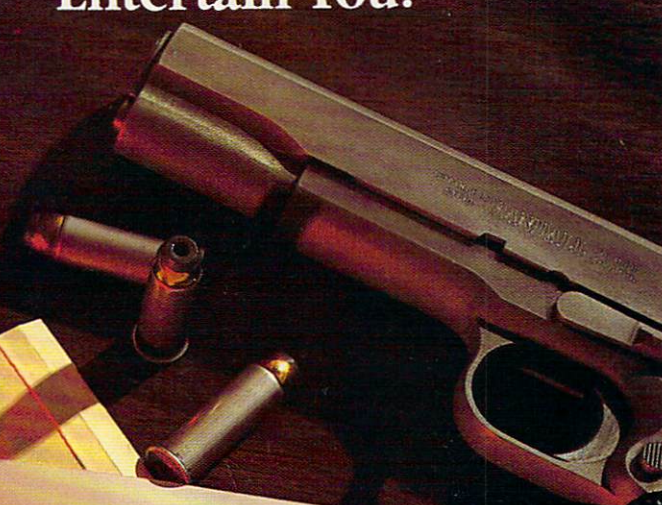
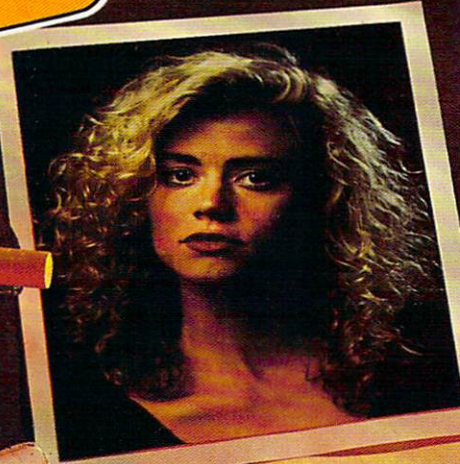
In his games, Crawford attempts to redirect this message by working some humanity into the manual or right into the game itself. Take, for example, his upcoming game, *Patton Strikes Back*.

"After each major battle, there are these interruptions that stop the game to tell you personal stories about Patton and other people in the war—how this battle affected them personally. Some of them are quite graphic. People will still be en-

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8

SEPT. 2039

New Case:
• MARSHALL ALEXANDER
• DAUGHTER MISSING
• MINING ON MARS

I DON'T TRUST HIM!

DAY OF THE YEAR
251

THURSDAY SEPT. 8

DATE RECORDED
114



IF OUR IDEAS OF CONFLICT ARE LIMITED TO VIOLENCE, WE'VE GOT A LOT TO LEARN ABOUT GAME DESIGN

tertained, but I hope they also walk away with a deeper sense of how horrific a real battle is."

Sid Meier of MicroProse, a company known for its war simulations, takes a different attitude. "You can make a case that war is full of terrible consequences—but I don't think that's news to anyone. There are a lot of movies and books about war, with a lot of different points of view. And I think that's because 'war is terrible' is not the only lesson to be learned; there's also the decision making and leadership and personal growth that occur because people have been through that situation. In our simulations, we want you to come to understand the decision process, the tradeoffs that are involved, the kinds of things people in battle are faced with.

Shoot-'em-up games in which the object is to blow away everything that moves. "It's instructive that all the early computer games were shoot-'em-ups," notes Meier. "In the beginning, it was just technically easier to do those kinds of games. And people didn't know what computer games were all about, so you had to make it clear who the good guys and the bad guys were. It's easy to do that in a battle context." These days, notes Meier, the last bastion of the shoot-'em-up is "your classic Nintendo game, where violence is the focal point of everything that happens."

"This sort of generalized bloodthirstiness, which a lot of games have, makes people very uncomfortable, and I think rightly so," muses Crawford. "This sort of rampant, dehumanized killing generates an aura of tawdriness that does our industry no favors."

Blood and gore. Designers are widely divided about the morality of

showing up-close-and-personal scenes of blood and death. "Of the games I've done, I've stayed away from gore; I don't think it adds anything to the game to show blood and arms and legs flying around," says Meier.

Tom Loughry, who designed the close-range combat simulation *Gunboat* for Accolade, wrestled long

to create game conflict, which is why you see so much of it. But I don't buy the notion that you need it to create dramatic tension. There's almost always a more elegant way to move the plot along if the designer is willing to think a little more creatively. Our perception is that people equate death with failure. And failure is not fun."

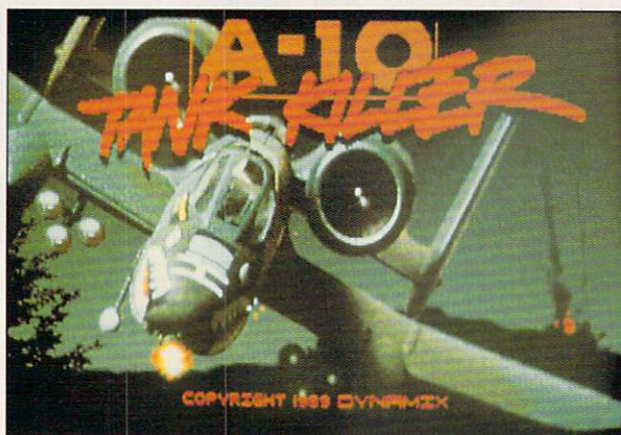
Among Moriarty's more recent games is *Loom*, "which took this idea even further—not only can't you die, you can't fail. The fun of the game is in making choices for your character. Like all good stories, it also has a strong moral.

"After all, computer games do teach people things about the world," he concludes. "If our ideas of conflict are limited to violence, we've got a lot to learn about art, storytelling, and game design."

Moriarty, Crawford, and Williams project that shoot-'em-ups, war games, and other types of violent games will soon be only small niches in a much broader market. In fact, the game shelf at your local Egghead might ultimately be as diverse as your local video rental store with a full spectrum of comedy, drama, mystery, adventure, and children's software. And the analogy may extend one step further to include X-rated adult games behind a curtain in the back of the store.

For Adults Only

Games with strong sexual content have been around almost as long as personal computers. Along with the infamous *Custer's Revenge*, the more notable efforts include *Interlude*, a 1982 text adventure that contained several X-rated scenarios; *Leather Goddesses of Phobos*, a 1986 game that was actually a lot tamer than its hype led one to think;



A-10 Tank Killer from Dynamix is a typical war game.

and hard before coming to the opposite conclusion. "The fact is, when you shoot people, they bleed and die. You're not telling them the truth about war if you sanitize the death scenes."

Why are computer games so violent? According to most of the designers interviewed, they don't need to be. "Violence is a symptom of lazy design," asserts Crawford. "All games must have conflict of some kind, and violence is the most direct and intense form of conflict there is. As the industry matures, we should move away from it, but for that to happen, people have to make the effort to design games that take other approaches."

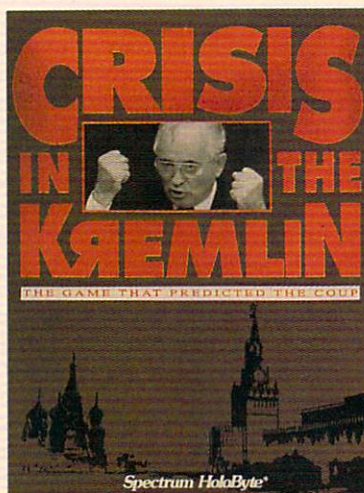
Several thoughtful designers and publishers are already making the effort. "We've all but banned death from our games," boasts Brian Moriarty, a senior game designer at Lucasfilm Games. "The possibility of death is a convenient and easy way



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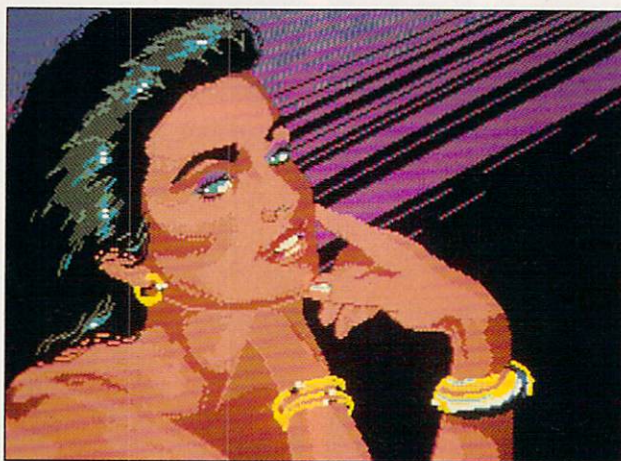
WE DECIDED AT THE TIME WE DID LARRY THAT THAT WAS OUR ABSOLUTE LIMIT

and Sierra's Leisure Suit Larry series, a tacky spoof on the hot-tubs-and-gold-chains singles lifestyle.

Perhaps the most famous of all, however, are *MacPlaymate* (1986) and its second incarnation, *Virtual Valerie* (1989). "They're probably the most pirated games in the history of Macintosh," sighs creator Mike Saenz, who cobbled *MacPlaymate* together in just three days. "I don't even think the games were very erotic. I did them for a laugh because I think the idea of interactive sexual computer entertainment is patently absurd. *MacPlaymate* was a spoof of all the fetishistic trappings of the average male's preferred sexual imagery."

Saenz says there's no question that his two products objectify women as sexual playthings. "It's like having your own 'Stepford date-on-a-disk'; you don't even have to send her roses," he muses. "But I was hoping that the absurdity of it would sink in, that by putting it into such bold, simplified relief, men would realize how unreal it is to expect women to behave that way sexually. I was hoping to make some of this outrageousness clear. But I overestimated my audience; it ended up in the hands of a bunch of nerdy guys who'd never talked to a woman besides their mother."

Although it seems that there are always one or two popular adult-oriented games on the market at any given time, most mainstream publishers regard X-rated games as a very small niche. "Every company has its moral or ethical limits," says Williams. "There might be some company that decides it wants to make money doing *Playboy*-type games. But that's not what Sierra is about. We decided at the time we did Lar-



Sierra's Leisure Suit Larry series offers mild adult humor.

ry that that was our absolute limit, as far as the R-rated stuff is concerned."

Williams adds that some of her designers approached her about doing a more explicit game, but she refused. "It's not just that I don't like the way women are portrayed in these games. It's also that we'd be shooting ourselves in the foot if we sold them. We might sell quite a few to the men who buy that kind of thing, but over the long run, we'd lose the respect of our market. Even those same men would hesitate to buy our kids' games for their families—and women wouldn't go near us. It would be a long-term loss for us. If some other company decided that that's who they were, fine, but we're in the business to make software for everybody."

Saenz admits to feeling a similar backlash. He recently published a mainstream fantasy game called *Spaceship Warlock*—"an old-fashioned space opera that's nostalgic in a Flash Gordon/Buck Rogers sort of way, complete with sophomorically bombastic dialogue. Unfortunately, if you really try to capture that 'golden age of science fiction' feel, it will inevitably be somewhat chauvinistic, although it looks very liberated compared to, say, the first *Star Trek* series. Still, be-

cause of *MacPlaymate* and *Valerie*, people are looking for me to have this attitude. It turns out that there are a whole bunch of people who love what I do—a lot of closet Mike Saenz fans out there—and a lot of other people who think, 'That guy's sick.' I've been typecast as a terrible misogynist."

Of Demons, Drugs, and Censorship

Sex and violence may be the big ethical issues, but they're not the only

ones. Over the years, the television, film, recording, and publishing industries have felt pressure to watch their language (as in the recording industry's well-publicized debate over parental warning stickers), Just Say No (as part of the federal government's much-ballyhooed War on Drugs), and beware of demons (at the behest of the fundamentalist Christian movement). Through it all, though, computer game developers have managed to stay well out of the range of fire.

You would think that Mike Saenz, for example, would be an obvious target. "But none of the pressure groups seem to have found me yet," he marvels. "I haven't heard from Tipper Gore or Women Against Pornography. I think the hardliners and fascists must be very small groups that exert a lot of focused pressure—and right now they're going after the record companies."

"Sure, we've all gotten letters from parents who scream that hack-and-slash fantasy games are inspired by the devil," concurs Crawford, "but the numbers are so small that we tend to think of it as a marginal concern."

As computer games go mainstream, though, they're starting to attract at least some attention. And,

WORLD OF ELECTRONIC GAMES

A RATINGS SYSTEM WOULD BE USEFUL BECAUSE YOU'D KNOW WHERE BOUNDARIES EXIST

surprisingly, one of the early battle-grounds wasn't violence or sex, but drug abuse. "Drugs and tobacco just aren't usually a part of the context of most games," says Moriarty. Crawford echoed this, adding that "sometimes players will come across a vial that says, 'Drink me,' like in *Alice in Wonderland*, and you float over the river or something as a result of taking it. But nobody's ever suggested that this promotes drug abuse."

Because designers and publishers regard drugs as such a non-issue, the introduction of California Assembly Bill 3280 in June 1990 took them completely by surprise.

The bill, introduced by Assemblywoman Sally Tanner (D-El Monte), would have prohibited designers from placing any alcohol or tobacco company logos in games or showing characters holding or using alcohol or tobacco products. Even though it was drafted with the loftiest of intentions, the computer game industry was quick to perceive a threat and moved quickly to block the bill. "We ship a children's product called *Mixed-Up Mother Goose*, which has been widely used in classrooms for years," says Williams. "In the game, King Cole loses his pipe, and the child helps him find it. It didn't make sense. Under this bill, reading a book of nursery rhymes would be perfectly legal, but I could go to jail for animating the same nursery rhyme. I don't like my kids seeing people smoke or drink, either, but to be restricted where other media aren't isn't fair."

A Kinder, Gentler Future?

All the designers and publishers interviewed for this article were optimis-

tic that the ethical nature of computer games will continue to improve as the audience broadens in numbers and sophistication.

"Right now, we're locked into a traditional, hobbyist market that has a specific set of expectations about the kinds of games they want," Moriarty observes. "A lot of us want to move beyond those expectations

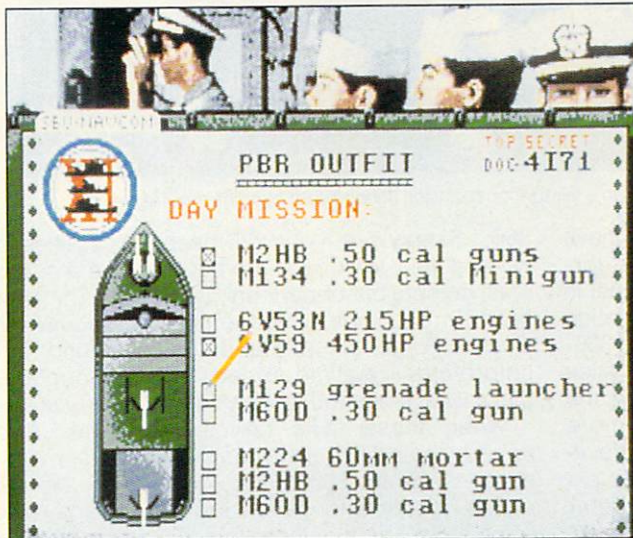
games are categorized as either adult games, like *Leisure Suit Larry* and *Space Quest*; family games, like *King's Quest*, that children and parents will likely play together; or children's games, in which blood, death, and violence are entirely banned. "Our goal is to make software for everyone," says Williams.

There's also widespread talk of an industrywide rating system, based on the system the MPA uses to rate movies. "We're kind of in this window where we don't have a ratings system yet because we're still a new industry and not all the pieces are together," Saenz says. "But I think a ratings system would be useful because you'd know where boundaries exist and it would help both the developers and the audience clear up a lot of the confusion in the marketplace. I don't want to limit freedom of expression, and

a rating system might be one way to protect it."

Crawford points out that, as with books and movies, the truly outrageous games appeal only to very small and specialized niche markets. (The numbers bear this out. *MacPlaymate*, despite its tremendous popularity, was only available through mail order. The concentration-camp game is only distributed via BBS, and no American game designer interviewed had actually seen it.) "Mass marketing will be the key to improving the ethical climate in computer games," Crawford predicts. "You can only push people so fast, but the messages we communicate will certainly improve as we slowly learn how to design games for a larger audience."

SARA REEDER



Accolade's *Gunboat* doesn't sanitize death scenes.

but feel held back. Still, I'm convinced that there are a lot more computer owners out there who are interested in using their machines for entertainment but aren't attracted to the traditional offerings."

He's pleased that *Loom* has been very popular with first-time gamers and women—two groups outside the core market—but complains that publishers are often reluctant to support games that fall outside of standard genres, even if they might open up the world of computer gaming to a broader market.

As game developers look toward the big time, they're taking their cues from the film and recording industries. Many publishers have long adhered to their own internal standards. At Sierra, for example,

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THE TIME WHEN A 286 WITH A 40MB
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THE LATEST SHOOT-'EM-UP IS FADING FAST

Normally when you read about an "ideal" this or a "perfect" that, what you get is a wish list of what someone would buy if cost were no object. This isn't one of those. You hold in your hands a down-and-dirty survival guide to playing state-of-the-art computer games in the 1990s. All the more exciting and frightening because it covers only the basic necessities, this guide puts you on the road to the upper limits of gameplay on the PC.

As inconceivable as it may have sounded just two or three years ago, the following statement is now true: In order to play the newest generation of computer games, you need a 386-class machine. Sure, plenty of titles still run on 286s or even XTs, but the next wave of games, even more than the current crop, will need everything the 386 has to offer. The expectations of today's computer game players contribute to this headlong rush toward high-end machines. People demand wall-to-wall VGA graphics, sound, and animation.

Fred Schmidt, general manager of Origin Systems, says it's all quite simple. "If you're going to have graphics and sound moving at high speed, then you need a 386." He means it. Most of Origin's recent major releases basically require a 386 to run satisfactorily. *Strike Commander*, *Ultima VII*, and *Wing Commander II* all warn buyers that they need at minimum a 12-MHz 286 to run, but even then, Schmidt admits, the games' performance on those machines tends to be unacceptably slow. "The settling point for writing games is now a 16- to 20-MHz 386."

John Williams, vice president of marketing at Sierra On-Line, agrees. "This is the... shame of the system right now—VGA is so far ahead of the machine that it necessitates a



Origin's *Wing Commander II* has hefty system requirements.

386." Simply put, your 286-based PC and your VGA card are not the most compatible of partners. David Bradley, developer of *Bane of the Cosmic Forge*, allows that the 386 chip offers "realtime speed, and that's what's needed for realism."

When these folks talk about speed, they don't just mean chip speed. A 16-MHz 386SX chip, for example, moves information around twice as fast as a comparable 286. On top of that, a 386DX moves that info out twice as fast as its SX cousin. That makes it at least four times as fast as a 286 with the same clock speed. This striking speed advantage allows animation at a realistic rate. A 486 is faster still, but no one expects games to demand 486s for another four or five years.

Today's game machine demands VGA color. A high-resolution video mode that also allows 256 colors to be displayed on the screen at the same time, VGA exhibits dramatic improvement in sharpness and clarity over EGA graphics. VGA comes in a number of different flavors, but as a gamer, your VGA or Super VGA (SVGA) card should have at least 512K of video RAM (VRAM) on board, which handles higher resolution and more colors. Of course, you'll also need a VGA or multisync color monitor to go with the card.

Most game producers now add sound effects and musical scoring to their work, but to hear these, you need a sound card. Sound cards sport everything from low-end synthesizers on a chip to the glorious Roland MT-32, a full-powered synthesizer in a box. Games that support one board may not support another, though most support the Ad Lib board—the de facto standard.

There are still three major items to go. Two of these are absolute necessities today; the third is going to be a necessity very soon.

The problem with all of this gorgeous, cinematic animation and sound is that it consumes an enormous amount of disk space. *King's Quest V* fills over 9 megabytes; *Falcon 3.0*, 8 megs; *Trial by Fire*, more than 4 megs; and *Bane of the Cosmic Forge*, about 3 megs. Most impressive computer simulations, adventures, and role-playing games today begin at about 3 megs. With DOS, *Windows*, and one or two other "serious" applications installed, a typical 40MB hard drive only has room for two or three of the newer games before it runs out of space.

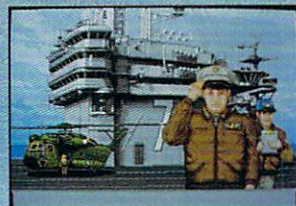
Asked what size hard drive he'd put in a PC game machine, Sierra's director of engineering, Chris Iden, recommends 80 megabytes—minimum. Other experts feel 100 megs would leave room for comfort. So add a jumbo hard drive to your list of necessities.

Don't think you can get along on just 640K of RAM, either. *Wing Commander*, for instance, needs a full meg in order to take full advantage of the game's sound. Soon, games demanding two megs of memory won't be uncommon.

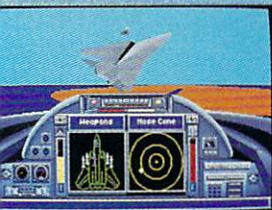
Finally, we arrive at the one piece of optional equipment that will be a ne-



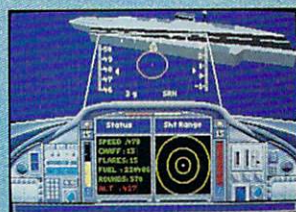
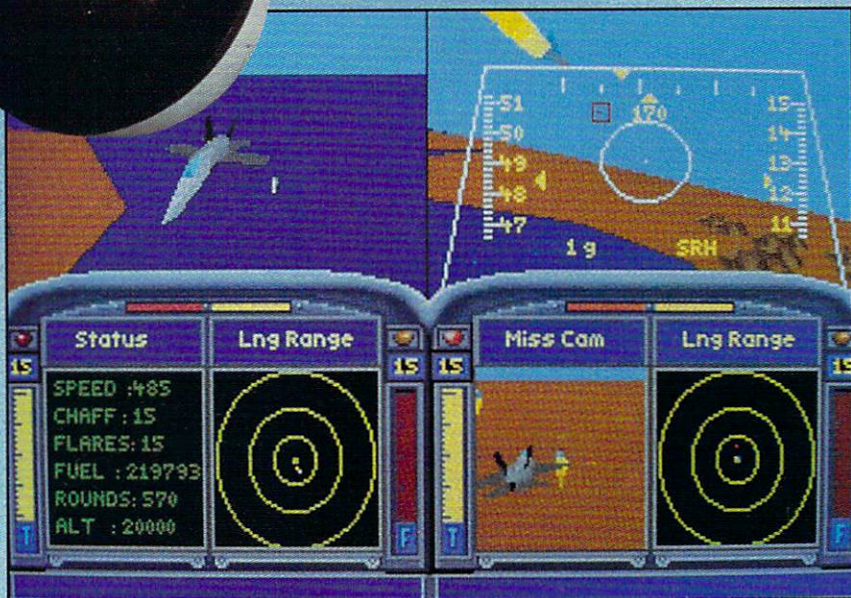
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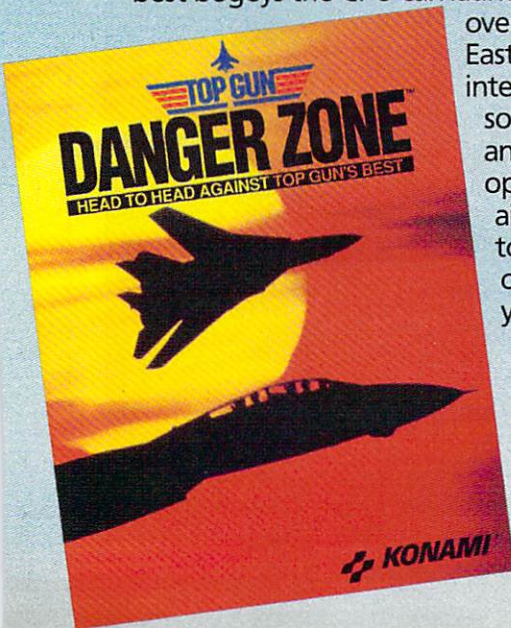


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WORLD OF ELECTRONIC GAMES

THE ADVENT OF THE CD-ROM IS FUELED BY ECONOMY—IT'S MUCH CHEAPER TO PRODUCE A CD THAN DUPLICATE A DOZEN FLOPPY DISKS

cessity before we get the shrink-wrap off this year's latest and greatest games—a CD-ROM drive. The first trickle of CD-based games from major publishers began at Christmas. Soon you will see a steady stream.

The reason for CD-ROM's inevitability, in a word, is money—the cost of duplicating each disk in a game box (over \$1 per disk in many cases) multiplied by the large number of disks it takes to contain one of these monster games. Then there's the added cost to publishers for shipping the heavier boxes. It's no longer economically feasible to ship large games on floppies when publishers can put significantly more information on a CD-ROM that can be duplicated much more cheaply.

Also, the cost of developing these games with all the sound and animation has broken the \$1 million barrier. This adds up to a retail price of \$70 to \$80 on many new games. That, too, is frightening. Schmidt comments that customers can't afford to pay any more. "From now on, [CD-ROM] is not a novelty; it's a requirement. In two years you won't see products from major companies shipped on disk." Williams agrees. "CD-ROM is inevitable. Most games will be shipping on it in two years."

How much will your next gaming PC cost? Today, including a CD-ROM drive, somewhere in the vicinity of \$600 to \$800 more than a basic 386 with VGA and a hard drive—a price that has dropped to well under \$1,500. The extra cost moves closer to \$1,000 if you upgrade from an XT or a 286.

As demand increases, spurring competition among manufacturers, hardware should cost you less. For your money, you'll receive a serious computer with enough power to desktop publish, prepare presentations, and run a business—all without stretching the limits of what you really bought the machine for—playing the best of the newest games.

PETER SPEAR



Falcon 3.0 from Spectrum HoloByte requires 8 megs of disk space.

CD-ROM SOFTWARE

Despite the small numbers of CD-ROM players, some entertainment software is already available. Most titles available now are what Nolan Bushnell (former head of Commodore's CDTV division) calls shovelware; floppy disk software placed on CD-ROM.

Currently, the TurboGrafx-CD and CDTV have the most titles available. Some new products for the TurboGrafx-CD, such as HudsonSoft's *J. B. Harold Murder Club* and Cinemaware's *It Came from the Desert*, were due to ship for Christmas of 1991. In total, there are about 15 titles available or announced for the TurboGrafx-CD.

Over 100 titles have been announced so far for CDTV, with entertainment software as the largest category. Among others, Disney, Interplay, and Maxis announced CDTV titles. Lucasfilm announced three titles for CDTV for Christmas of 1991—*Loom*, *Indy III*, and *Monkey Island*. CDTV *Loom* combines an audio drama with the game and presents every line of dialogue in 16-bit digital stereo. This version sports revised graphics, too.

Several companies, including Brøderbund, Sierra, Maxis, and Virgin Games, have announced products for the MPC standard. Sierra will put its best-selling adventure game titles on CD, including *King's Quest V* (which

will require three CDs!). Expect a number of entertainment titles for the MPC standard by early 1992.

A few CD-only games are being developed by some publishers. ICOM Simulations produces *Sherlock Holmes Consulting Detective* for a variety of CD-ROM systems, including the TurboGrafx-CD, CDTV, and the MPC. This mystery game features video of actors in costume on period sets. Reactor's *Spaceship Warlock* is one of only a handful of CD-ROM games that are available for the Macintosh. It contains well over a hundred megabytes of graphics and sound to take you through an interstellar adventure. The elaborate high-resolution graphics and animations prove quite compelling.

Look for a pure CD-ROM title from Trilobyte for Virgin Games. Tentatively titled *Guest*, this horror game is designed for the upcoming MPC standard (with versions possible on other CD platforms). *Guest* uses the full audio and video capability of the MPC to create an atmosphere of terror. The game contains an entire 22-room mansion modeled in 3-D, along with digitized video and sound.

Undoubtedly, many more CD titles are under development for each of the systems discussed, but most companies dislike talking about future projects. We'll just have to wait and see.

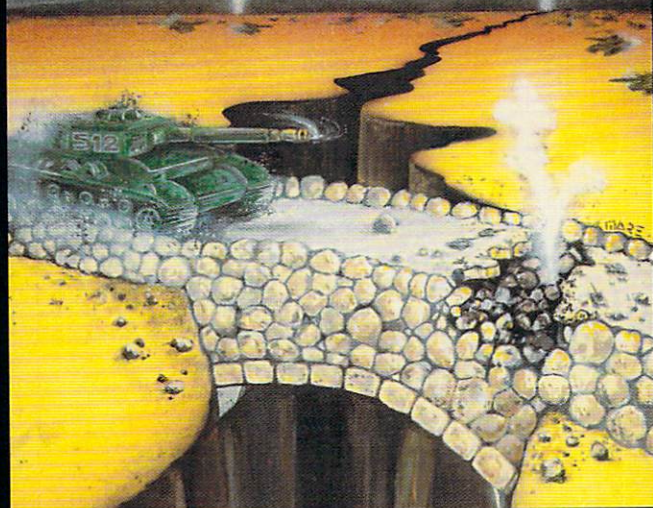
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GAMEPLAY

Howard Millman

THE GAMES USERS PLAY

The single most important factor fueling the accelerating success of computer games is their ability to substitute variety for routine. As a means to put your brain in neutral, idle the cares of the day, or drive away boredom, electronic games have no legal equal. Like the magic genie imprisoned in a bottle, your computer remains poised to release its silicon sorcery to entertain on demand.

The advantages of recreational software over more traditional games are many. Unlike sports, they can be played alone. While most other forms of gameplay from football to Monopoly encourage mixing and mingling, computer games promote isolation. Then again, unlike static board games, computer games are dynamic; they can deliver nonstop action, realistic sound, and vibrant color.

Jay Novins, a White Plains, New York, psychiatrist, recognizes the value computer games have in relieving bore-

dom but echoes a caution that was sounded a decade ago, when electronic games meant Atari 2600 and Colecovision: Don't overindulge or let games become an obsession. Novins says playing computer games is "fine so long as it's in the context of a healthy lifestyle. That means keeping it in balance. Otherwise, this constant interaction with a machine can lead to a self-imposed isolation."

What's wrong with wanting to be by yourself? Is a desire for solitude necessarily unhealthy? That depends on whom you're getting away from and why.

Roger Kallhovd, chairman of the Department of Psychiatry, Phelps Hospital, North Tarrytown, New York, likewise stresses moderation to avoid unpleasant side effects. "Yes, computer game playing can lead to isolation and withdrawal. Many games are deeply absorbing and entirely solitary activities," he says. Some of the complaints he hears about computer games are "from wives who complain that their husbands spend so much time with their computer games [that] they exclude other kinds of interaction." I didn't ask him to elaborate, but the computer widow (or widower) has taken a place in our society right beside spouses widowed by football and golf.

According to mental health professionals, occasional short-term solitude is beneficial. However, ongoing lack of social interaction can lead to isolation, particularly among those who already tend to shy away from social situations.

Steven Witzl, vice president of marketing at Access Software, comments that traditionally "people all across America communicated by sitting on the front porch. They talked with each other. Now

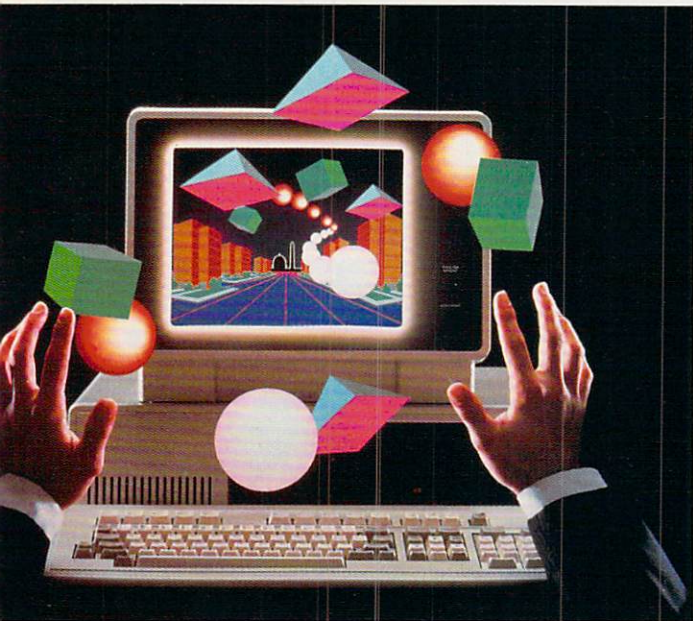
that's gone, taken away by the speed of everyday living and replaced with technology." Witzl sees technology both creating and solving the problem of isolationism. "It helps people keep pace with the faster lifestyle we've adopted. It helps them relax." Computer games can help people relax by enabling them to focus on completing more passes in a football simulation, amassing a taller mound of dead mutants, or even getting higher marks in geometry.

Educational software disguised as games will capture and hold a student's interest. Compared to learning by rote, learning with colorful, dynamic computer screens will prevail every time. Judith Bliss, president of Mindplay (a producer of educational software in Tucson, Arizona), asserts that educational software needs to be fun. "As with adults, life for children is filled with stress. Relief from that stress is healthy and beneficial." Software that entertains "will more effectively communicate its educational message," says Bliss. The range of educational software extends from teaching first graders reading skills to teaching astronauts how to pilot the space shuttle.

Tomorrow's multimedia technology will present mind-bogglingly realistic and innovative games. Online services like America Online and the Sierra Network will allow us to interact socially while playing computer games.

Beyond bolstering intelligence, game playing builds confidence. According to Novins, "It imparts a sense of accomplishment and mastery over the environment that can increase self-esteem." Game playing can enable players to become symbolically triumphant over others, an important, perhaps necessary victory for some. □

Guest columnist
Howard Millman takes a
look at the
psychological aspects of
computer games.



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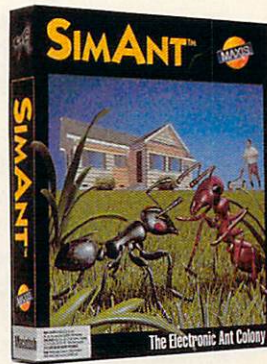
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Macintosh and VGA screens shown. Available for Macintosh. DOS version available soon. SimAnt, SimCity and SimEarth are trademarks of MAXIS. ©1991, MAXIS. All rights reserved worldwide. And then some. CMP192



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64/128 VIEW

Two new COMPUTE disks offer great graphics and powerful utilities for your 64 or 128.

Tom Netsel

It's been said that one graphic is worth a thousand bytes. If that's true, don't bother reading this message; just order our *Gazette Graphics Grab Bag* and see for yourself. We've compiled a collection of tools for the 64 and 128 that can soon have you turning out impressive graphic demonstrations and works of computer art.

You say you aren't the artistic type? If the left side of your brain is the dominant side and you prefer logical and practical programs, then check out our *1992 Best of Gazette Utilities*. These programs will help you seize control of your operating system.

Here's a brief look at some of the programs on these disks. Let's start with the *Grab Bag* and some of its programs.

Artists can bring their hi-res graphics to life, producing smooth 3-D animation with *64 Animator*. There's also a 128 version.

Screen Maker lets artists and programmers streamline the construction of custom screens. Packed with features, this fast and efficient program offers joystick operation, a palette of colors, and lots of characters. A separate subroutine makes it easy to access your custom screens from BASIC.

Screen Designer 128 lets 128 owners create impressive text and graphic screens on their machines. These screens can also be sent directly to Commodore odd-series or compatible printers.

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Starburst Graphics; then sit back and watch colorful graphics fill your screen.

With *Supratechnic* you can take the 64's video chip beyond its natural limits, and *VDC Graphics* adds nine new commands for BASIC 7.0 to let you control bitmapped graphics on the 128's 80-column screen. Then use *Dissolve 128* to make them dissolve in and out of view. Show off a number of images with *Super Slideshow*. This program displays both hi-res and multi-color files in 13 formats.

Special editions of Bruce Bowden's *Graphic Assault System* (separate versions for the 64 and 128) give you exceptional power to manipulate 40-column graphic images. Create your own or load popular-format graphics or sprites, and then invert them, flip them, reverse them, mirror them, rotate them, and experiment with many more techniques.

If utilities appeal to you, then go for the *Best of Gazette Utilities*. This outstanding collection includes BASIC enhancements, an assembly language editor, a 1541 speed enhancer, a BASIC compiler, a character editor, a scientific calculator, and much more.

Try *MetaBASIC*, *Quick*, *Sprint II*, *Ultrafont+*, *RAM-Disk*, *BASSEM*, *SciCalc 64*, *List Formatter*, and *MegaSqueeze* to add punch to your programming library.

These disks are \$11.95 each, plus \$2.00 shipping and handling. Look for an ad in this section or order by writing to COMPUTE's Utilities, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. □

GAZETTE

64/128 VIEW

G-1

Two new COMPUTE disks offer great graphics and powerful utilities for your 64 or 128.
By Tom Netsel.

FEEDBACK

G-2

Questions, answers, and comments.

FLYING COLORS

G-6

If you're frustrated by the 64's color cell limitations, check the freedom that FLI can offer.
By Bill Pitts.

REVIEWS

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RAMDrive, RAMLink,
and *Elvira, Mistress of the Dark*

MACHINE LANGUAGE

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Logical operations deal directly with the computer's fundamental elements: bits.
By Jim Butterfield.

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Let color liven the winter doldrums.
By Steve Vander Ark.

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Make sure others see you as you see yourself, with digital electronic cosmetics.
By Fred D'Ignazio.

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See what RND can do for sound and graphics.
By Larry Cotton.

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FEEDBACK

Bug-Swatter

There are a couple of errors in *Showdown* (September 1991). When playing the game, bumping the borders too many times can result in an OUT OF MEMORY error. To fix this, in line 510 change GOSUB 530 to GOTO 530.

The other error is similar, but may not cause problems unless the autoplay feature is used repeatedly. It could also prevent a crash just as someone is about to get a perfect score. Change two lines to read as follows.

```
120 H=0: GOSUB 1000: IF H=-1
    THEN 150
1180 H=-1: PRINT "[CLR]":
    RETURN
```

MIKE STYPE
MICHIGAN CITY, IN

The program listing of *Sci-Calcul 64* (June 1991) has a printing defect in the line which starts at address 0DC1. It makes the checksum value at the end of that line appear to be AE when, in fact, the value is AF.

GEORGE VANLANDEGHEM
STERLING HEIGHTS, MI

Cross Aid, published in the March 1991 Gazette, doesn't allow for words to be edited as stated in the article. Here is a way to correct that.

First, load *Cross Aid* as usual, but don't run it. Then enter the following two lines in immediate mode.

```
POKE 2287,20: POKE 3400,201:
    POKE 3401,141: POKE 3402,
    208
POKE 3403,3: POKE 3404,76:
    POKE 3405,70: POKE 3406,8
```

Save the program with a new name before running it. When you want to delete or change words, use Shift-Return and then, where necessary, the Del key. Use the cursor key if more than one word is displayed, and, finally, press Re-

turn when your changes have been made. Avoid using the Run/Stop key during operations as it ruins the database.

DOREEN HORNE
BRISBANE, QUEENSLAND
AUSTRALIA

Our copy of the program permits editing as the article states, so it's difficult for us to test your correction. If any reader has trouble editing previously saved words, however, give these pokes a try.

Sequential Arrays

I have been trying unsuccessfully for the last year now to write an array to a sequential access file while in BASIC. What am I doing wrong?

NEIL F. COPEL
PLANT CITY, FL

The following BASIC program illustrates how to write numeric and string array data to disk, then read them back.

```
XX 10 POKE 53280,6:POKE5
    3281,6:PRINT"[CLR]"
    {2 DOWN}{N}{WHT}"
DS 20 DIM NA(100),ST$(10
    0),N2(100),S2$(100
    )
SQ 30 INPUT"WHAT NUMBER
    {SPACE}(USE 99 TO
    {SPACE}STOP)";XX
SF 40 IF XX=99 THEN 60
DJ 50 NM=NM+1:NA(NM)=XX:
    GOTO30
CQ 60 INPUT"WHAT STRING
    {SPACE}(USE 99 TO
    {SPACE}STOP)";YY$
XG 70 IF YY$="99" THEN 9
    0
AX 80 SG=SG+1:SR$(SG)=YY
    $:GOTO60
DG 90 PRINT"WHAT DATA FI
    LE NAME DO YOU WAN
    T?":INPUT NA$
XG 100 PRINT"SAVING THE
    {SPACE}DATA..."
PH 110 :
FE 120 REM WRITING THE D
    ATA OUT
GG 130 OPEN1,8,5,(NA$)+"
    ,S,W":PRINT#1,NM;
    CHR$(13);SG;CHR$(
    13)
HE 140 IF NM>0 THEN FOR
    {SPACE}XX=1 TO NM
    :PRINT#1,NA(XX);C
    HR$(13):NEXT
```

```
QS 150 IF SG>0 THEN FOR
    {SPACE}XX=1 TO SG
    :PRINT#1,SR$(XX);
    CHR$(13):NEXT
MM 160 PRINT#1:CLOSE1
DQ 170 :
DR 180 REM READING THE D
    ATA BACK IN
CM 190 OPEN1,8,5,(NA$)+"
    ,S,R":INPUT#1,AA,
    BB:REM LOAD ARRAY
    SIZES
MA 200 IF AA>0 THEN FOR
    {SPACE}XX=1 TO AA
    :INPUT#1,N2(XX):N
    EXT
SG 210 IF BB>0 THEN FOR
    {SPACE}XX=1 TO BB
    :INPUT#1,S2$(XX):
    NEXT
GJ 220 CLOSE1
EX 230 :
HK 240 IF AA>0 THEN FOR
    {SPACE}XX=1 TO AA
    :PRINT"NUMERIC";X
    X;" = ";N2(XX):NEX
    T
MR 250 IF BB>0 THEN FOR
    {SPACE}XX=1 TO BB
    :PRINT"STRING";XX
    ;" = ";S2$(XX):NE
    XT
```

In line 10 we set the screen, border, and text colors, clear the screen, and shift to upper- and lowercase mode.

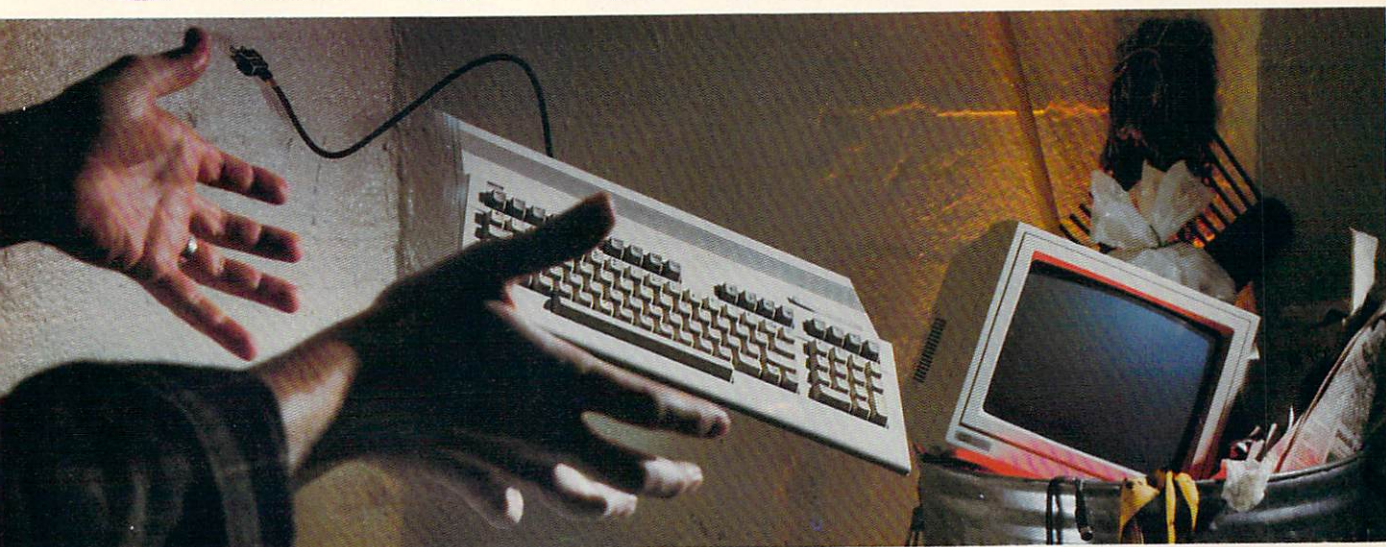
In line 20, we dimension four arrays—two for the original numeric and string data when it is written to disk as a sequential file and two to receive the data when it is read from the disk.

Lines 30-80 comprise two loops for getting numeric and string data. Enter as many numbers as you like. Enter 99 when you wish to stop. You'll then be asked to enter a string, which can be a letter, word, or sentence. It can also be a number that is saved as a string. To stop, enter 99 again. Variables in these loops also keep track of the number of elements in each of the arrays.

The data is saved to a sequential file in lines 130-160, starting with the number of elements in the array. Notice that each datum is delineated by a carriage return,

Questions and
answers
about previous
programs,
sequential arrays,
and more

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CG12

CHR\$(13). The sequential file is saved with the filename you provided in line 90.

In lines 190-220, the data is read from disk and loaded into two new arrays. Lines 240-250 verify that the data was saved properly by printing the loaded values to the screen.

Manuals Needed

I was never into the "computer thing," but recently I inherited some computers that included a 128D, a 64C, and a Plus/4. There were manuals with all the devices except for the Plus/4. Does anybody know where I can get one? Suddenly I am excited about computers.

JIM HOUGH
1107 ARKANSAS AVE.
KILLEEN, TX 76541

You could write to Commodore, Department C, 1200 Wilson Avenue, West Chester, Pennsylvania 19380 and ask if the Plus/4 manual (#310196-01) is still available. The price was \$7.30, plus \$3.00 shipping and handling, but there's a good chance one of our readers will help you find one.

Do Not List

I am writing a text adventure game for the 64. A couple of years ago you published information about a command that could be used to prevent users from listing a program. Can you tell me how to do this so I can keep users from prying into my game?

Also, can you tell me where I can still purchase Infocom games?

DANIEL POLSTON
JACKSONVILLE, AR

One of the more common tricks is to enter a Shift-L after a REM statement on the first line of your program. This will print a syntax-error message on the screen when anyone

tries to list the program.

To answer your second question, try Software Support International, 2700 NE Andresen Road, Suite A-10, Vancouver, Washington 98661. It has a number of new and used Infocom games available. Call (800) 356-1179 to order or request a free catalog.

Uninterrupted Power Source

I recently acquired an UPS Datasield AT 800 which appears to be in excellent working condition. It is my understanding that the unit maintains a constant green light and will emit a beeping sound when the local power to the computer and disk drive is cut off. I'd like to find someone from whom I could obtain a manual or operating instructions.

MERLE WILLIAMS
842 RIVERVIEW LN.
TARPON SPRINGS, FL 34689

We're not familiar with that power supply, but perhaps our readers can help.

More on Printer Ribbons

A few months ago a Gazette reader wrote requesting information about where he could find ribbons for an Okidata 10 printer. I get mine from Quill Corporation, Box 4700, Lincolnshire, Illinois 60197-4700; (708) 634-4800. The price is \$3.49 each. I buy six at a time and pay a total of \$22.72, which includes shipping. You can't beat that.

DURHAM J. "BUD" BELANGER
LAS VEGAS, NV

If anyone is looking for a ribbon for a 1525 printer, try Radio Shack. Ask for the ribbon with stock number 26-1424.

DAN WAGNER
LEWISTON, ID

Missing SYS Address

In your April issue I read about someone's problem

with missing SYS addresses for machine language programs. The following short program may help. After the program runs, insert the disk that contains the program whose address you need, type in the name, and that's it.

```
10 INPUT "[CLR] [DOWN] FILE
NAME";F$
20 PRINT "LOAD ADDRESS IS";
30 OPEN 1,8,1,"0:"+F$
40 GET#1,LS
50 GET#1,HS
60 X$=H$:GOSUB100:H=X*256
70 X$=L$:GOSUB100:L=X
80 PRINT H+L:CLOSE1
90 END
100 IF X$="" THEN X=0: RETURN
110 X=ASC(X$)
120 RETURN
```

JERRY JOHNSON
SUGARCREEK, OH

Thanks for your suggestion, Jerry. Your program does provide the address where a program starts to load in memory, but that is not necessarily the SYS address needed to run it. Of course, that's a good address to try if you can't remember the other. If that doesn't work, however, you may still have to examine the program with an assembler to determine the proper address to make it run. Fortunately, many programmers these days include code that makes their machine language programs load and run like BASIC ones. Another trick before you forget the SYS address is to write your own BASIC loader that automatically loads and runs the machine language program for you.

If you have a question, comment, or problem, we want to hear from you. Send your letters to Gazette Feedback, COMPUTE Publications, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. □

Readers need help with manuals, and others offer tips about SYS addresses and printer ribbons.

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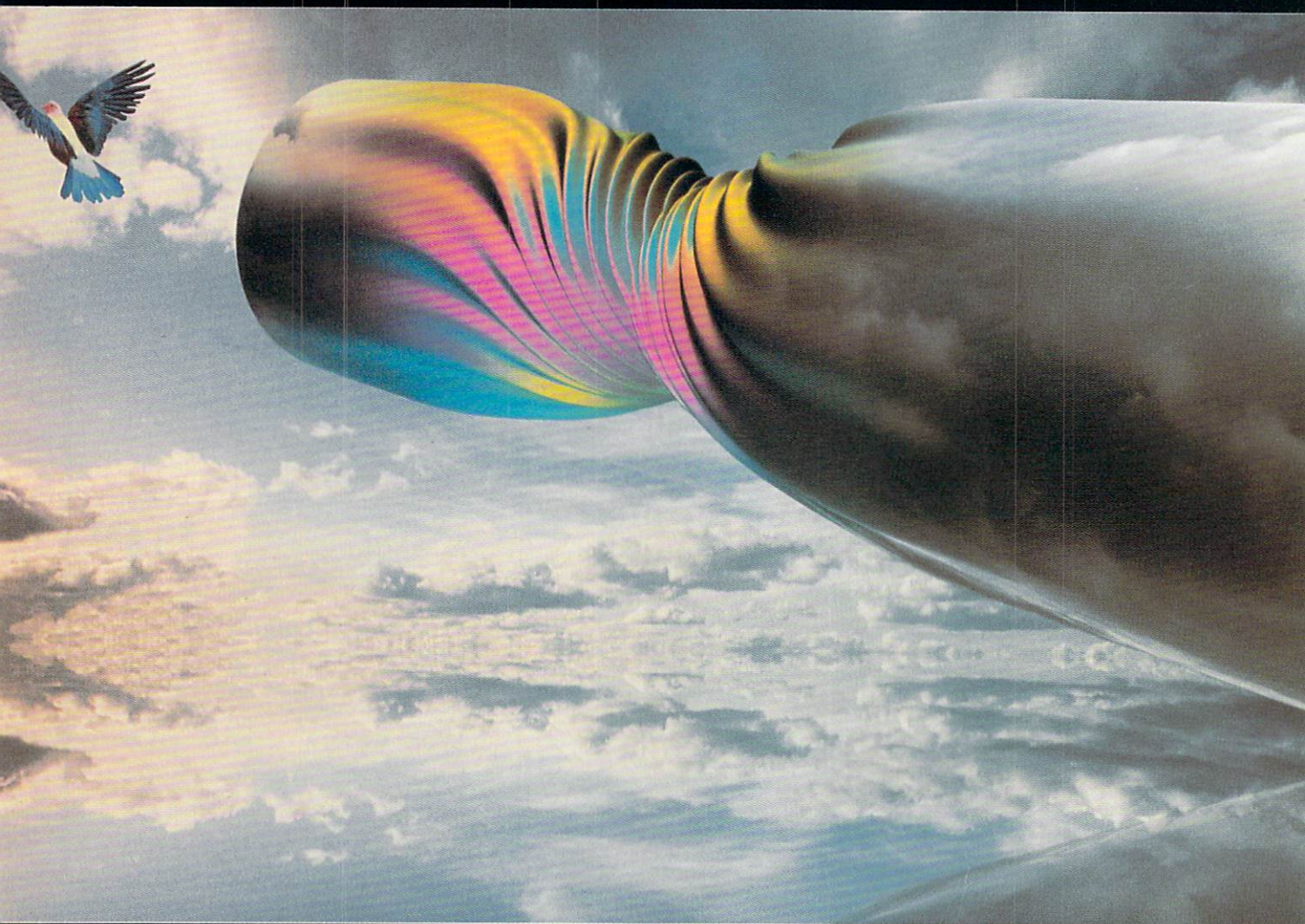


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FLYING

COLORS

Whether you're a beginner or an accomplished computer artist, if you find the color cell limitations of the 64 to be a source of frustration, then I'm sure you'll welcome the added freedom that FLI can offer.

Article by
Bill Pitts



What is FLI? Well, depending on whom you ask, FLI stands for Flexible Line Interrupt or Flexible Line Interpretation. European software producers originally developed FLI to create more colorful logos for their software demonstrations.

What FLI does is to offer the use of all 16 of the 64's colors in each 4 x 8 multicolor (medium resolution) cell. The standard multicolor format limits the number of colors used to four.

Due to technical limitations, which I'll discuss shortly, there are currently no full-blown paint programs that use FLI. There are several FLI editors currently available, however, with each having its own unique features. I'll mention more about them later.

A Little Background

To explain the benefits and limitations of FLI, I'll start with an overview of how the 64 uses color and then explain how this relates to FLI. The designers of the 64 realized that certain compromises would have to be made to obtain the desired range of colors, flexibility, and speed needed to make the 64 the marvelous game machine that it is.

They came up with a unique color cell or card system based on the 8-dot x 8-dot character grid, where each dot or pixel is represented by one bit in memory. This system allowed a palette of 16 colors when other personal computers of that era were hard-pressed to produce four colors.

Hi-Res Mode

This system has several operating modes, but I'm going to concentrate on the so-called color bitmap modes. The first of these is hi-res (high resolution) mode, where we have an 8K area of memory corresponding to the 64,000 bits of a 320 x 200 bitmap screen, divided into one thousand 8 x 8 cells or cards.

In addition, another 1K area of memory must be set aside to hold the information for one foreground and one background color per cell. This is done by dividing each byte (8 bits) in this special color memory into a lower nybble and upper nybble of four bits each. Reading from right to left in binary notation, the first four bits (0-3), the lower nybble, hold the color information for the background color, while the second four bits (4-7) hold the foreground color information. Since the maximum number you can count with four bits in binary is 16 (0-15), that's the origin of the 16-color limitation.

Multicolor Mode

The other bitmap mode, the one we're most concerned with here, is the mul-

ticolor mode, so named because it allows three foreground colors per cell instead of the single color of hi-res mode. Since, as the old saying goes, you don't get something for nothing, there is a tradeoff. That tradeoff is twofold. There is a limit of only one background color for the entire bitmap, and the horizontal bitmap resolution is cut in half, from 320 single-bit dots to 160 double-wide bit-pair dots, with the cells themselves reduced from 8 x 8 to 4 x 8 "fat dots."

Why? Well, if you want two more foreground colors, you're going to need another 1K block of color memory or video matrix. You have to store this added color information somewhere, and you'll need a means of keeping track of where you stored it. That's where the VIC registers come in.

There are only so many registers available in the VIC chip. We now have four areas of color information to manage: the background color—one per screen—and three foreground colors per cell. One of the foreground areas is stored in color RAM from 55296 to 56295 and the other two within 1000-byte video matrices in locations of our choosing.

With all this added information to deal with, we need to do a bit of borrowing from somewhere to point to our stored colors. Now we'll see why the horizontal resolution must be cut in half. With four areas to keep track of, we obviously cannot use the high/low nybble system we used in hi-res. Instead, we get the needed pointers by splitting the eight bits in each graphics bitmap data byte into four bit-pairs instead of the high/low nybbles of hi-res color mode.

We then use these bit pairs (0-1, 2-3, 4-5, 6-7) to control the corresponding horizontal pairs of screen bits (dots). The source of the color nybble that each bit pair points to will depend on the binary number combination contained in that pair, according to the following binary chart:

- 11 - Low nybble of color RAM, starting at \$D800 (55296)
- 10 - Low nybble of screen RAM, (video matrix) often starting at \$0400 (1024)
- 01 - High nybble of screen RAM (video matrix)
- 00 - Low nybble of background color register at \$D021 (53281)

Since we are doing this on a cell-by-cell basis and there are four choices we can make above (one for each of the four bit-pairs), we can have up to four colors per cell, with one being the common background color set at

\$D021 (53281 in decimal).

The other three colors will be whatever we set in the appropriate screen and color RAM maps that parallel our visible screen. If we change any of the color nybbles already set, we will affect all occurrences of that color within the cell that point to that nybble.

For example, if we set the low nybble of screen RAM to 14 (binary 1110), then all bit pairs in that cell that we set to point there (10) would show up as Commodore light blue, number 14. If we change that nybble to 15 (1111), then all occurrences of the 10 bit-pair for that cell would now show up as light gray, number 15.

The Artist's Point of View

So what does all this mean to the artist? Well, let's say you've fired up your favorite drawing program and started work on the ultimate masterpiece. You've carefully shaded the hair and beard in a portrait by judiciously combining brown and two shades of gray (dark and medium) on a black background.

Now, perhaps you decide that a touch of light gray or white here and there would really set this off. So you choose light gray from your palette and click your mouse or joystick button on a dot that you have already set to medium gray. POW! Much to your surprise and chagrin, not only is that medium gray dot now light gray, all the other medium gray dots in that cell have also changed to light gray. You probably think you've done something wrong as you laboriously redo all the changed dots back to medium gray.

You try one more time, and it happens again! At this point, your language may be more colorful than the screen. Welcome to the world of computer graphics! You have just encountered your first color collision or color blowout.

Some paint programs try to get around this problem by preventing you from entering a fifth color or by reverting all instances of the affected color to the background color, which is really no solution at all.

Now the Good (and Bad) Stuff

By now you're thinking there has to be a better way. There is. Suppose we create seven more 1K screen RAM (video matrix) areas, for a total of eight, and set up a way to choose between any one of these color sources as we draw each of a cell's eight horizontal rows.

While we're at it, why not add a special 256-byte area that has enough free nybbles to allow each horizontal screen row (40 cells wide) to have its

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AN ARTIST'S EXPLANATION

The original *Illuminatus* picture accompanying this article only took me an hour or so to rough out using various commands and features of the *OCP Advanced Art Studio*. I can't begin to estimate how much time it would have taken to do it if I'd had to draw it all freehand with a mouse.

To begin with, the actual pyramid shape was created with the triangle option. It actually took me longer to position the cursor exactly halfway between the left and right margins than it did to draw the pyramid.

The bricks were done with the Fill and Pattern Edit commands. The brick wall pattern was slightly edited for color. I changed the color of the red bricks to yellow and the white mortar to black. I used the Line and Magnify commands to isolate the apex of the pyramid from the rest of the pyramid in order to keep from filling the whole thing. Magnify was used again to smooth out the resulting rough sides of the pyramid and to give it a more realistic stepped appearance.

The oval portion of the eye was done by cutting and pasting arc segments of a circle until I was satisfied with it; then the entire oval was cut and pasted inside the apex. From there, it was just a matter of using the Fill and Magnify features to do the detailing.

I'm rather proud of the drop shadow text effect. I've never seen it done else-

where, and it's easy to do with the Exclude option on the *Art Studio's* color menu. Think of the picture as having several planes. There is a background plane (the screen color), a midground plane (the area where the text is written), and a foreground plane (the text itself). In the case of my picture, the background color is black, the midground is brown, and the foreground is light gray. I selected black and brown to be excluded on the Color menu, then used the Cut, Clear, and Paste option to move the text (the foreground) a few pixels up and to the left. The drop shadow effect is the result of the black and brown colors being excluded in the cut-and-paste operation.

I estimate I spent about 20 hours in total work on this picture, mainly trying various color combinations of text and background, and tweaking the pixels of the eye and the star field.

The FLI version was created from the original multicolor picture. Since FLI cannot use the leftmost 12 columns of pixels and the bottom 8 rows of pixels, I used the Cut and Paste options to erase the rightmost six and topmost four pixels. I then centered the picture so that four pixels on the left and four on the bottom would be erased by the FLI editor, effectively producing a balanced, centered picture. The rest of the FLI detailing was in adding 3-D shading to

each brick and some detailing in the background and corners of the pyramid apex.

The FLI pixel tweaking added another three hours or so of work to the picture.

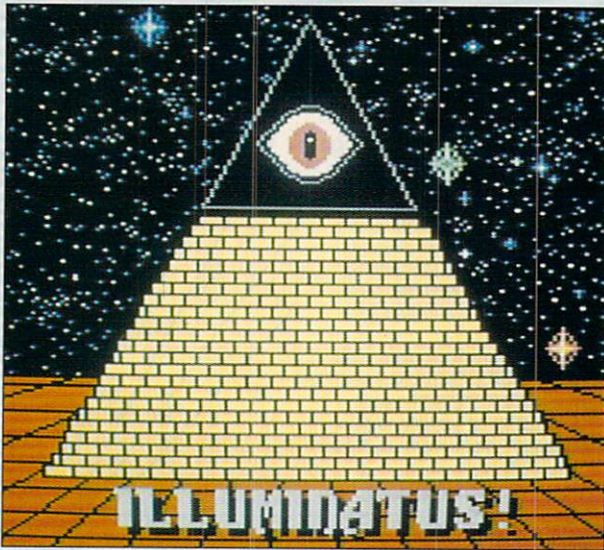
Had I intended this to be an FLI picture from the start, I would have done several things differently. For example, I would have used the Pattern Edit feature to create a somewhat larger brick which would have allowed me to add individual detailing and shading to each brick. Also, I would have used the Paintbrush command to place individual bricks in rows.

The eye in the apex would have been modeled on the eye and pyramid of the Great Seal of the United States. I also might have chosen a larger font with serifs to better add shadowing and detailing to the letters.

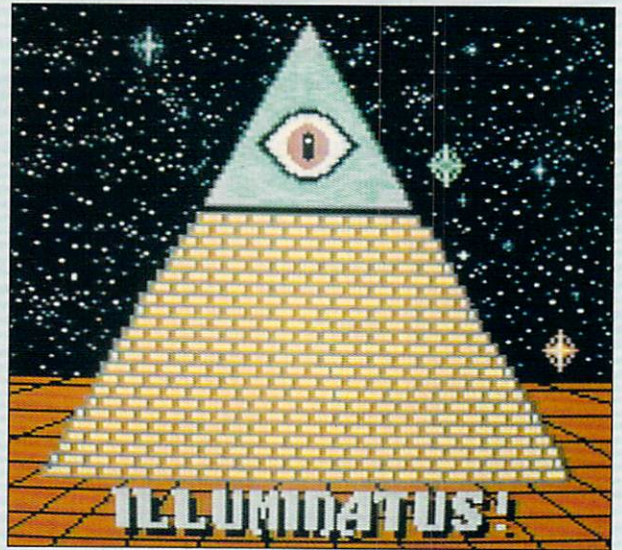
There are several aspects to FLI graphics that I find intriguing, not the least of which is that it stretches the envelope of what the 64 can do. From a strictly pedestrian standpoint, it allows a degree of detailing that multicolor mode is incapable of displaying.

—CHRIS TUCKER

Chris Tucker lives in Vermont. He is interested in space sciences, science fiction, shortwave radio, and computers and international networks as tools of communication and education. He can be contacted on Q-Link as Chris43.



Since no FLI paint programs exist, Chris Tucker created Illuminatus in multicolor mode.



This FLI version has been enhanced around the bricks and background. See "An Artist's Explanation" for more details.

own background color? That's exactly what Flexible Line Interpretation does. This way, we can call up any of eight sets of two foreground colors and one unique background color per row. This makes it possible to use all 16 available colors in each cell. This is similar to the concept of Page Flipping for bitmap screens but with multiple color maps instead.

While FLI will allow greater freedom of color usage, it is not a cure-all for the 64's color cell limitations. There are still certain restrictions that prevent complete freedom of color placement within each cell. We can now create and point to multiple copies of the screen RAM or video matrix by manipulating the VIC II register at 53272 (\$D018). We also can look at up to 200 individual custom background color registers in the newer FLI editors. (Some older editors still use the standard register at 53281.) However, we still cannot move or duplicate the fixed-location color RAM (55296-56295). This restriction limits us to only two new foreground colors in each horizontal row of the cell. The other two colors must be taken from the color RAM and background register.

How the background color is handled depends on the editor in use. Most newer editors allow for a different color on each screen row as noted above, while older editors use a common background color for the entire screen. Once the color RAM value is set to any particular color other than the background color, that color becomes the global value for the cell, meaning it will be in effect for the entire 4 x 8 cell.

From the artist's point of view, once this value is set, that color must be used as the third foreground color in any horizontal row in that cell. You can always change this global color to any other nonbackground value. How this color is set or cleared depends on the editor you are using. Each of the three editors that I have do it a slightly different way.

The Bottom Line

While you can now have all 16 colors per cell, you are still limited to one background and three foreground colors per row, and one of these three must be common to the entire cell. Any attempt to get around this within various editors will result in the old familiar color blowout or in no response at all.

Space will not permit me to elaborate on all the different ways these color priorities can be handled. I'd like to note here that most older editors that use a common background color for the entire screen have been modified to be compatible with the newer multiple-background editors. While they don't actually use the 256-byte area for extra colors (it remains all black or \$00), they will recognize it to allow disk file load/save compatibility with the newer editors. If you run across an editor that saves 68-block files rather than 69, then most likely you have an older, unmodified editor.

There are a few more limitations that are very important. For starters, the first 12 columns (3 cells) on the left side of the screen must be left blank, usually by setting them to the background color of the screen. The reason for this is that we need a certain

amount of time to execute the needed switch from one video matrix to another before scanning the remainder of each line. That switch takes place while the scan for each line is still within these first 12 columns. Any attempt to use these 12 columns during this switch will result in garbage dots at these locations unless all dots are colored alike (usually black) or "blanked out" in these leftmost cells.

This means you'll have to exercise a bit of artistic license here by adding an equally sized right border to your picture or using some other means of hiding or balancing this offset. (There are supposedly some editors that allow up to eight colors in these columns, although at present they are only available in a European PAL version.)

The reason there are presently no full-blown FLI drawing programs is mainly due to the critical timing needed to ensure that the video matrix switch will always take place in these first 12 columns. This means no program features like fancy sprite pointers; plotted squares, circles, or other shapes; drop-down windows; and so on.

There is one final timing-related limitation. In most editors set up for NTSC (American) systems, the top and bottom horizontal rows may be unusable. This does not usually cause serious problems, but you should be aware that the situation exists. I've included a set of diagrams to illustrate many of the above points for both the standard multicolor and FLI formats.

Making the Most of FLI

As you can see, FLI is not some revolutionary new method that is going to

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FLI SOFTWARE

The present crop of FLI editors is limited for the most part to zoom mode that lets you edit pictures on a dot-by-dot basis. There are three editors presently available in the graphics section of QuantumLink's public domain libraries. They may also be found on various BBSs as well.

FLI Graph 2.2 has the most options, including the ability to import Koala and other standard multicolor format files into the editor. It also lets you choose a new background color when loading. Unfortunately, it's not very user-friendly.

FLI Editor V3.2 has the most advanced editing options of the three, with the ability to change the background color on every line. It also has a unique color tracking feature.

Perhaps the nicest offering on any of these editors is the split screen used in *FLI Editor* (no version number). This feature allows you to keep track of an actual-size image of the screen area you are currently editing. As any computer artist will tell you, that is a very handy feature. Unfortunately, this editor does not offer many of the oth-

er features mentioned above.

Other handy FLI utilities that can be found in the Q-Link libraries and on BBSs are two Koala-FLI converters, a viewer for FLI images, and the *SR-FLI Creator* program by Jon Purkey (known as Gullible on Q-Link) that creates self-running files of your FLI masterpieces. It also offers the added advantage of optional file compression. This is a handy feature that can reduce the size of a standard 69-block FLI file to as little as 10 blocks. The reason that the original file is so large is that each 1K of data takes four disk blocks, and you need 40 blocks for the 10K of the standard multicolor file (8K for the bitmap and 2K for the color info [video matrix], color RAM, and background color).

In addition, we need another 7K, or 1K for each additional video matrix file used with FLI. This adds 28 more blocks to our FLI file, plus 1 more block for our custom background registers, for a total of 69 blocks. Since much of this information is redundant or repetitive, FLI pictures lend themselves well to file compression.

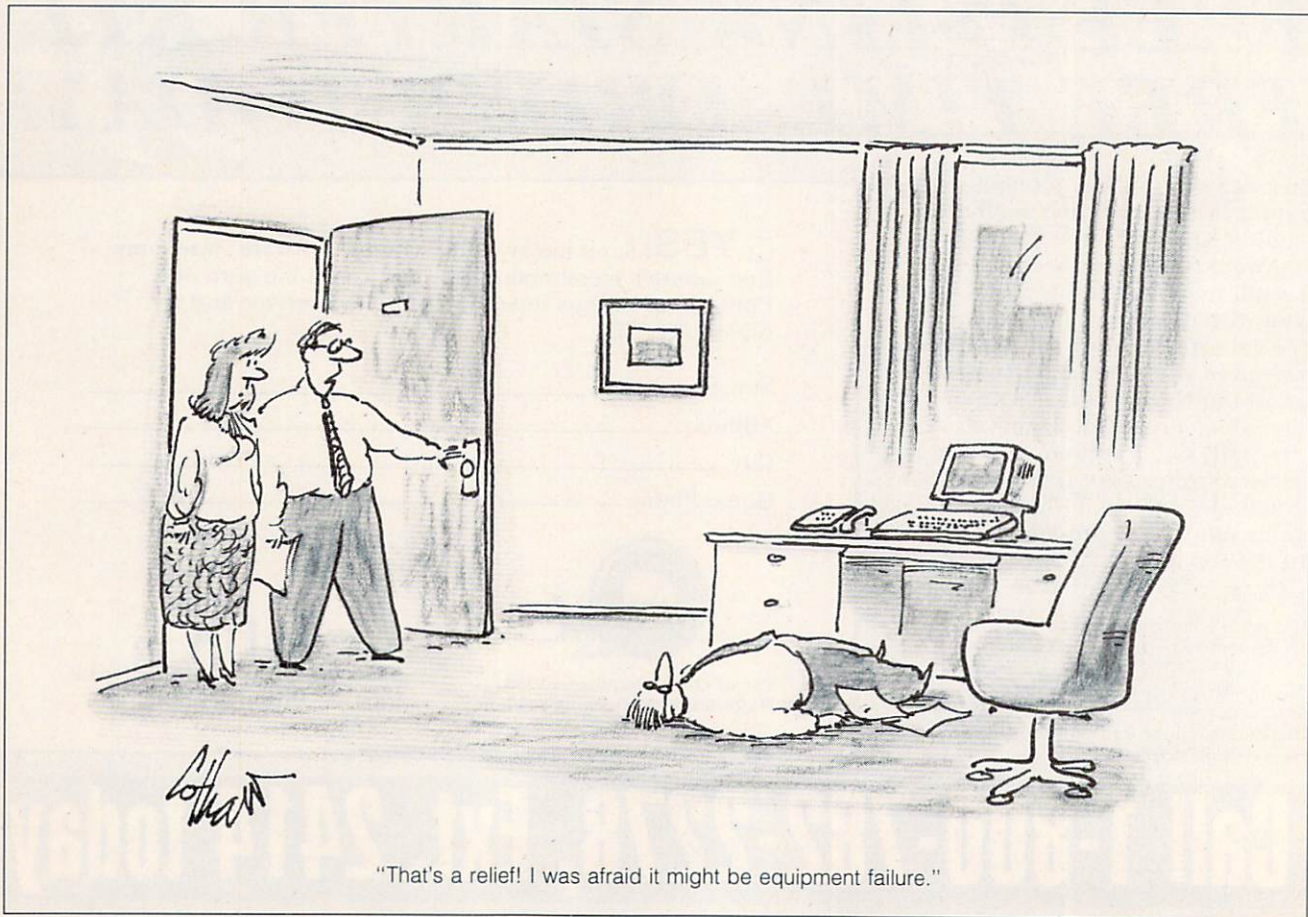
Since it is upwardly compatible with standard multicolor files, the logical way to use it would be to do most of the groundwork in a standard paint program like *KoalaPainter* or *OCP Advanced Art Studio* and then import the image into an FLI editor for the final touch-ups not possible in standard multicolor.

As the sample pictures included with this article illustrate, the differences between regular and FLI multicolor are more subtle than dramatic, with results depending on the artist and subject. Above all, this illustrates that, while the 64 may be ancient by today's computer standards, it still has capabilities that we have not yet fully explored or exploited! This has been proven repeatedly by innovative programmers like the creators of FLI. As you can plainly see, Flexible Line Interpretation is a very appropriate name for this new way to paint on your 64!

Bill Pitts, an industrial electrician in Warren, Ohio, has been a graphics sysop on QuantumLink for more than four years. Additional information about FLI can be found in Q-Link's graphic areas. Questions may be addressed to Pitts (Sysop WP), Chris Tucker (Chris43), or other online artists. □

make an Amiga or Super VGA machine out of your 64. It is a very handy tool for the artist who is looking for a way to get that extra mile from existing hardware and who wants to exercise more creative control over his or her im-

ages. Since there are no commercial paint programs available for FLI, its primary use will likely be in utilizing the enhanced color options to improve or clean up areas in detailed images where color collisions are a problem.



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REVIEWS

RAMLINK AND RAMDRIVE

Random access memory (RAM) devices exist either to instantly load software or quickly save and load data. Until recently, all external RAM expansion units (REUs) had handicaps of one kind or another.



Most REUs have volatile memory. That means they lose any data in memory whenever the computer's power is turned off. Power itself can be a problem since the 64's power supply isn't rugged enough to supply power to many REUs. Another problem is that most programs have to be adapted in some way to take advantage of an REU.

Creative Micro Designs has developed two units, RAMLink and RAMDrive, which overcome most of these problems. Since the software that accompanies these units is virtually identical, I'll describe the similarities between the devices before stating their differences. The CMD systems create par-

titions and subpartitions. These may be accessed via direct mode or from within adapted versions of certain programs, such as *The Write Stuff* word processor or CMD's *gateWay* program.

Partitions default to native mode. This format means the unit will accept data files from most applications and can store the programs themselves, such as *SpeedScript* and all of its files.

Emulation modes imitate the 1541, 1571, and 1581 to increase compatibility for some drive-specific software. Direct access mode is useful if an REU needs to be accessed by a program that cannot work directly with the CMD unit. For example, I use a 1571, a CMD unit, and a 1750 REU in direct mode. CMD's *GEOS* adaptation for its RAM units, *gateWay*, recognizes each of these units as a separate drive.

Since each partition acts like a disk drive, most files can be loaded to and saved from these partitions, and the speed is virtually instantaneous. Programs stored within a CMD unit are instantly available once you press Return.

When a program such as *GEOS* switches layers in and out, the rapid interchange gives the illusion of a very large computer memory. Saving and loading is so fast that you may want to check the directory just to make sure that the file was actually saved.

CMD partitions in RAMLink and RAMDrive can handle a wide range of programs. They will accept most newer unprotected programs from Timeworks and DOSerm, most text-based *Dungeons and Dragons*

games, *Superbase V3*, and the *Stereo Sid Player* version 10.1 or newer. I also store *Print Shop* graphics and a number of *SpeedScript* programs. The *Fleet System 2+* word processor recognizes its spelling dictionary and most of its thesaurus when they are stored in a CMD RAM device.

Usually, if a program can be transferred from a 1541 to a 1571, it can be stored in and run from a CMD unit. Two programs that work particularly well with CMD products, *gateWay* and *The Write Stuff*, take advantage of the large storage space and quick access. This means *GEOS* can be immediately available, with all applications and accessories appearing at the click of a mouse button.

The Write Stuff will store files in subpartitions and will allow the user to move among partitions from within the program. *TWS* has numerous features, which include several pages of onscreen help files and a large dictionary. There is practically no waiting time when any of these features are called.

CMD devices recognize the *Maverick V5* disk copier, but I can't vouch for most cartridges. The Turbomaster speedup CPU is not yet compatible, but may soon be adapted to work with CMD units. The Commodore 1700 series of REUs will work with CMD units, including those that have been expanded to two megabytes. CMD has included a wedge that abbreviates most drive commands and speeds up floppy disk access when a special CMD chip is inserted in the floppy drive. Without the special drive chip, floppy saves and loads are the same as those of a stock 64/128. Since I had already installed CMD's

JiffyDOS in my computer and 1571 drive (which also eliminated the usual 1571 problems), I had to set my computer's JiffyDOS switch to off for the wedge in the RAM device to work.

The floppy disk access is as fast as it was previously. The wedge is still available and works for both the floppy and RAM device. It also uses the built-in disk copier that allows one floppy to be copied to another via the RAM device with only one change of disks in the floppy drive.

With the included software, it's easy to create partitions, change their modes, and copy files between partitions and another drive. Since a disk is used for system initialization, it should be easy to make upgrades of the operating system.

The default device number for CMD drives is 16. This can be changed through software, however, to any desired number. *The Write Stuff* expects a default of 12, and *gateWay* (*GEOS*) requires 8 or 9. A pressure-sensitive spot on CMD units makes it easy to assign device 8 or 9 to the RAM device. This feature lets you load and save files to and from the CMD unit from most programs. I load *Print Shop* from my floppy drive, depress the Swap 8 location on my RAM unit, and load picture files from the RAM drive. A reset button helps 64 owners clear their machine without turning off the computer. Users of *gateWay* will be able to reset and recall *GEOS* with no data loss.

If the CMD units interfere with the operation of any software, they each have an enable/disable switch that isolates them from your system. I haven't discovered any problems with software, though.

RAMLink

RAMLink is housed in a 6 x 2 x 5 inch metal case with two openings on the top for an REU and a cartridge. CMD offers an optional RAMCard that can be used alone as a RAM disk or in conjunction with other REUs for a maximum capacity of 16MB.

In addition to the enable/disable toggle switch common to both CMD devices, there is a normal/direct switch that allows the attached REU to be treated separately if it contains a direct-access partition. The memory of the attached REU remains permanent when the computer is turned off. This is because RAMLink has its own AC

power supply. An optional backup battery is available that will power RAMLink for several hours.

I have used the battery while switching the AC cord between wall outlets and found that memory contents were retained. Three outlets on the back of the unit are for the AC supply, a battery backup, and parallel connection to a CMD hard drive.

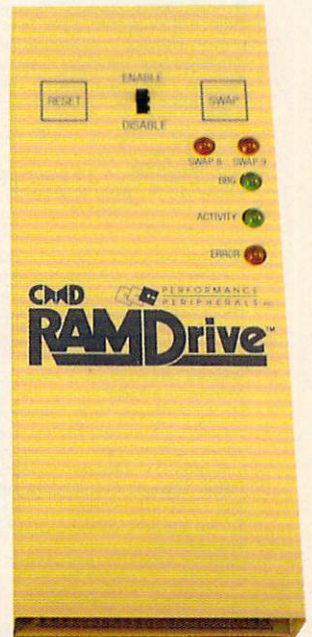
I have 2MB in my unit plus the 512K contained in my 1750. The type of memory chips (SIMM) installed in my unit would allow expansion to 4MB plus my REU. A different size of SIMM would permit expansion to 16MB. Mixing two SIMM types will not work. The CMD operating system is

able to use the maximum range of memory.

The Final Cartridge III, which according to its U.S. distributors is not designed to work with any other cartridge or REU, works quite well with RAMLink and my attached 1750 REU. The Final Cartridge will perform all normal disk operations on my floppy drive. While it will identify the contents of the default partition on RAMLink, it will not perform disk operations on the RAM device. My other cartridges function normally when attached to this unit.

RAMDrive

This unit can either be inserted into the cartridge port or share an Aprospand car-



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REVIEWS

tridge holder with a Commodore series REU of any size. The geoRAM cartridge will not work with RAMDrive. No cartridges other than the 1700 series REUs will work in conjunction with this unit. It has a built-in battery and AC power source, putting no additional load on the 64. Its maximum capacity is two megabytes. While it has no normal/direct switch, its controls are otherwise similar to those found on RAM-Link.

What makes this device unique is that once its battery is charged, it will operate for several days without connection to any power source. Although I leave the AC source connected while RAMDrive is in use, I can easily carry this metal-cased unit between home and work in my jacket.

There are at least three aspects to RAMDrive's portability. It is much smaller and lighter than RAMLink. Its built-in battery allows for memory retention over several days, while RAMLink's battery is for short-term blackouts or accidentally interrupted power supplies.

RAMDrive can easily be connected/disconnected from cartridge ports without any loss of data and in most cases without the need of a special jumper wire. RAMLink requires that a jumper cable be connected between a chip within the computer and RAMLink to synchronize timing. Only some 64/128 computers will need this adjustment with RAMDrive. A software test will tell the user whether this installation is required. Although I am a very timid technician, I performed the installation in about half an hour with no special tools. Many users of RAMDrive will not need to do this with their computers.

Customer Service

One of the devices' designers from Performance Peripherals told me that to make the CMD devices work they had to make the 64 do what it wasn't designed to do. They quickly discovered that the wide variety of chips in the 64 and 128 added to the difficulties in making RAMLink and RAMDrive work with all 64 or 128 computers. My 64 was especially stubborn with RAMDrive, but the designers modified another RAMDrive and sent it to me by courier. It worked with no problems.

I made innumerable calls to the

CMD office for technical advice and discussions. The help was not only effective but friendly. Only a tiny minority of you will have computer compatibility problems. If you do have difficulties, CMD will fix them. In one case the CMD staff even worked on a customer's computer in their lab. Now that's service!

I use *GeoWorks Ensemble* at work on an IBM-compatible AT with a 40MB hard disk. It's a wonderful program that takes full advantage of the machine. That 286 cost us nearly \$2,000 when we bought it two years ago. I am running *GEOS* (CMD's *gateWay*) on my 64 with a CMD RAM device. I have faster response time for all activities on my Commodore than I do with the more expensive IBM clone and software. For many 64 or 128 owners, a CMD RAM unit may be a more effective upgrade than the purchase of a more expensive machine.

JOHN ELLIOTT

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ELVIRA, MISTRESS OF THE DARK

Hollywood's influence on the computer software field is far-reaching. Every time you turn around, another game based on a movie pops up on the software shelves. With *Elvira, Mistress of the Dark*, the video vixen stars in an adventure game that has nothing to do with her dud movie of the same title and everything to do with the atmosphere and invitingly haunting images that Elvira evokes.

Elvira has established herself as a hostess of the macabre, and her computer game reeks of the horror genre in a delightfully disgusting way. Lots of gruesome images, fearsome monsters,

and campy humor await the role-playing adventurer in need of a challenging game.

In *Elvira*, you must help the hostess with the mostest rid her inherited castle of her insane, evil Aunt Emelda's ghost. The only way to do this is to find the six keys that will unlock a chest that contains the Scroll of Spiritual Mastery. This scroll is the only means of resurrecting the departed Emelda.

After collecting the keys, you must also unearth the chest and destroy the scroll so that no one will try to bring Emelda back to life again. *Elvira* is an enjoyable game, but it's so large that many players may give up before they finish the quest.

Elvira's icon-driven interface is effortless to use. The center window displays a first-person view of your surroundings. Objects like doors and weapons may be selected right in this window. A list of commands on the right side of the picture window and directional arrows and inventory icons on the left side complete the interface. All are clickable. Underneath the picture window is space for your inventory or game messages. You play *Elvira* by clicking command icons, objects in your inventory, directional arrows, or objects in the main window.

Elvira is not a simple game, but its interface makes it much more playable than it might have been.

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
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The best part of the game is the design of the castle and its surrounding locations. Particularly interesting are the hedge maze, garden, and moat.

Elvira's inherited castle is easily the best representation of a stony fortress in a computer game. From the dungeon to the ramparts, the castle is large and detailed. You'll forget you're in a computer game. Particularly nasty areas are the dungeon and the ramparts. Watch out for monsters, and always be ready with an effective potion.

Potions and spells are a large part of *Elvira*. In your journeys throughout the castle grounds, you'll find many strange plants and other ingredients. Every now and then, return to the castle's kitchen, and Elvira herself will tell you which potions may be mixed effectively with the ingredients in your inventory. You can learn all about the potions in *Emelda's Book of Recipes*

and *Spells* that comes with the game. It acts as copy protection because you need a piece of red plastic to read the spells. The book also reveals the many possible combinations of ingredients.

Some spells affect monsters and other evil characters you may encounter. Others protect you or restore life points. Your character has a few role-playing characteristics (strength, resilience, dexterity, skill, and life) that may be affected by one or more potions. Experiment, but save your game often.

After a complete journey through the game, I can verify that not all spells are necessary, and you may interchange specific spells in some instances. Some spells increase knowledge and reveal information desperately needed to complete portions of the game. Save your position often, and never use a spell in combat unless absolutely necessary.

The graphics in *Elvira* are most impressive. Although a

little bland in some areas of the castle, most of the screens are suitably detailed. The death scenes are particularly fun because there are so many ways to die in this game. In all cases, your character's picture pops up onscreen to reveal a gruesome form of death.

In combat sequences, you must block your attacker's blows and return them when you have the advantage. Animation is smooth, and you'll pick up the rhythm in no time. Keep those potions ready!

Elvira is perfect for the graphic adventurer in need of a bizarre twist. Mapping is not necessary in the game, but a good sense of spatial orientation is important. The castle is large and full of surprises. The game is packed on three double-sided disks to eliminate excessive disk swapping.

Elvira is also perfect for the fans of the fright flick femme fatale who want a game that offers a complex

but fair challenge. Still pushing the 64 computer beyond its preconceived limits, *Elvira* mixes fantasy and fun in a ghoulishly delicious potion that entices players to drink.
RUSS CECCOLA

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MACHINE LANGUAGE

Jim Butterfield

SMOOTH OPERATORS

The logical instructions of the 65xx microprocessors deal directly with its fundamental elements: bits.

The three instructions are AND (logical AND), OR (logical OR), and EOR (exclusive OR). All three work with the A register and a specified memory location, placing the results of the operation into A. All three are capable of manipulating one or several bits within the 8-bit byte, leaving the other bits untouched. Another instruction, BIT, is capable of testing selected bits but will not change data.

Though logical operators can be used to calculate checksums, determine game strategy, or form complex decision values, programmers most often use these instructions to select or change data bits by means of a mask value.

To use a mask, select the bits you want to change and set up a mask value of ones and zeros to specify those bits. AND turns bits off, OR turns bits on, and EOR flips bits.

AND: A 1 in the mask leaves the corresponding data bit alone; a 0 bit forces the corresponding data bit to 0 (turns it off).

OR: A 0 leaves the data bit alone, and a 1 forces it to 1 (turns it on).

EOR: A 0 bit leaves the data bit alone, but a 1 bit causes the data bit to flip from 0 to 1 or 1 to 0.

The AND and OR instructions destroy data. Whatever the bits were before, they are forced to one or zero and the previous information is gone. But EOR flips bits, and such bits could be flipped back to their original state if desired.

AND, which sets bits to 0, is often used to extract bits for testing. This is especially true

of I/O (Input/Output) ports, where each of the eight bits of a port or register may have an individual meaning. AND is also frequently used to eliminate the higher bits of an ASCII character in order to convert it to a number; an ASCII digit from 0 to 9 (hexadecimal \$30 to \$39) can be reduced to its value with AND #\$0F.

OR will do the reverse of this; it can convert a binary value in the range 0 to 9 into an ASCII decimal digit. It's also a valuable instruction for turning on a bit in an output port.

EOR is good for use as a counter, or it can be used to create oscillating effects, such as making parts of the screen blink.

The following program performs the three operations on screen data. To work on a 64 or a 128 in 40-column mode, the program assumes that the screen is located at hex 0400.

Keep in mind that screen memory uses a special code for data. The alphabetic characters A to Z are represented as values 1 to 26; that's different from ASCII code. Numeric digits 0 to 9 are the same as ASCII (hex \$30 to \$39), as is the space character (hex \$20). Watch for screen binary zero, the @ character.

The BASIC program given below prints a number of identical lines to the screen then POKES a tiny program into memory. The program is modified during the run, but it starts like this:

```
2000 A2 00 LDX #$00
2002 BD 50 04 LDA $0450,X
2005 29 0F AND #$0F
2007 9D 50 04 STA $0450,X
200A E8 INX
200B E0 12 CPX #$12
200D D0 F3 BNE $2002
200F 60 RTS
```

As the BASIC program runs, the logical operation changes to OR and then to EOR, and

the address of the line is adjusted upward to match following screen lines. The BASIC program runs the whole logical set nine times. Lines modified by AND and OR won't change after the first time. The bits have been set off or on, and they stay that way. But the bits affected by EOR will flip back to their original values and then flip again, and so on. You'll quickly notice that the high bit of the screen display (mask \$80) creates reverse video when it's turned on so that EOR creates a flash effect.

```
100 PRINT CHR$(147);
"LOGIC OPERATORS!"
110 DATA ORIGINAL,AND-
$0F,OR--$30
120 DATA EOR-$1,EOR-$30,
EOR-$80
130 FOR J=1 TO 6
140 READ X$
150 PRINT "ABCDEFGHI
123456789";TAB(20);X$
160 NEXT J
200 DATA 162,0,189,80,4,41,15,
157,80,4,232,224,18,208,
243,96
210 FOR J=8192 TO 8207
220 READ X:POKE J,X
230 NEXT J
300 FOR J=1 TO 9
320 POKE 8195,80:POKE 8200,
80:POKE 8197,41:POKE
8198,15
330 SYS 8192
340 POKE 8195,120:POKE 8200,
120:POKE 8197,9:POKE
8198,48
350 SYS 8192
360 POKE 8195,160:POKE 8200,
160:POKE 8197,73:POKE
8198,1
370 SYS 8192
380 POKE 8195,200:POKE 8200,
200:POKE 8197,73:POKE
8198,48
390 SYS 8192
400 POKE 8195,240:POKE 8200,
240:POKE 8197,73:POKE
8198,128
410 SYS 8192
420 FOR K=1 TO 500:NEXT K
500 NEXT J
```

Logical operations AND, OR, and EOR deal directly with the 65xx's fundamental elements: bits.

Steve Vander Ark

BRIGHTEN UP YOUR WINTER

Winter sure gets dreary once the holidays have careened past. Here in Michigan, the stretch from New Year's to the end of February seems to consist of little more than scraping the windshield and shoveling the driveway. What January needs is a little pick-me-up—something to add a little pizzazz to computing.

This is the perfect time for a splash of graphics. There are quite a few good sources for graphics to perk up your documents, and just because graphics aren't in *geoPaint* format doesn't mean you can't use them for *GEOS*.

You can convert just about any kind of graphic image into *GEOS* using one conversion utility or another. Commercially available packages include *Graphics Integrator 2* from Inkwell Systems (P.O. Box 1997, Imperial Beach, California 91933) and Solutions Unlimited's *Icon Factory* (Briwall, P.O. Box 129, Kutztown, Pennsylvania 19530). Either of these programs will convert between Commodore formats. *Graphics Integrator* also includes a routine to convert to *GEOS* from *Doodle*, while a separate utility called *Grafix Link* does the conversion for *Icon Factory*.

GEOS users do have the option of making the conversions from within *GEOS* itself using a program called *Graphics Storm* (Storm Systems, 464 Beale Street, West Quincy, Massachusetts 02169) or *Import Runner*, two similar programs written by Joe Buckley. Each of these conversion programs has its own distinctive features; both will convert *Doodle* graphics format and standard bitmaps.

Import Runner will also convert regular or compressed mul-

ticolor images as well as *MacPaint* and RLE files. *Graphics Storm* also handles clip art from *The Newsroom*, *The Print Shop*, and *PrintMaster*. Between the two, there are few graphic files that can't be converted into the *GEOS* universe. Both programs can be found on Q-Link.

Armed with conversion programs like these, you're ready to track down a few new graphics. Some sources are pretty well known. *Newsroom* clip art disks, for example, are certainly some of the best buys.

The Print Shop graphics abound as well, not only in *The Print Shop* collections themselves but also in numerous collections by other artists. You'll find them on BBSs and in user group libraries; Q-Link also has a nice selection. You owe it to yourself to track down the collections by Kathy Wright (KathyW5/Syshelp KW on Q-Link); they are some of the best around.

The Print Shop, *PrintMaster*, or *Newsroom* graphics can be grabbed and converted into *GEOS* photo scraps using *Graphic Storm* or the *Graphics Grabber* found on the *DeskPack Plus* disk from Berkeley.

If you have a disk full of *The Print Shop* graphics you'd like to turn into *GEOS* photo scraps, *GetGraphic V1.2* from Nick Vrtis (5863 Pinetree SE, Kentwood, Michigan 49508) will nicely automate the process. Vrtis' program displays clips by name, allowing you to select those you'd like to convert. The program then converts the ones you've picked until you have a new photo album filled with the selected clips.

Screen-sized high-resolution images, such as the ones created by *Doodle*, can be easily converted to *GEOS* using one of the conversion programs available. *GEOS* itself

operates in high-resolution mode, so the image will not be distorted at all. Multicolor images, those generated by *KoalaPaint*, for example, are another matter. They can be converted, but the results may be less than perfect. Since the size of the pixels (the dots on the screen that make up the image) and the color information are different in the two modes, even a fine program like *Import Runner* may not do the job perfectly.

You needn't confine yourself to Commodore formats. If you have a modem, you have access to thousands of images in formats designed for other computers, images which you can download and convert into *GEOS* with the help of other utilities.

On IBM bulletin boards you'll find scads of graphics in a format called GIF. There are several utilities which will convert these into Commodore multicolor images, but since a conversion from multicolor to *GEOS* is problematic, it's better to convert them directly to *GEOS*. One program, *geoGIF* by Randy Weems, which is available on Q-Link, converts GIF files into a *geoPaint* image. The results can be quite spectacular when printed out.

Another common type of graphics image is from the Macintosh program called *MacPaint*. These files, identified by their MAC suffix, are full-page bitmaps just like *geoPaint*, so a conversion to *GEOS* is quick and painless. The job can be accomplished using *Import Runner* or with a program called *MacAttack*, also written by the ubiquitous and talented Joe Buckley.

So forget about shoveling the driveway. It'll just fill up with snow again anyhow. Come in out of the cold and liven the winter doldrums with a splash of graphics. It sure beats scraping ice! □

Come in
out of the cold
and let a
splash of graphics
liven the
winter doldrums.

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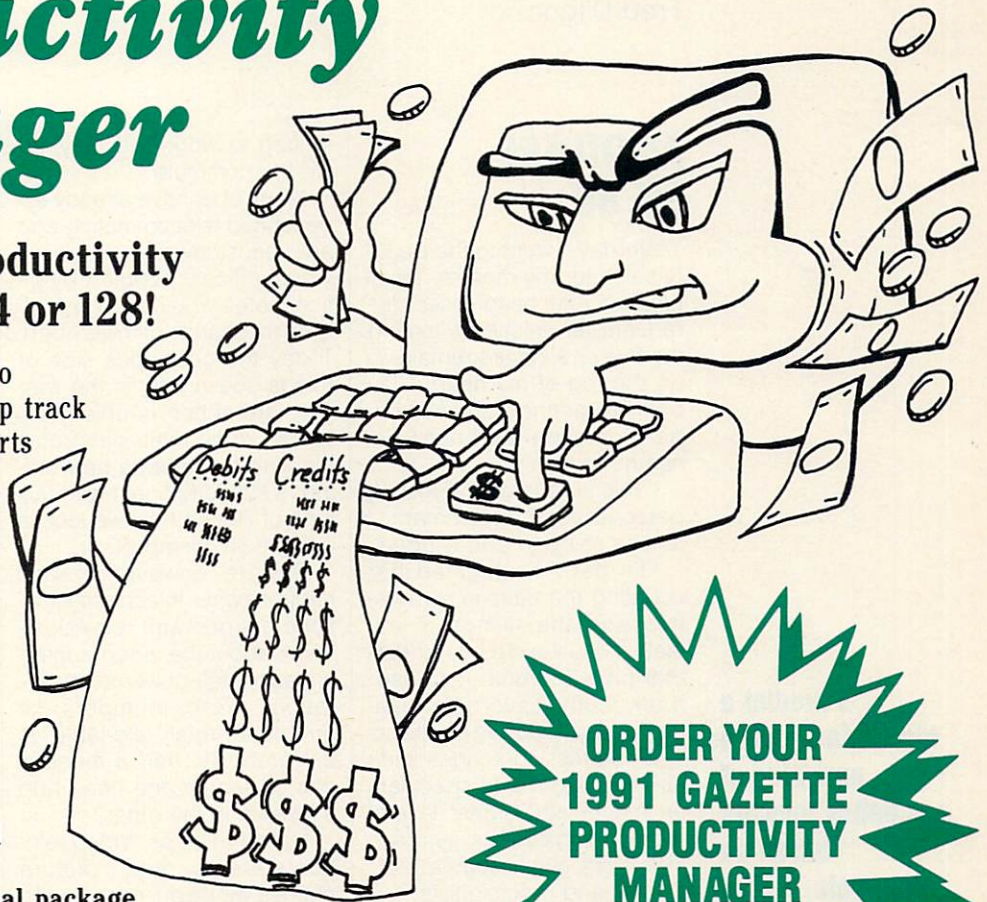
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D'IVERSIONS

Fred D'Ignazio

AS OTHERS SEE ME

Yesterday, I went to the beauty salon for my monthly facial tune-up. After hairdresser Laura Dantzer finished trimming the five or six hairs remaining on the top of my head, I lay back in her chair, and she began trimming my beard beneath my chin.

"This sure is an interesting perspective," Laura remarked as she snipped and clipped.

"I'll bet." I imagined her counting the hairs in my nostrils and the fillings in my teeth. I visualized the Neanderthal pose I struck—all nose, buck teeth, cavernous eyebrows, and massive forehead.

Embarrassing images such as these led me to speculate on images others may have of us, including dentists, aerobics instructors, gynecologists, morticians, and proctologists.

As Laura chopped at the jungle beneath my chin, it dawned on me that the "me" who preens and poses in the mirror each morning might not be the image that others see.

Like any vain human being, I wish other people would see me as I see myself—or even better! Because of this natural and powerful human longing, I predict a big business for a new kind of cosmetics industry—an industry based on electronic, digital cosmetics.

Today people spend billions of dollars on cosmetics to become prettier, sexier, and more handsome. The persona who walks out of the bathroom might be wearing a deliberate mask and creating an intentional illusion, but it is part of the consensual virtual reality that everyone shares.

Now think about life in the next century. We will do a lot less physical interacting with each other and a lot more *virtual* interacting. Instead of com-

muting to work and play, we will telecommute.

Many of us have already experienced telecommuting and are accustomed to working in virtual offices, peopled by office mates who may physically be thousands of miles apart. Today the cosmetics side of things doesn't get in the way. Our interaction is chiefly via voice, voice mail, electronic mail, and wide-area networking. It's strictly a text-and-talk kind of life, so how we look is delightfully unimportant.

Beware, however, of what happens when telecommunication merges with television. Think about the video conferences of high-powered corporations. Can members sit around a virtual "tele-table" in undershorts, hair a mess, a can of beer in one hand and a Twinkie in the other?

I don't think so. Video teleconferences and picture phones will be an inescapable part of our work and leisure lives sometime in the next decade. But I bet they'll have an escape hatch built in. Unlike the Ma Bell television phones of yesteryear, the new picture phones will be nine-tenths computer and only one-tenth telephone and television. The computer will massage all images, data, and sound.

So if you don't want to look like you really are—all nostril hairs, beard stubble, and skimpy eyelashes—you can call up cosmetic clip art from a library of persona-enhancing facial templates online in your CD-ROM optical library. For example, I might be a wimp of a guy with glasses, thinning hair, and an understated bony body, but when I attend my corporate video conferences in 1997, I will appear with Mel Gibson's head on Arnold Schwarzenegger's body and sound like James Earl Jones. Similarly, a female attorney who needs a quick "do"

to attend a high-powered stockholder's meeting can assemble her persona from electronic body parts and appear with a Candice Bergen head, a Madonna body, and a Katherine Hepburn voice.

Today's computer networks are only a muted, shadowy reflection of the multimedia, video networks of the future. People who hang around electronic malls, game arcades, and forums today have only their words to introduce themselves or to judge others.

Think about electronic parties held on future networks. People will have gigantic CD-ROM libraries to mix-and-match body parts from movie actors, musicians, circus performers, politicians, cartoon characters, or historical figures. Composite persons will come to these parties with bodies that resemble anything from King Kong to Attila the Hun; faces from Chewbacca to Freddie Kruger; and voices that mimic Dolly Parton, Judy Garland, or M. C. Hammer.

Things sound idyllic, don't they? Perhaps. But you'd better be on guard for "cosmetic viruses." For example, you might think you are transmitting an image of yourself with Oprah Winfrey's head atop Ann-Margret's body (a recent virtual composite person on the cover of *TV Guide*). But your colleagues at the video teleconference may be receiving your image as Pee Wee Herman's head atop Rosanne Barr's body, and they might hear you speaking with the voice of Strawberry Shortcake.

After a hectic and mystifying day at the virtual office of the future, staffed by dozens of mix-and-match telepresences, the rallying cry might be for a little sense, a little sanity. Wanting just one unedited shot, office buddies may cry: Will the real Fred D'Ignazio please stand up? □

I predict a big business for a new kind of cosmetics industry based on electronic, digital cosmetics.

BEGINNER BASIC

Larry Cotton

MUSIC PATTERNS

Happy 1992! We're nearing the finale of our series on RND, the BASIC keyword which creates randomness.

Sound and graphics can be enhanced by judicious use of the RND statement. This month, I'll try to prove it by re-writing one of my first programs, *Music Patterns*, which appeared in *COMPUTE!'s Gazette* (February 1985). This 64 program creates colorful semi-random patterns accompanied by randomly generated tones. We begin with a classic randomizing statement to prevent the program's always starting with the same pattern:

```
10 X=RND(-TI)
```

One statement, DEF FN, and one function, FN, work particularly well with RND. DEF FN and FN are always used together to create programmer-defined functions. These functions are usually written as formulas or equations. DEF FN and FN save you from having to type the same formula over and over. Enter these lines, which will be the next ones in our new *Music Patterns* program:

```
20 DEFFNA(X)=INT(110*RND(1))+20
30 DEFFNB(X)=INT(14*RND(1))+1
40 DEFFNC(X)=INT(11*RND(1))+1
50 DEFFND(X)=INT(25*RND(1))+1
60 DEFFNE(X)=INT(959*RND(0))+1024
```

Run this program now; then, in the immediate mode, type the following.

```
PRINT FN A(X)
```

Run the cursor up and repeat this a few times. You'll see several numbers from 20-129, inclusive. Thus a random statement must be defined only once, but it can then be exe-

cuted using FN as many times and as late in the program as desired.

Next, we dimension a one-dimensional array.

```
70 DIM T(26)
```

This sets aside 26 pigeon-holes which we now will fill.

```
80 FORI=1TO26:READT(I):NEXT
```

The data will appear later in the program, but we can enter it now. (As in the past, I know what the line numbers are since I've written the whole program. You don't normally program this way.)

```
430 DATA81,95,105,127,160,170,171,174,186,192,205,206,209,214,215,219,221
440 DATA223,226,230,233,236,251,252,254,255
```

What are these data? They're CHR\$ codes for some of the keyboard characters appropriate for the patterns. If you enter PRINT CHR\$(81) (in immediate mode), you'll see what character the first data item would produce. (If you'd like to use other characters, feel free to change this data.) After the program is run, the array T(1) through T(26) will be filled with these CHR\$ codes. We're going to choose one of these characters randomly later and then poke it to the screen in interesting patterns accompanied by randomly generated musical tones.

Speaking of tones, let's set up SID in our usual way.

```
90 FORI=54272TO54295:POKEI,0:
NEXT: POKE54296,15:
POKE54277,16:POKE54275,8
```

Generous use of constants (variables which don't vary) significantly speeds up the execution of a BASIC program. Let's define those which will be used the most.

```
100 FR=54273:VC=54276:SC=1024:MN=1063:MO=1064:MA=1983:
CO=40:LO=39:LI=41
110 VN=65:VO=64:C=54272
```

By studying these constant values, the experienced BASIC programmer can get clues about what's going on.

FR and VC are obviously memory registers; they're too big to be pokeable numbers. They happen to be two SID registers—one to determine Voice 1's pitch (frequency) and the other to turn Voice 1 on and off.

SC, MN, MO, and MA are also too big to be pokeable; they are memory registers for screen locations. CO, LO, and LI are of pokeable size, but they also should remind you of screen width. Since the screen is 40 columns wide, these must be limits of some sort. (They are. We don't want characters poked offscreen!)

VN and VO are also pokeable values. You may recall that the square wave is turned on by poking a 65 and off by poking a 64. The most ambiguous constant is C, which could be a SID register, or it could be the number that's added to the screen memory location to add color to the poked characters. It happens to be the latter.

Later, you'll see what all these constants do. Now, let's prepare the screen and present a short message.

```
120 PRINTCHR$(147)CHR$(5):
POKE53280,0: POKE53281,0
130 FORT=1TO10:PRINT:NEXT
140 PRINTTAB(4)“PRESS SPACE
BAR FOR NEW PATTERN”
150 FORT=1TO1000:NEXT
160 PRINTCHR$(147)
```

You should know what all these lines do. Next month we'll finish *Music Patterns* and our study of RND. □

Sound and graphics can be enhanced by the judicious use of the RND statement.

PROGRAMMER'S PAGE

Randy Thompson

READER TIPS

Here are more programming tips from our readers.

Fast Format

If you ever need to format a disk that has been formatted before, here's a quick way to get the job done. When you issue the format command, don't include the disk ID. For example, the usual way to format a disk is to issue a command such as the following.

```
OPEN 15,8,15,"NO:
DISKNAME,ID":CLOSE 15
```

To perform a fast format, you change the syntax to look like the following.

```
OPEN 15,8,15,"NO:
DISKNAME":CLOSE 15
```

If you decide to use this shorter command, the disk drive formats your floppy disk in about two seconds, and the disk ID remains the same.

STEVE MILLER
BAYVILLE, NJ

Secret Messages

Type in and run the following 64 program to see a secret message and a listing of all of the BASIC commands and error messages.

```
10 FOR I=40964 TO 40974
20 PRINT CHR$(PEEK(I));
30 NEXT
40 PRINT
50 FOR I=41118 TO 41767
60 PRINT CHR$(PEEK(I));
70 NEXT
```

If you own a 1581 disk drive, try running this program for yet another hidden message.

```
10 OPEN 1,8,15
20 PRINT#1,"M-R"CHR$(50)
CHR$(167) CHR$(45)
30 FOR I=1 TO 45
40 GET#1,A$:M1$=M1$+A$
50 NEXT
```

```
60 PRINT#1,"M-R"CHR$(96)
CHR$(167) CHR$(26)
```

```
70 FOR I=1 TO 26
```

```
80 GET#1,A$:M2$=M2$+A$
```

```
90 NEXT
```

```
100 CLOSE 1
```

```
110 PRINT M1$CHR$(13)M2$
```

HENNING VAHLENKAMP
MATAWAN, NJ

DIM for Faster Programs

Believe it or not, you can actually speed up your programs by dimensioning nonarray variables. For example, type in and run the following program.

```
10 TI$="000000"
20 DIM A$(1000),B(1000),
C%(1000)
30 A=1:B=75:C$="D LEE"
40 PRINT TI/60;"SECONDS"
```

Now enter the line

```
15 DIM A,B,C$
```

and run the program again. Notice the difference? The program is noticeably faster with line 15.

In line 20, BASIC dimensions the variables A\$(), B(), and C%() by allocating array tables in computer memory just above the program code. Nonarray variables are always stored in memory between the program code and BASIC's array tables, so when BASIC encounters line 30, it must take the time to move up its array tables to make room for the three new variables A, B, and C\$.

By adding line 15, you force BASIC to allocate space for A, B and C\$ before the array tables are built. This saves the computer from having to move the array tables. In this simple example, you could simply switch lines 20 and 30 to speed up the program. In a much larger program, however, you might find it easier to use DIM to ensure the optimum order of var-

iable definitions.

DAVID LEE
WAVERLY, TN

How Much Is a Period Worth?

How much is a period worth? Nothing. Or more accurately, 0. Wherever you use the digit 0 all by itself, you can replace it with a period. BASIC even interprets the period faster than it does the digit 0. In other words, the program

```
10 POKE 53281,,: POKE
53281,1:GOTO 10
```

executes faster than the following program.

```
10 POKE 53281,0: POKE
53281,1:GOTO 10
```

RANDY THOMPSON
EUGENE, OR

Easy-Load Filenames

Try this the next time you save a program to disk: Immediately after entering a filename in a Save command (before you enter the closing quotation mark), hold down the Shift key and press the space bar; hold down the Commodore key and type DUDE; hold down the Shift key and press @; and then type the terminating ",8 and press Return. When you list the disk directory, the computer shows the filename with a ,8,1 extension. Now, all you have to do to load and run the program is move the cursor to the first column of the line containing the filename and press Shift-Run/Stop.

STACY OLIVAS
GRAHAM, WA

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 or trick we use in the magazine. □

Format disks in seconds, reveal secret messages in your 64, speed up your programs, and more.

IMPROVED FRE

By Louis Giglio

Improved FRE is a small utility for the 64 that provides a quick, useful free-memory function. The FRE command provided by the 64's BASIC interpreter is awkward to use, can be slow, and doesn't always provide the information you need. Unlike FRE, *Improved FRE* accurately reports free memory, program size, variable workspace size, array workspace size, string workspace size, and total RAM available for programs and data. In addition, *Improved FRE* doesn't force the potentially time-consuming task of garbage collection.

To understand these benefits, it is important to understand how BASIC uses memory. A BASIC program is stored in memory starting at the bottom of the BASIC workspace. Directly above the program is a region of memory used to store variables created by the program. Just above this area is the section used to store array data. (These areas are created when the program is run, as variables are assigned and arrays are dimensioned.)

BASIC keeps information about strings in the variable and array storage areas, but the actual string data is stored in the string workspace, which expands from the top of memory downward. This is because BASIC strings are dynamic objects that have no fixed size. The region above the array workspace and below the string workspace is free memory.

If a string variable such as A\$ = "APPLE" is redefined as A\$ = "ORANGE", the new string will be added to the string workspace. This will leave the old string inactive, but still resident in the computer's memory.

The garbage collection process overwrites strings which are inactive with active strings, freeing up additional memory. In programs where a lot of string manipulation has occurred, the procedure can be time consuming.

In addition to forcing garbage collection, FRE has other drawbacks. For instance, if the amount of free memory is greater than 32,768 bytes, FRE returns a negative number instead of the actual amount of free memory. *Improved FRE* does not suffer from either of these limitations.

Typing It In

Improved FRE is a machine language program in the form of a BASIC loader. To avoid typing errors, type it in using *The Automatic Proofreader*. See "Typing Aids" elsewhere in this section. Be sure to save a copy before you exit *The Automatic Proofreader*.

Counting Bytes

To use the program, load and run it. A message will indicate that the machine language program has been installed. Now, you may go ahead and enter or load other programs.

Improved FRE commands are issued with the seldom-used USR function. For example, X=USR(*n*), where *n* is any BASIC variable or expression having an integer value in the range from 0 to 5, is a valid command. The value of *n* will determine the type of information returned by the USR function. The meanings of the values are listed in the table printed below.

Function call	Return value (bytes)
USR(0)	Free memory
USR(1)	Program size
USR(2)	Variable workspace size
USR(3)	Array workspace size
USR(4)	String workspace size
USR(5)	Total RAM available for program and variables

As an example, to determine the size of your BASIC program, you could use the command PRINT USR(1).

Keep in mind that even after performing a NEW, USR(1) will report a program size of two bytes. This is because a BASIC program is stored with two zero bytes attached to its end.

Memory Conflicts

The program resides in the 64's cassette buffer and modifies the USR vector at 785 (\$0311). Other programs that use these areas will probably not work with *Improved FRE*.

IMPROVED FRE

```

0801:16 08 0A 00 8F 20 49 4D 3C
0809:50 52 4F 56 45 44 20 46 E6
0811:52 45 28 29 00 1F 08 14 D3
0819:00 43 4B B2 30 00 32 08 7C
0821:1E 00 81 20 49 B2 38 32 2A
0829:38 20 A4 20 31 30 31 34 D4

```

```

0831:00 48 08 28 00 87 20 42 77
0839:3A 97 20 49 2C 42 3A 43 07
0841:4B B2 43 4B AA 42 00 4E 6D
0849:08 32 00 82 00 7E 08 3C 58
0851:00 8B 20 43 4B B3 B1 32 3B
0859:34 38 30 32 20 A7 20 99 34
0861:22 45 52 52 4F 52 20 49 90
0869:4E 20 44 41 54 41 20 53 80
0871:54 41 54 45 4D 45 4E 54 4B
0879:53 22 3A 90 00 93 08 46 B0
0881:00 97 20 37 38 35 2C 36 14
0889:30 3A 97 20 37 38 36 2C 68
0891:33 00 AF 08 50 00 99 20 87
0899:22 50 52 4F 47 52 41 4D 61
08A1:20 49 4E 53 54 41 4C 4C 9F
08A9:45 44 22 3A 80 00 D4 08 0B
08B1:5A 00 83 20 33 32 32 31 4D
08B9:36 31 2C 31 38 33 2C 32 E2
08C1:32 34 2C 30 2C 32 30 38 43
08C9:2C 31 39 2C 31 36 35 2C 1F
08D1:35 31 00 F8 08 64 00 83 AD
08D9:20 31 33 33 2C 32 35 31 A5
08E1:2C 31 36 35 2C 35 32 3C 35
08E9:31 33 33 2C 32 35 32 2C 7F
08F1:31 36 35 2C 34 39 00 1C 34
08F9:09 6E 00 83 20 31 33 33 C1
0901:2C 32 35 33 2C 31 36 35 57
0909:2C 35 30 2C 31 33 33 2C 30
0911:32 35 34 2C 37 36 2C 31 E8
0919:39 38 00 40 09 78 00 83 87
0921:20 33 2C 32 32 34 2C 31 A4
0929:2C 32 30 38 2C 31 39 2C 2C
0931:31 36 35 2C 34 35 2C 31 D2
0939:33 33 2C 32 35 31 00 64 2D
0941:09 82 00 83 20 31 36 35 18
0949:2C 34 36 2C 31 33 33 2C F0
0951:32 35 32 2C 31 36 35 2C CB
0959:34 33 2C 31 33 33 2C 32 DB
0961:35 33 00 88 09 8C 00 83 61
0969:20 31 36 35 2C 34 34 2C B8
0971:31 33 33 2C 32 35 34 2C 0D
0979:37 36 2C 31 39 38 2C 33 83
0981:2C 32 32 34 2C 32 00 AB 95
0989:09 96 00 83 20 32 30 38 60
0991:2C 31 39 2C 31 36 35 2C E8
0999:34 37 2C 31 33 33 2C 32 1D
09A1:35 31 2C 31 36 35 2C 34 46
09A9:38 00 CF 09 A0 00 83 20 8E
09B1:31 33 33 2C 32 35 32 2C 49
09B9:31 36 35 2C 34 35 2C 31 5B
09C1:33 33 2C 32 35 33 2C 31 E2
09C9:36 35 2C 34 36 00 F3 09 AF
09D1:AA 00 83 20 31 33 33 2C 94
09D9:32 35 34 2C 37 36 2C 31 B7
09E1:39 38 2C 33 2C 32 32 34 1A
09E9:2C 33 2C 32 30 38 2C 31 73
09F1:39 00 17 0A B4 00 83 20 F0
09F9:31 36 35 2C 34 39 2C 31 AB
0A01:33 33 2C 32 35 31 2C 31 1C
0A09:36 35 2C 35 30 2C 31 33 26
0A11:33 2C 32 35 32 00 3B 0A 75
0A19:BE 00 83 20 31 36 35 2C F7
0A21:34 37 2C 31 33 33 2C 34 A6
0A29:35 33 2C 31 36 35 2C 34 50
0A31:38 2C 31 33 33 2C 32 35 A9
0A39:34 00 5E 0A C8 00 83 20 41
0A41:37 36 2C 31 39 38 2C 33 4D
0A49:2C 32 32 34 2C 34 2C 32 46
0A51:30 38 2C 31 39 2C 31 36 37
0A59:35 2C 35 35 00 82 0A D2 FD

```

```

0A61:00 83 20 31 33 33 2C 32 5B
0A69:35 31 2C 31 36 35 2C 35 11
0A71:36 2C 31 33 33 2C 32 35 E8
0A79:32 2C 31 36 35 2C 35 31 31
0A81:00 A6 0A DC 00 83 20 31 CD
0A89:33 33 2C 32 35 33 2C 31 AC
0A91:36 35 2C 35 32 2C 31 33 BE
0A99:33 2C 32 35 34 2C 37 36 E2
0AA1:2C 31 39 38 00 CB 0A E6 EC
0AA9:00 83 20 33 2C 32 32 34 98
0AB1:2C 35 2C 20 32 30 38 2C 9F
0AB9:34 31 2C 31 36 35 2C 35 E0
0AC1:35 2C 31 33 33 2C 32 35 B8
0AC9:31 00 EF 0A F0 00 83 20 C3
0AD1:31 36 35 2C 35 36 2C 31 81
0AD9:33 33 2C 32 35 32 2C 31 F8
0AE1:36 35 2C 34 33 2C 31 33 07
0AE9:33 2C 32 35 33 00 13 0B 07
0AF1:FA 00 83 20 31 36 35 2C EE
0AF9:34 34 2C 31 33 33 2C 32 BE
0B01:35 34 2C 33 32 2C 32 32 50
0B09:38 2C 33 2C 31 36 35 2C 68
0B11:34 00 38 0B 04 01 83 20 44
0B19:31 36 34 2C 33 2C 33 32 81
0B21:2C 31 34 35 2C 31 37 39 41
0B29:2C 33 32 2C 34 33 2C 31 23
0B31:38 38 2C 32 30 31 00 5D BD
0B39:0B 0E 01 83 20 32 35 35 1A
0B41:2C 32 30 38 2C 37 2C 31 4B
0B49:36 39 2C 32 34 32 2C 31 65
0B51:36 30 2C 33 2C 33 32 2C 06
0B59:31 30 33 00 80 0B 18 01 DB
0B61:83 20 31 38 34 2C 39 36 E5
0B69:2C 31 36 32 2C 31 34 2C 86
0B71:31 30 38 2C 30 2C 33 2C BA
0B79:35 36 2C 31 36 35 00 A4 7B
0B81:0B 22 01 83 20 32 35 31 63
0B89:2C 32 32 39 2C 32 35 33 E3
0B91:2C 31 33 33 2C 33 2C 31 5B
0B99:36 35 2C 32 35 32 2C 32 BD
0BA1:32 39 00 C7 0B 2C 01 83 2A
0BA9:20 32 35 34 2C 31 33 33 06
0BB1:2C 34 2C 39 36 2C 31 34 FC
0BB9:34 2C 31 32 37 2C 32 35 42
0BC1:35 2C 30 2C 30 00 00 00 C7
    
```

Louis Giglio is a 64 programmer who lives in Odenton, Maryland. □

MULTI-SCREEN 64

By Bryan Flick

We've all seen those programs that use raster interrupts to put text and bitmap graphics onscreen at the same time or let you have 16 instead of the normal 8 sprites. But they've always restricted where you could put the text or sprites.

Wouldn't it be great if we could print text anywhere on the screen with a bitmap backdrop to add some other effects? Wouldn't it be nice to line up 16 sprites in a row for large moving titles? *Multi-Screen 64* allows you to do just this and more.

Multi-Screen does this by using two

shadow registers. These shadow registers are each 47 bytes long and are arranged exactly like the VIC chip.

Now, suppose you want text and a bitmap screen on at the same time. You would first turn on one set of registers to the text screen and the second set to the bitmap screen. Both appear on the screen simultaneously! Not really, but it appears that way. Every $1/60$ second, one set of shadow registers is copied into the VIC chip. During the next $1/60$ second, the other set of shadow registers is copied in. This happens so fast that they appear to be onscreen at the same time.

Typing It In

Multi-Screen 64 is written entirely in machine language. To enter this short program without errors, use *MLX*, our machine language editor, to type it in. See "Typing Aids" elsewhere in this section. When *MLX* prompts, respond with the following values.

Starting address: C000

Ending address: C067

When you've finished typing, be sure to save a copy of the program before exiting *MLX*.

Turn your computer off and on, or press your reset button, before loading *Multi-Screen 64*. Load it with the ,8,1 extension. When you get a READY prompt, type NEW. This won't erase *Multi-Screen*; it'll just fix some pointers used by BASIC. Now type SYS 49152 to enable *Multi-Screen*.

How to Use

Your 64 or 128 in 64 mode is now set up so you can easily take advantage of these extra features in your own programs. To make it easier to use these features, the first line of your program should always be the following.

10 V1=53153: V2=53201

V1 is the variable that points to the first set of shadow registers. V2 points to the second set. The *Multi-Screen* shadow registers work exactly like the VIC chip, but you must poke different memory values. Use the Offset Table printed here for help regarding these locations in the shadow registers.

A Border Shuffle

Now let's write a simple demonstration. Suppose you want a black border. According to the table, the offset to change the border color is 32. This means that you must poke the figure at the start of the shadow registers plus 32.

To get a black border (color 0), type POKE V1+32,0. The border will change colors, but it won't be black. This is because you didn't change the second set of shadow registers. *Multi-Screen* is now flipping between a black border and the usual light blue border 60 times a second. This happens so fast that the two colors appear to blend together, making one unique color. While most color combinations flicker too much to be useful, a couple (such as black and dark gray, and red and purple) are quite stable. To make the border black, you must also change the second set of shadow registers. Do this by typing POKE V2+33,0. The border is now black.

Text and Graphics

For our second demonstration, we'll mix text and hi-res graphics. According to the *64 Programmer's Reference Guide*, the following lines will turn the bitmap screen on at memory location 8192. POKE 53265,PEEK(53265) OR 32 enables hi-res mode, and POKE 53272,PEEK(53272) OR 8 puts hi-res at 8192.

To find out where to poke our registers, subtract each number after POKE and PEEK by 53248. Doing this gives us 17 for the first POKE (53265-53248=17) and 24 for the second (53272-53248=24). This means that 17 is the register to poke to enable the hi-res screen and register 24 puts the bitmap screen at 8192. The table verifies this. So to enable hi-res mode at that location, type the following.

POKE V1+17,PEEK(V1+17) OR 32
POKE V1+24,PEEK(V1+24) OR 8

Now a bitmap and text screen are on simultaneously. You can type as you would with the normal screen editor, and you can perform hi-res functions as you would normally. For instance, to clear the hi-res screen, type FOR I=8192 TO 16191:POKE I,0:NEXT. If

you have trouble seeing your cursor and text, type PRINT CHR\$(5) to set the text color to white. Note that all characters have different background colors. This is because the hi-res screen is getting its color data from the text screen. You can change this with the following two lines.

POKE V1+24,(PEEK(V1+24) AND 15) OR 48 FOR I=3072 TO 4071:POKE I,16:NEXT

Now the bitmap is getting its color data from location 3072. This completes the effect of the two screens being on simultaneously. To see a design on the hi-res screen, enter lines 50-130 from page 126 of the *Programmer's Reference Guide*.

You'll notice that this interesting backdrop won't be erased by pressing the Clr/Home key. Try typing something or listing the program. You'll notice that the backdrop does not move. It becomes apparent that you can do some effects that would be impossible without *Multi-Screen*. You can even have a multicolored bitmap screen on with a regular text screen. POKE 53270, PEEK (53270) OR 16 turns on multicolor mode. Again, subtract the number after POKE and PEEK by 53248, to get 22. Now, POKE V1+22,PEEK(V1+22) OR 16 makes the hi-res screen turn to multicolored hi-res. These examples show how powerful *Multi-Screen* is. For more features and programming tips, see the demonstration programs.

Different Banks

You can also switch to different video banks. The VIC-II chip can only access 16K at a time, so if you have a hi-res screen that's not in the current bank, you must switch banks. Do this with the following line.

POKE V1-1,(PEEK(V1-1) AND 252) OR x, where x is a number from 0 to 3 which changes banks according to the following table.

X Bank VIC Chip Range

3	0	00000-16383
2	1	16384-32767
1	2	32768-49151
0	3	49152-65536

So if you have a bitmap screen at loca-

tion 40960, you'd type POKE V1-1,(PEEK(V1-1) AND 252) OR 2 to switch to video bank 1, since 40960 lies between 32768 and 49151. The VIC chip is usually in bank 0. If you would like to change the bank for the second set of shadow registers (the above sets the first set of registers), substitute V2 for V1.

Demonstration Programs

Included are three programs to type in and examine. These demonstrations are written entirely in BASIC. To avoid typing errors, enter them with *The Automatic Proofreader*. See "Typing Aids."

Demo 1 mixes hi-res and text graphics, *Demo 2* puts 16 sprites onscreen, and *Demo 3* shows how two colors can be mixed to form unique combinations. Press 1 in the final demo to step through the choices for the first color, and 2 for the second color. Press Q to quit.

I recommend that you examine these three programs to pick up several programming tricks. They are fairly short and easy to understand.

How It Works

As I said before, *Multi-Screen 64* works by flipping between two separate screens. It does this 60 times a second using an IRQ (interrupt). A variable is used to determine which screen is currently being displayed; then it flips. Then a new set of shadow registers is copied in. All this happens before you can blink. Since it happens so quickly, your eye retains both images.

Offset Table

- 0 - Sprite 0 X Coordinate
- 1 - Sprite 0 Y Coordinate
- 2 - Sprite 1 X Coordinate
- 3 - Sprite 1 Y Coordinate
- 4 - Sprite 2 X Coordinate
- 5 - Sprite 2 Y Coordinate
- 6 - Sprite 3 X Coordinate
- 7 - Sprite 3 Y Coordinate
- 8 - Sprite 4 X Coordinate
- 9 - Sprite 4 Y Coordinate
- 10 - Sprite 5 X Coordinate
- 11 - Sprite 5 Y Coordinate
- 12 - Sprite 6 X Coordinate
- 13 - Sprite 6 Y Coordinate
- 14 - Sprite 7 X Coordinate
- 15 - Sprite 7 Y Coordinate

- 16 - Sprites 0-7 X Most Significant Bit
- 17 - Control Register 1
- 18 - Not Available
- 19 - Not Available
- 20 - Not Available
- 21 - Sprite Enable
- 22 - Control Register 2
- 23 - Sprites 0-7 Y Expansion
- 24 - Memory Control
- 25 - Not Available
- 26 - Not Available
- 27 - Sprite Background Priority
- 28 - Sprites 0-7 MCM
- 29 - Sprites 0-7 X Expansion
- 30 - Not Available
- 31 - Not Available
- 32 - Border Color
- 33 - Background Color
- 34 - Background Color 1
- 35 - Background Color 2
- 36 - Background Color 3
- 37 - Sprite Multicolor Register 0
- 38 - Sprite Multicolor Register 1
- 39 - Sprite 0 Color
- 40 - Sprite 1 Color
- 41 - Sprite 2 Color
- 42 - Sprite 3 Color
- 43 - Sprite 4 Color
- 44 - Sprite 5 Color
- 45 - Sprite 6 Color
- 46 - Sprite 7 Color

MULTI-SCREEN 64

```
C000:AD 00 DD 8D A0 CF 8D D0 1D
C008:CF A2 2E BD 00 D0 9D A1 DB
C010:CF 9D D1 CF CA 10 F4 A9 42
C018:00 8D 60 C0 78 A9 29 8D 5F
C020:14 03 A9 C0 8D 15 03 58 CC
C028:60 AD 60 C0 D0 19 AD A0 44
C030:CF 8D 00 DD A2 2E BD A1 C5
C038:CF 9D 00 D0 CA 10 F7 A9 46
C040:01 8D 60 C0 4C 31 EA AD 68
C048:D0 CF 8D 00 DD A2 2E BD 6B
C050:D1 CF 9D 00 D0 CA 10 F7 2C
C058:A9 00 8D 60 C0 4C 31 EA EA
C060:00 00 00 00 00 00 00 00 E1
```

DEMO 1

```
FQ 5 COPYRIGHT 1992 - COMPUTE
    {SPACE}PUBLICATIONS INTL
    {SPACE}LTD - ALL RIGHTS R
    ESERVED
PP 10 SYS 49152
BJ 20 V1=53153:V2=53201
MG 30 POKE V1+32,0:POKE V1+33,
    0
RA 40 POKE V2+32,0:POKE V2+33,
    0
QA 50 POKE V1+17,PEEK(V1+17) 0
    R 32
EA 60 POKE V1+24,PEEK(V1+24) 0
    R 8
```

PROGRAMS

```
FS 70 POKE V1+24,(PEEK(V1+24)
{SPACE}AND 15) OR 48
QX 80 FOR I=3072 TO 4071:POKE
{SPACE}I,48:NEXT
AB 90 FOR I=8192 TO 16191:POKE
I,0:NEXT
GK 100 FOR X=0 TO 319 STEP .5
SK 110 Y=INT(90+80*SIN(X/10))
PS 120 CH%=X/8:RO%=Y/8
FB 130 LN=Y AND 7
SX 140 BY=8192+RO%*320+CH%*8+L
N
KM 150 BI=7-(X AND 7)
JP 160 POKE BY,PEEK(BY) OR 2↑B
I
SQ 170 NEXT
SJ 180 PRINT CHR$(147);
KG 190 FOR I=0 TO 100:C=I AND
{SPACE}31
CA 192 POKE 646,C
DH 195 IF C>=16 THEN PRINT CHR
$(18);
MR 200 PRINT "THIS IS LINE #";
I
PS 210 NEXT
CD 220 END
```

DEMO 2

```
FQ 5 COPYRIGHT 1992 - COMPUTE
{SPACE}PUBLICATIONS INTL
{SPACE}LTD - ALL RIGHTS R
ESERVED
PP 10 SYS 49152
BJ 20 V1=53153;V2=53201
JK 30 FOR I=832 TO 894:POKE I,
255:NEXT
BG 40 POKE V1+32,0:POKE V1+33,
0
JB 50 POKE V2+32,0:POKE V2+33,
0
QD 55 POKE V1+21,255
PC 56 POKE V2+21,255
JH 60 FOR I=0 TO 7:POKE 2040+I
,13
MP 70 POKE V1+39+I,I+2:POKE V2
+39+I,I+2
AK 80 NEXT
GG 90 POKE V1+29,0:POKE V2+29,
0
MD 95 POKE V1+23,0:POKE V2+23,
0
HH 100 POKE V1+28,0:POKE V2+28
,0
EM 110 FOR I=0 TO 15:X=24+I*20
:Y=128
AK 120 GOSUB 1000
SK 130 NEXT
CM 140 PRINT CHR$(5);CHR$(147)
;TAB(8);"YOU NOW HAVE 1
6 SPRITES,"
GD 150 PRINT TAB(10);"ON-SCREE
N, AT ONCE!!"
MX 160 END
HS 1000 A=0:J=I:IF J>=8 THEN A
=48
DK 1010 J=J AND 7
AJ 1020 POKE V1+A+J*2,X AND 25
5
HA 1030 B=PEEK(V1+A+16):C=2↑J
FS 1040 IF X>=256 THEN 1060
```

```
CF 1050 POKE V1+A+16,B AND (25
5-C):GOTO 1070
DM 1060 POKE V1+A+16,B OR C
RR 1070 POKE V1+A+J*2+1,Y
XF 1080 RETURN
```

DEMO 3

```
FQ 5 COPYRIGHT 1992 - COMPUTE
{SPACE}PUBLICATIONS INTL
{SPACE}LTD - ALL RIGHTS R
ESERVED
PP 10 SYS 49152
BJ 20 V1=53153;V2=53201
PJ 30 C1=0
MK 40 C2=0
MP 100 PRINT CHR$(5);CHR$(147)
;
JB 110 PRINT "1ST COLOR=";C1
HR 120 PRINT "2ND COLOR=";C2
RX 122 PRINT
XJ 123 PRINT "PRESS 1 TO INCRE
MENT 1ST COLOR"
XA 124 PRINT "PRESS 2 TO INCRE
MENT 2ND COLOR"
EP 125 PRINT "PRESS Q TO QUIT"
ES 130 POKE V1+32,C1:POKE V1+3
3,C1
XE 140 POKE V2+32,C2:POKE V2+3
3,C2
QB 150 GET A$
JF 160 IF A$="1" THEN C1=C1+1
{SPACE}AND 15:GOTO 100
SK 170 IF A$="2" THEN C2=C2+1
{SPACE}AND 15:GOTO 100
RQ 175 IF A$="Q" THEN END
XX 180 GOTO 150
```

Bryan Flick lives in Stroudsburg, Penn-
sylvania.

PADLOCK

By Albert and Emil Heyrovsky

If you have programs that you would like to keep private, then *Padlock* for the 64 is just the utility for you. This utility encodes programs with a given code word. If someone doesn't know that word, the program is impossible to run. You gain access to the file *only* after entering the correct word. There is no other way to unlock the coded information, so you'd better remember the password.

Typing It In

Padlock is written entirely in machine language, but it loads and runs like a BASIC program. Use *MLX*, our machine language entry program, to type it in. When *MLX* prompts, respond with the following values.

Starting address: 0801
Ending address: 0ED0

After you've entered the program, remember to save a copy before exiting *MLX*.

Locking Your Files

When you run *Padlock*, you'll see several prompts.

Source: This is the name of the file you wish to encode. Make a note of its name before you run *Padlock*, since the program has no provisions for reading a directory.

Destination: This is the new name for the encoded version. For maximum security, be sure to delete the unencoded version of your file after you make the coded copy.

SYS \$: This is the SYS address in hexadecimal notation with which to run your program. If your program is in BASIC or if it is a machine language program that runs from BASIC, enter A496. Other common SYS addresses include 49152 (\$C000), 828 (\$33C), 32768 (\$8000), and 24576 (\$6000).

\$0001: Enter the value at address \$0001. This value will be 37 in hex unless you have reconfigured the computer's memory locations.

Code Word: This is your secret word (up to 20 characters in length) that is needed to activate the encoded version of your program. You are strongly advised to write down the password or keep an unencoded version of your file hidden safely away as a backup. If you forget the password, the file is inaccessible. If you enter the wrong password, the data will be incorrectly decoded. If you make a mistake, you'll have to reload the file in order to type in the correct word.

Padlock and your source program don't have to be on the same disk. When you run *Padlock*, you'll be prompted to insert source and destination disks. Press Return at the prompts. Load the encoded file as you would any BASIC program. You'll be asked for a password when you run it.

How It Works

The encoding system employed in *Padlock* uses the code word that you supply to perform an exclusive OR (EOR) function on a byte-by-byte basis with the data in the program. It also performs another EOR function with the sum of the ASCII values of the code

word. This sum is increased with every new byte to take the encoding process even further. When decoding, the EOR process works identically, but this time in reverse. Commercial and military encrypting machines use variations of this logical procedure to encode and decode messages when security is required.

PADLOCK

```

0801:0B 08 C7 07 9E 32 30 36 56
0809:31 00 00 00 A9 36 85 01 E3
0811:A2 00 8E 20 D0 8E 21 D0 1A
0819:86 9D A9 C1 8D 18 03 A9 A1
0821:FE 8D 19 03 BD DF 09 9D 84
0829:00 CB E8 D0 F7 EE 27 08 28
0831:EE 2A 08 AD 2A 08 C9 D0 F4
0839:D0 EA BD 54 08 9D 00 01 21
0841:E8 E0 17 D0 F5 A0 03 B9 DF
0849:27 0A 20 16 E7 88 D0 F7 CF
0851:4C 00 01 B9 6B 08 99 0D FE
0859:08 C8 D0 F7 B9 6B 09 99 60
0861:0D 09 C8 C0 D1 D0 F5 4C 69
0869:5D CB A2 00 86 7B 86 FD 9C
0871:8E 20 D0 8E 21 D0 A9 C1 35
0879:8D 18 03 A9 FE 8D 19 03 B4
0881:A2 22 BD A9 09 20 16 E7 9A
0889:CA 10 F7 20 42 F1 C9 0D 7E
0891:D0 04 A4 FD D0 3F C9 14 AA
0899:D0 0B A4 D3 C0 0B F0 EB A6
08A1:C6 FD 20 16 E7 20 66 08 8E
08A9:A0 15 C4 FD D0 05 C6 FD ED
08B1:4C 2E 08 20 16 E7 A4 D3 E3
08B9:A9 01 91 F3 A9 3C 91 D1 83
08C1:4C 2E 08 C9 A0 B0 0B C9 C8
08C9:80 B0 04 C9 20 B0 03 A9 D6
08D1:00 6E E6 FD 60 20 9D 09 7E
08D9:A9 DE 85 FB A9 09 85 FC 60
08E1:A0 00 A6 FD 98 18 7D 5A 71
08E9:04 CA D0 FA 85 FE A9 36 2A
08F1:85 01 A6 FD B1 FB 8D AC FE
08F9:04 5D 5A 04 45 FE E6 FE E1
0901:91 FB A5 FB C9 00 D0 06 45
0909:A5 FC C9 00 F0 0B E6 FB E3
0911:D0 02 E6 FC CA D0 DD F0 FE
0919:D9 A9 20 8D AC 04 A0 7F 95
0921:B9 1D 09 9D 00 01 88 10 37
0929:F7 A9 DE 85 FB A9 09 85 F3
0931:FC A9 00 85 2D A9 00 85 1A
0939:2E A0 00 AD D9 08 C9 09 F0
0941:90 35 D0 07 AD D5 08 C9 12
0949:DE 90 2C 38 AD A8 08 E9 02
0951:DE 8D 67 01 AD AE 08 E9 55
0959:09 18 6D D9 08 8D 6D 01 93
0961:18 AD 67 01 6D D5 08 8D 48
0969:67 01 90 03 EE 6D 01 A9 8A
0971:49 8D 01 01 8D 08 01 4C 96
0979:00 01 20 7F 01 B1 FB 91 20
0981:2D 20 7F 01 E6 2D D0 02 C1
0989:E6 2E A5 FB C9 00 D0 2A 29
0991:A5 FC C9 00 D0 24 E6 01 D4
0999:20 59 A6 20 33 A5 BA A9 38
09A1:73 9D 01 01 A9 A4 9D 02 22
09A9:01 A9 09 20 16 E7 A9 47 B4
09B1:8D 18 03 A9 00 85 01 4C EF
09B9:00 00 E6 FB D0 BC E6 FC AC

```

```

09C1:38 B0 B7 38 AD 13 01 E5 38
09C9:FB 85 FB AD 19 01 E5 FC 2B
09D1:85 FC 18 A5 FB 69 DE 85 0C
09D9:FB A5 FC 69 09 85 FC 38 1A
09E1:A9 00 E5 2D 85 2D A9 00 8C
09E9:E5 2E 85 2E 18 A5 2D 69 29
09F1:00 85 2D A5 2E 69 00 85 02
09F9:2E 60 A2 10 BD CD 09 20 E7
0A01:16 E7 CA 10 F7 60 9E 20 13
0A09:3A 44 52 4F 57 20 45 44 94
0A11:4F C3 00 0D 0D 4D 45 54 0B
0A19:53 59 D3 20 59 54 49 52 AA
0A21:55 43 45 D3 00 93 05 08 F6
0A29:0E 09 0D 0D 05 2E 2E 64
0A31:47 4E 49 44 4F 43 45 C4 C0
0A39:99 11 0D A9 93 20 16 E7 CB
0A41:A9 0D 20 16 E7 A9 09 85 50
0A49:D3 A9 03 85 D6 20 6C E5 60
0A51:A2 00 BD E0 CE C9 FF F0 0B
0A59:1A C9 0D F0 06 20 16 E7 62
0A61:E8 D0 EF A9 05 85 D3 E6 83
0A69:D6 8A 48 20 6C E5 68 AA 0D
0A71:E8 D0 DF A2 04 A9 00 95 B0
0A79:FB CA 10 FB E8 86 02 BD 23
0A81:D6 CE 85 D3 8A 0A 18 69 B8
0A89:08 85 D6 20 6C E5 20 42 5D
0A91:F1 C9 0D D0 08 A6 02 48 E6
0A99:B5 FB D0 39 68 C9 14 D0 98
0AA1:10 A6 02 A5 D3 DD D6 CE 94
0AA9:F0 07 D6 FB A9 14 20 16 86
0AB1:E7 20 03 CC 48 A6 02 B5 85
0AB9:FB DD DB CE D0 06 D6 FB F3
0AC1:68 4C B0 CB 68 20 16 E7 C7
0AC9:A4 D3 A9 01 91 F3 A9 3C 56
0AD1:91 D1 4C B0 CB 68 20 16 0E
0AD9:E7 E8 E0 05 D0 9F 4C 3B 61
0AE1:CC A6 02 E0 04 F0 04 E0 21
0AE9:02 B0 14 C9 A0 B0 0B C9 F1
0AF1:80 B0 04 C9 20 B0 03 A9 03
0AF9:00 60 A6 02 F6 FB 60 C9 4D
0B01:30 90 F4 C9 3A 90 F3 C9 54
0B09:41 90 EC C9 47 90 EB C9 3C
0B11:C1 90 E4 C9 C7 B0 E0 90 B8
0B19:E1 A9 00 A6 FF 18 7D 8F DF
0B21:06 CA D0 FA 85 97 A6 FD 8C
0B29:BD E9 05 20 A5 CC 95 4B 12
0B31:CA D0 F5 A6 FE BD 3A 06 73
0B39:20 A5 CC 95 26 CA D0 F5 AF
0B41:A6 FD B5 4B A8 CA D0 04 AB
0B49:8A E8 D0 02 B5 4B 20 B5 E9
0B51:CC 95 4B CA D0 EC A6 ED CE
0B59:E0 03 B0 0A A5 4C 85 4B 0C
0B61:A9 00 85 4C F0 04 B5 4A 0F
0B69:85 4B A6 FE E0 02 D0 0C 96
0B71:A5 27 A4 28 20 B5 CC 85 32
0B79:26 4C C0 CC A4 27 84 26 8B
0B81:4C C0 CC C9 1B 90 09 C9 1B
0B89:41 90 02 69 08 29 0F 60 9E
0B91:69 09 60 0A 0A 0A 85 5D
0B99:02 98 18 65 02 60 20 62 64
0BA1:CE 20 FA CD 90 03 4C 5D E9
0BA9:CB 20 EF CD A6 FB BD 4C 75
0BB1:05 20 A8 CE 9D EF CF CA 6B
0BB9:D0 F4 20 0C CE 20 42 F1 A7
0BC1:F0 FB 20 EF CD A5 FB A2 F1
0BC9:F0 A0 CF 20 F9 FD A2 08 91
0BD1:A0 00 20 00 FE 20 4A F3 3D
0BD9:90 06 20 BE CD 4C 9D CE 53
0BE1:20 3F CE A9 00 A2 DE A0 35
0BE9:09 20 9E F4 90 06 20 BE 4B

```

```

0BF1:CD 4C 9D CE A9 DE 85 FA 71
0BF9:A9 09 85 FB A0 00 A6 AE 98
0C01:D0 02 C6 AF C6 AE A6 FF 14
0C09:B1 FA 5D 8F 06 45 97 E6 B8
0C11:97 91 FA A5 FA C5 AE D0 30
0C19:09 A5 FB C5 AF D0 03 4C 0E
0C21:4F CD E6 FA D0 02 E6 FB 39
0C29:CA D0 DD F0 D9 20 29 CE 16
0C31:20 42 F1 F0 FB 20 EF CD 45
0C39:A6 FC BD A1 05 20 A8 CE 7E
0C41:9D EF CF CA D0 F4 A5 FC 6D
0C49:A2 F0 A0 CF 20 F9 FD A2 87

```

Albert and Emil Heyrovsky live in Prague, Czechoslovakia. □

TRIBLOX

By Mark Neri

TriBlox is a highly addictive game of falling blocks for the 64. In this arcade-style game, you must rotate and position groups of blocks to get three blocks of the same color in a row.

Entering the Program

TriBlox is written entirely in machine language, but it can be loaded and run like a BASIC program. To type in the program, use *MLX*, our machine language entry program. See "Typing Aids" elsewhere in this section. When *MLX* asks for the starting and ending addresses, respond with the following values.

Starting address: 0801

Ending address: 0E80

When you are finished typing, be sure to save a copy of the program before exiting *MLX*.

Playing the Game

After you load and run *TriBlox*, you'll see a bin in the center of your monitor's screen. This is the area where the game is played. To the left of the screen is your score and the level-selection meter.

To begin a game, move the joystick left or right to select which level you want to play. A black needle on the yellow meter indicates which level is currently selected. When the needle is positioned toward the left, the game plays slower. As you move it to the right, game speed increases. Once you have selected a level, press the joystick button to begin play.

When the game begins, groups of three blocks, stacked vertically, will

PROGRAMS

drop from the top of the screen. Each block in the group has its own color. Pressing the joystick button will rotate the colors in a group of blocks. Moving the joystick left or right will move the blocks from side to side. Pulling down on the joystick will cause the blocks to fall more quickly.

A group of blocks will stop falling when it encounters either the bottom of the bin or another block. The object of the game is to get three matching blocks in a row, either vertically, horizontally, or diagonally. When you align three blocks of the same color, those blocks will disappear, and the blocks above them will drop down.

You are awarded points for each block that you eliminate. The number of points depends on the difficulty level that you have selected. Faster levels earn more points per block. As you play the game for a while, your skill at maneuvering the blocks will increase. The computer takes note of this. After you eliminate a certain number of blocks, your level increases, and the blocks fall faster. When the blocks stack up to the top of the bin, the game is over. To play again, press the joystick button.

TRIBLOX

```
0801:0B 08 70 17 9E 32 34 30 6E
0809:37 00 00 00 20 20 20 20 96
0811:20 20 20 20 20 A0 C4 B9 06
0819:3C 08 99 F8 00 B9 FD 08 F6
0821:99 33 03 88 D0 F1 A0 09 4C
0829:B9 0C 08 99 FF 03 88 D0 A1
0831:F7 A9 EE 85 2D A9 13 85 99
0839:2E 4C 00 01 07 60 05 EE 36
0841:13 F3 0C B9 6E 09 99 E8 A8
0849:07 C8 D0 F7 EE 02 01 EE 19
0851:05 01 C6 F9 D0 ED A2 03 23
0859:20 34 03 F0 33 C9 07 D0 95
0861:16 A2 01 20 34 03 D0 0A A0
0869:A2 04 20 34 03 18 69 07 65
0871:10 05 A2 0A 20 34 03 85 1D
0879:A8 A5 A7 85 A9 A5 FE 85 FB
0881:F7 A5 FF 85 F8 20 6C 03 73
0889:A5 F8 85 FF A5 F7 85 FE 72
0891:E8 20 34 03 D0 1E A2 08 21
0899:20 34 03 A0 02 84 A8 85 2A
08A1:A6 18 A5 FC 65 A6 85 F7 58
08A9:A5 FD 65 A7 85 F8 20 6C EF
08B1:03 4C 13 01 E8 20 34 03 FB
08B9:D0 1C A0 03 84 A8 E8 20 36
08C1:34 03 F0 08 A2 08 20 34 F4
08C9:03 4C 5C 01 A2 0A 20 34 BB
08D1:03 E6 A7 4C 5C 01 E8 20 AF
08D9:34 03 D0 0A E8 20 34 03 B2
08E1:18 69 04 A8 D0 D6 E8 20 37
08E9:34 03 D0 0A A2 02 20 34 21
08F1:03 18 69 06 D0 ED A2 08 A2
```

```
08F9:20 34 03 D0 E6 A9 00 85 F7
0901:A7 A4 FB F0 0C 06 FA 2A 37
0909:26 A7 C6 FB CA D0 F2 A8 D8
0911:60 48 B1 FE 85 FA A9 08 FE
0919:85 FB 68 A4 FE D0 02 C6 4A
0921:FF C6 FE C0 E7 D0 DE A4 B5
0929:FF C0 07 D0 D8 A9 37 85 BA
0931:01 58 4C 0D 08 A4 A8 F0 49
0939:22 A5 F7 38 E5 A8 B0 03 7E
0941:C6 F8 38 85 F7 A5 FC E5 8A
0949:A8 B0 02 C6 FD 85 FC B1 3A
0951:F7 88 91 FC 98 D0 F8 C4 42
0959:A9 F0 0A B1 F7 C6 FD C6 76
0961:F8 C6 A9 10 EC 60 78 E6 98
0969:01 4C 16 08 60 00 0B 08 73
0971:C7 07 9E 32 30 36 31 00 DC
0979:00 00 20 F3 0A B9 41 A2 EB
0981:1B 95 01 CA D0 FB C0 17 62
0989:16 85 15 20 76 5A 47 5E B6
0991:0B 2A 80 02 A9 08 33 85 3D
0999:68 58 21 A1 0E 67 48 A8 7B
09A1:05 A9 06 20 5F 09 BB 60 5A
09A9:85 86 42 24 74 61 A3 38 53
09B1:80 04 09 39 07 85 A8 76 CF
09B9:08 85 0A 4C 0A 0A 9A 26 0B
09C1:02 0A A8 02 6A 8B 81 08 19
09C9:06 07 26 CC 07 03 18 65 0C
09D1:07 18 69 10 85 E1 1D 08 91
09D9:69 64 08 A5 0A F0 0E A5 EA
09E1:38 45 03 C0 C0 09 83 44 F7
09E9:09 34 7B A0 00 54 05 A0 03
09F1:28 D0 15 A5 06 90 04 07 CA
09F9:20 BF 0A E4 6C 70 C0 F7 33
0A01:05 C6 16 4C 04 09 00 57 6C
0A09:8D 00 1A 69 44 27 1A 91 42
0A11:4F 1D 91 77 1D 91 C6 1C 96
0A19:91 08 79 56 1C A5 16 A9 D9
0A21:20 A0 29 0A 5E 12 A0 51 01
0A29:D0 15 14 A4 79 D1 07 D0 A9
0A31:06 E6 03 C0 89 16 61 10 E5
0A39:02 D0 48 03 08 0F A4 2E 73
0A41:C9 00 D0 6E 17 F0 17 A5 8B
0A49:04 A6 05 A4 06 85 05 86 CA
0A51:06 84 C0 39 18 68 17 4C 12
0A59:2F 99 01 85 17 A0 78 B1 C1
0A61:0D F0 20 F0 0C 19 46 02 26
0A69:83 F4 0B 4C 59 09 C6 15 34
0A71:D0 0F A9 10 38 E5 0F 85 E4
0A79:15 E6 02 A5 02 C9 14 B0 7C
0A81:03 4C 5C 08 20 F6 09 4C 71
0A89:25 08 8D 78 D1 11 9E FF 7B
0A91:8D 0E C3 0E 0F D4 A9 80 E8
0A99:8D 12 D4 8D 18 D4 AD 1B F6
0AA1:D4 29 07 C9 08 B0 F7 B0 8B
0AA9:E7 E3 09 91 37 10 A2 04 28
0AB1:A9 97 6C 0E 0D 4C 5F F1 39
0AB9:B7 BD DA 45 0B BD DE 09 DE
0AC1:85 0C C0 1F 90 C9 66 B0 CE
0AC9:1E C9 60 90 1A 27 FC 01 DC
0AD1:0A 14 A4 0C D1 11 D0 0E C7
0AD9:A9 01 2A 3E A4 B0 40 03 01
0AE1:A0 50 91 56 10 C6 11 C6 76
0AE9:84 82 11 C9 44 0A 08 0E 08
0AF1:C6 14 12 C9 03 D0 C6 CA 01
0AF9:D0 AB 60 29 51 79 78 02 63
0B01:52 A2 40 A9 00 AA A7 5D EE
0B09:C0 40 04 C1 44 C2 40 22 FB
0B11:C3 E8 D0 F1 60 20 7C 09 02
0B19:A5 10 8D 67 F0 76 A0 27 F7
0B21:A9 C0 B0 07 08 C1 0C 64 86
```

```
0B29:14 C0 E4 C3 36 3C B1 0D 65
0B31:29 01 D0 14 7C 0B 3F 21 27
0B39:34 0A 98 48 20 9E 0B 68 7D
0B41:A8 5E DC F0 1B 94 18 11 5A
0B49:72 4C 81 A1 12 A5 0D CB 03
0B51:C8 0D A5 0E CB 0E 4C 13 E6
0B59:0A 28 13 C9 D8 F0 14 A9 D9
0B61:20 58 A5 13 8F E6 A0 0F EB
0B69:FE 14 E9 E8 14 4C 53 0A 52
0B71:88 C0 FF D0 8F 4C F6 09 AD
0B79:60 A2 00 8E 21 D0 8E 20 DA
0B81:D0 BD 1E 0C 0F 06 7E 01 84
0B89:05 18 0D 74 04 BD 12 0E 5A
0B91:81 17 05 BD 0C 0F 78 06 3E
0B99:BD 06 10 9D 00 C1 05 00 FC
0BA1:52 FA D8 BD FA 11 9D F4 E2
0BA9:D9 BD F4 12 9D EE DA E8 23
0BB1:E0 FB D0 CB 60 A0 9D A0 6F
0BB9:10 FB AD 11 D0 30 FB 60 3D
0BC1:A9 0F E3 1E A9 04 59 20 FE
0BC9:A9 D8 14 A2 16 A0 08 B1 8C
0BD1:11 38 E9 5E 91 13 82 7C FB
0BD9:F6 A5 11 C6 18 28 85 11 E0
0BE1:85 13 A5 12 80 2F 12 37 71
0BE9:B5 D4 85 14 56 DD 60 78 65
0BF1:A9 03 A2 2E A9 38 8D 76 94
0BF9:A9 D0 8D 61 0F A2 08 14 08
0C01:B9 00 D0 99 00 38 88 0D A8
0C09:7C EE 08 0B EE 0B 0B 82 09
0C11:15 EE A2 31 BD 2D 0B 9D 2D
0C19:FF 3A 88 CB F7 A9 07 85 87
0C21:01 58 A9 1E 8D 18 D0 60 B5
0C29:29 1F DB E7 E7 DB C1 8D 57
0C31:22 00 02 AB D5 E8 00 04 AB
0C39:8A 00 A5 39 A5 C3 C3 A5 48
0C41:28 0F 99 BD AA 01 BD 99 AE
0C49:FF FF C3 BD BD C3 FF 17
0C51:A9 D0 29 68 CB 20 B4 0A 70
0C59:AE DC 04 05 04 D0 06 53 93
0C61:00 06 C6 61 08 D0 08 E8 66
0C69:98 0C F0 02 3A 26 8A 11 9F
0C71:01 60 4C 62 0B A2 0D A9 78
0C79:A0 9D 07 06 6C 39 FA A6 6F
0C81:18 A9 C2 9D 08 06 60 17 72
0C89:F1 14 30 01 C9 0A 90 03 50
0C91:D0 1B 06 F8 18 65 1A 85 39
0C99:1A A5 1B E2 05 1B A5 1C B5
0CAL:69 00 85 1C D8 20 D4 0B DC
0CA9:E6 19 A5 19 C9 3F D0 0B B9
0CB1:A5 18 C9 D0 F0 05 E6 18 2E
0CB9:20 8C 0B F5 E0 3F 03 A0 70
0CC1:00 B5 19 48 38 4A 4A 80 EE
0CC9:12 E6 68 29 0F 18 69 30 20
0CD1:99 1B 05 C8 E3 10 E5 60 36
0CD9:A2 0A BD 14 0C C0 09 05 39
0CE1:A9 01 9D 9F D9 CA D0 F2 4B
0CE9:88 1B D0 F9 AD 00 DC 29 17
0CF1:10 F0 F9 4C 10 08 07 01 02
0CF9:0D 6C F4 6A 0F 16 05 12 E5
0D01:3C 89 F2 78 0A F2 38 88 96
0D09:C9 E3 3D D4 E3 B8 C3 13 92
0D11:03 0F 12 05 F7 3D C6 E3 29
0D19:1B 25 8F F7 72 E6 02 3B E9
0D21:04 8A 00 30 30 BA C0 C5 96
0D29:E3 2A 15 8F BB 12 72 43 A9
0D31:6E BF 6F 90 3C 8A 5B 3C 68
0D39:EE 4E 71 43 7D FC 4C EE 28
0D41:0C 05 16 05 0C 3D 59 F1 AF
0D49:70 81 5F F1 78 2A F1 6B C2
0D51:39 71 91 E3 38 0A E2 10 94
```



```

0D59:28 02 A0 A0 E8 6E C5 4B FD
0D61:E7 24 CA E3 EE C9 E3 7D F3
0D69:C5 E3 E4 C3 6D E7 A4 43 CF
0D71:39 39 F2 55 43 72 49 92 33
0D79:93 23 8F 81 42 9C 93 24 FF
0D81:43 43 43 BF 93 24 0F A9 67
0D89:82 A9 38 39 F1 28 01 88 A4
0D91:39 02 E0 69 6B 43 73 0F D9
0D99:E9 C4 6A 20 4E AF A9 4D FA
0DA1:20 AE 93 55 4B 20 4A 49 F7
0DA9:DC 8F 12 6A 4E AF 85 0A 45
0DB1:4D 74 2F 93 0E 0F 8C 0D 81
0DB9:8F 82 38 04 77 77 77 3A 46
0DC1:83 39 04 8A 00 20 20 3A 10
0DC9:89 F2 78 0A F2 38 88 C9 68
0DD1:03 3F 03 E6 39 25 8F 93 1D
0DD9:0D 8F E3 1C 03 9F 94 0B 67
0DE1:8F F7 1A 8F 93 0D 8F A7 95
0DE9:1B 8F 00 40 81 93 3B D8 23
0DF1:E7 38 49 F1 18 04 04 A8 D7
0DF9:9E C6 3C 4E 6A 3C 4A 8A E4
0E01:E3 25 8F 00 05 05 05 33 C3
0E09:B9 23 01 01 01 C0 4E 66 09
0E11:3C EE 92 3C 4E 2A 3C 0A BA
0E19:E2 78 DC 50 84 93 11 8F 89
0E21:00 06 06 06 3B 89 F2 38 FD
0E29:49 F2 00 C2 C5 E3 24 C4 9D
0E31:23 07 07 07 C0 9E 2E 3D 0C
0E39:06 32 4E 92 3C 02 02 02 C7
0E41:02 EC E4 C8 E3 29 C6 43 57
0E49:21 0E 8E 39 0C 32 4C 00 A0
0E51:E5 C4 83 A1 80 BA F0 D8 C5
0E59:C8 10 03 03 A8 50 52 3C D5
0E61:38 32 3C 18 36 3C 32 36 6C
0E69:00 7C 0A E2 10 0E 0E 0E F6
0E71:E8 0A E2 10 28 02 00 00 2B
0E79:00 39 00 00 00 00 00 00 E3

```

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SYNTHESIZER

By Todd Piltingsrud

Synthesizer was designed for those who simply enjoy experimenting with the 64's sophisticated SID chip. Since *Synthesizer* displays the SID chip as it appears to the computer, the serious user can also use the program to design complex sound effects for use in other programs.

Synthesizer is a full-function SID chip editor that is operated with a mock-up of a real keyboard, which is composed of the upper two rows of the 64's keyboard. This keyboard appears at the top of your screen when the program is run. A joystick in port 2 controls the movement of the cursor.

Entering the Program

Synthesizer is a two-part program. The main part is written in BASIC. To help

avoid typing errors, enter it with *The Automatic Proofreader*. See "Typing Aids" elsewhere in this section. Be sure to save a copy of the program before exiting *Proofreader*.

The second part of *Synthesizer* is a machine language routine. To enter it, use *MLX*, our machine language entry program. See "Typing Aids" again. When *MLX* prompts, respond with the following values.

Starting address: C000
Ending address: C6C7

Be sure to save this program with the name SYNTH ML before exiting *MLX*. The main program automatically loads this file, and it looks for that name.

Making Sounds

To edit the settings, use the joystick to move the musical note sprite to the desired setting on the screen; then press and hold the fire button. Move the joystick up or down to change the setting.

Modes

Synthesizer has four keyboard modes: Polyphonic, Solo, Bi-Voice, and Tri-Voice. To select a keyboard mode, simply press the space bar. The first keyboard mode, Poly, uses all three voices played in succession to make chords. This keyboard mode can be used to mimic instruments that can play more than one note at a time, such as the piano or organ.

The second keyboard mode, Solo, uses only Voice 1 and can be used to simulate instruments that can play only one note at a time, such as the flute or trumpet.

The third mode, Bi-Voice, combines Voices 1 and 2 and slightly offsets the frequency of Voice 2 to give a rich, deep choir effect. The last mode, Tri-Voice, is the same as Bi-Voice except that it uses all three voices and slightly offsets the frequencies of Voices 2 and 3, producing an even richer, deeper choir effect.

Voices

The SID chip has three voices. Their different settings are displayed in three vertical rows in the middle of the screen. The first setting in each voice is the waveform. While normal pro-

grams for the SID chip have only the four basic waveforms (Triangle, Sawtooth, Pulse, and Noise), *Synthesizer* adds another four waveforms. These additional waveforms are actually combinations of the original four.

Waveforms

Synthesizer starts with the first two basic waveforms, Triangle and Sawtooth, and then combines these two in the third. *Synthesizer* labels this new waveform as TrSa.

The fourth waveform is the normal Pulse waveform and the fifth is a combination of the Pulse and Triangle waveforms. This new waveform created by *Synthesizer* is labeled PuTr.

The sixth waveform is a combination of the Pulse and Sawtooth waveforms and is labeled PuSa. The seventh waveform is a combination of the Pulse, Triangle, and Sawtooth waveforms. This last combination is labeled PuTS.

Finally, the eighth waveform is the normal Noise waveform. By combining different waveforms, complex sound effects can be created.

Pulse Rate

The next setting on each voice is pulse rate. Holding the fire button down and pushing either up or down will change the value of this setting by 20. To fine-tune this setting, move the joystick to the right; this will increase the pulse rate value by 1.

Octaves

In addition to all the normal functions of each voice, there is also an Octave function displayed at the bottom of each voice. This function can have values from -5 to 7, giving each voice more than a seven-octave range. The lower octave numbers are merely there so that the user can slow down the frequencies enough to hear how complex some of the waveforms really are. For example, set the octave to -5 and the waveform to PuTr for a fascinating breakdown of this waveform.

Equal Voices

For ease of editing the three voices, an extra keyboard function has been added. Pressing the Equal (=) key will equalize all three voices by whatever voice the cursor is positioned on.

PROGRAMS

Filter

The next feature is Filter, found at the bottom left of the screen. To use the filter, you must first turn it on. To do this, move the cursor to the voices setting and hold the fire button down until the desired voices have been selected for filtering. After selecting the voices to be filtered, choose a cutoff frequency, mode, or resonance setting to hear the desired effect.

Modulation

The last feature is Modulation, located on the bottom right of the screen. Modulation is similar to the Vibrato or Sweep functions found on other programs and can be used to create similar effects.

The Modulation feature uses the waveform and frequency settings of Voice 3 to produce a value which is then put into any three locations in the SID chip that the user chooses. The waveform controls the mode of this interesting feature.

Setting the waveform of Voice 3 to Triangle will cause the modulator to produce a value which oscillates from 0 to 255 and back again. This is useful for creating vibrato effects.

When the waveform setting is set to Sawtooth, the value starts from 0 and goes up to 255 and then starts back at 0 again. This is useful for creating sweep effects.

When the waveform is set to Pulse, the value switches immediately between 0 and 255.

Finally, when the waveform is set to Noise, the Modulation feature generates random numbers between the values of 0 and 255.

Frequency

The frequency setting is actually the frequency setting of Voice 3. This figure determines the speed at which the Modulation feature generates its numbers. Holding down the fire button and pressing up or down with this setting will increase or decrease the value by 100. To fine-tune this setting, simply press the joystick right or left; this will increase or decrease the frequency value by 1.

When using this feature, the user may want to turn off Voice 3 to silence any unwanted sounds that the voice

Sound effects for Synthesizer.

	Explosion	Bell	Flute	Synth1	Airplane	Synth2	Synth3
Kybrd	Tri	Solo	Solo	Tri	Bi	Poly	Poly
Voices	=	1	1	=	1&2 3 *	=	=
Wave	Noiz	Tria	Tria	Sawt	Puls	Tria	Tria
Puls	•	•	•	•	•	•	•
Ring	off	on	off	off	off	off	off
Sync	off	off	off	off	off	off	off
Attk	0	0	4	2	15	•	0
Dcay	15	12	0	0	0	•	15
Sust	0	0	15	15	15	•	0
RelS	15	12	5	4	15	•	0
Octv	2	3	6	2	1	•	3
Filter	on	off	off	off	on	off	on
Cutoff	1460	•	•	•	1380	•	1420
Voices	1 2 3	none	none	none	1 2	none	1 2 3
Mode	Lp	•	•	•	Lp	•	Lp
Res	15	•	•	•	15	•	15
Modulat	off	on	on	off	on	off	off
Freq	•	4000	100	•	100	•	•
Add1	25	25	0	25	2	25	25
Add2	25	25	25	25	9	25	25
Add3	25	25	25	25	25	25	25

- * Turn voice 3 off.
- = All voices the same.
- Not applicable.

may produce. To do this, press the f1 key. This key turns the output of Voice 3 on and off.

Solo and Bi-Voice

The Solo and Bi-Voice keyboard modes were designed specifically with the use of the modulator in mind. Since these modes do not use Voice 3, using them will not interfere with the output of the modulator.

Modulation Demo

For an example of the power of the Modulation feature, use the space bar to set the keyboard mode to either Solo or Bi-Voice. Then set the waveform setting of Voice 1 to Triangle and press the Equal key. Next, move the cursor to the frequency setting of the modulator and set it to about 60. Then set the first address to 0 and the second to 7; these are the low frequency settings of Voices 1 and 2. Now, press a key on the *Synthesizer* keyboard. The modulator is putting new values into the low frequency settings of Voices 1

and 2, causing a vibrato effect.

To turn the modulator off, simply set all three addresses to 25; this is a value outside the SID chip's range and has no effect on the chip's output.

Use the list of sound effects for *Synthesizer* printed above to experiment and learn more about one of the 64's most complex and fascinating features: the SID chip.

SYNTHESIZER

```

RP 1 COPYRIGHT 1992 - COMPUTE
  {SPACE}PUBLICATIONS INT'L
  {SPACE}LTD - ALL RIGHTS R
  ESERVED
GA 5 IFPEEK(49152)<>169THENPOK
  E53265,0:LOAD"SYNTH ML",8
  ,1
AP 10 SYS49152:KB$(0)="POLY":K
  B$(1)="SOLO":KB$(2)="BI-
  VOICE":KB$(3)="TRI-VOICE
  "
GB 13 WV$(1)="TRIA":WV$(2)="SA
  WT":WV$(3)="TRSA":WV$(4)
  ="PULS":WV$(5)="PUTR"
QK 14 WV$(6)="PUSA":WV$(7)="PU
  TS":WV$(8)="NOIZ":XP=14:
  YP=7
  
```

```

HA 15 DIMK(76),M(31):FORT=1TO2
4:READA,B:K(B)=A:NEXT:PO
KE53248,125:POKE53249,90
JJ 20 S=54272:M(5)=15:M(4)=17:
M(25)=4:KB=197:M(3)=5:M(
24)=31:M(23)=240:M(22)=2
00
FD 25 M(28)=25:M(29)=25:M(30)=
25:B=24:B$="={CLR}{F1}"
:FORT=STOS+24:POKET,0:NE
XTT
FK 27 FORT=0TO2:POKE49248+T*3,
M(28)+T:NEXT
PJ 30 POKES+22,M(22):POKES+24,
M(24):POKE53264,0:GOSUB3
20:POKE53265,27
JH 35 DATA 8583,62,9094,31,963
4,68,10207,32,10814,50,1
1457,63,12139,34,12860,6
5
PH 40 DATA 13625,35,14435,70,1
5294,36,16203,66,17167,5
4,18188,38,19269,60
FC 45 DATA 20415,29,21629,61,2
2915,45,24278,26,25721,2
3,27251,73,28871,75,3058
8,0
HE 50 DATA 32407,1
MS 55 REM ** WHICH KEYBOARD MO
DE? **
FD 60 IFM(31)=1THEN125
RR 70 IFM(31)=2THEN230
MJ 75 IFM(31)=3THEN175
HB 80 IFPEEK(56320)<>127THEN43
0
PP 85 GETA$:IFA$=""THEN80
QB 90 IFASC(A$)>95ORASC(A$)<19
THEN280
HR 95 F=K(ASC(A$)-19)/M(25+V/7
):IFF=0THEN280
MX 100 H=INT(F/256):L=F-(256*H
)
BR 105 POKES+4+V,M(V+4)AND254:
POKES+V,L:POKES+1+V,H
SP 110 POKES+4+V,M(V+4)ORL:V=V
+7:IFV=21THENV=0
GR 115 GOTO00
AX 120 REM ** SOLO **
MA 125 GETA$:IFPEEK(56320)<>12
7THEN430
DP 130 IFA$=""THEN155
PE 135 IFASC(A$)>95ORASC(A$)<1
9THEN280
FM 140 F=K(ASC(A$)-19)/M(25):I
FF=0THEN280
SP 145 H=INT(F/256):L=F-(256*H
)
KF 150 POKES,L:POKES+1,H:POKES
+4,M(4)
GA 155 IFPEEK(KB)<>64THEN125
MP 160 IFPEEK(KB)=64THENPOKES+
4,M(4)AND254
PA 165 GOTO125
QR 170 REM ** TRI-VOICE **
GD 175 GETA$:IFPEEK(56320)<>12
7THEN430
FG 180 IFA$=""THEN210
SJ 185 IFASC(A$)>95ORASC(A$)<1
9THEN280
SA 190 FORV=0TO14STEP7:F=K(ASC
(A$)-19)/M(25+V/7):IFF=
0THEN280
CD 195 H=INT(F/256):L=F-(256*H
):IFL-14<0THENL=L+14
RM 200 POKES+1+V,H:POKES+V,L-V
:NEXT:V=0
CH 205 FORV=0TO14STEP7:POKES+4
+V,M(V+4)ORL:NEXT:V=0
MM 210 IFPEEK(KB)<>64THEN175
CA 215 IFPEEK(KB)=64THENFORV=0
TO14STEP7:POKES+4+V,M(V
+4)AND254:NEXT:V=0
RF 220 GOTO175
AD 225 REM ** BI-VOICE **
HF 230 GETA$:IFPEEK(56320)<>12
7THEN430
AX 235 IFA$=""THEN260
KM 240 IFASC(A$)>95ORASC(A$)<1
9THEN280
PG 245 FORV=0TO7STEP7:F=K(ASC
(A$)-19)/M(25+V/7):IFF=0
THEN280
FS 250 H=INT(F/256):L=F-(256*H
):IFL<7THENL=L+7
GQ 255 POKES+V,L-V:POKES+1+V,H
:NEXT:V=0:POKES+4,M(4)O
RL:POKES+11,M(11)ORL
HB 260 IFPEEK(KB)<>64THENGOTO2
30
GQ 265 IFPEEK(KB)=64THENFORV=0
TO14STEP7:POKES+4+V,M(V
+4)AND254:NEXT:V=0
XE 270 GOTO230
CJ 275 REM ** KB MODE, EQUALIZ
E, RUN **
FF 280 FORT=1TO4:IFA$<>MID$(B$
,T,1)THENNEXT:GOTO60
CS 281 ONTGO295,288,287,282
FQ 282 PRINT"{HOME}{2 DOWN}"
EJ 283 SYS50078,128,M(24),24:M
(24)=PEEK(780)
DX 284 IFM(24)AND128THENPRINTT
AB(29)"{7}OFF":GOTO60
GQ 285 PRINTTAB(29)"{3 SPACES}"
":GOTO60
QC 287 RUN
AJ 288 GOSUB320:GOTO60
BA 290 REM ** KEYBOARD MODE **
JB 295 FORV=0TO14STEP7:POKES+4
+V,M(V+4)AND254:NEXT:V=
0:M(31)=M(31)+1
MP 300 POKES+14,M(14):POKES+15
,M(15):IFM(31)=4THENM(3
1)=0
FM 305 PRINT"{HOME}{2 DOWN}"
{WHT}"TAB(20)KBS(M(31))
"{5 SPACES}":GOTO60
PC 315 REM ** EQUALIZE VOICES
{SPACE}**
BG 320 FORV=0TO14STEP7:M(V+2)=
M(E+2):M(V+3)=M(E+3):M(
V+4)=M(E+4):M(V+5)=M(E+
5)
MP 323 M(V+6)=M(E+6):M(25+V/7)
=M(25+E/7)
MK 325 POKES+2+V,M(E+2):POKES+
3+V,M(E+3):POKES+5+V,M(
E+5):POKES+6+V,M(E+6)
DH 326 POKES+4+V,M(E+4):NEXT
XB 327 REM ** PRINT VALUES **
CK 330 PRINT"{HOME}{2 DOWN}"
{WHT}"TAB(20)KBS(M(31))
HD 335 FORV=0TO14STEP7:T=7+V/7
*13:PRINT"{RED}{HOME}"
{5 DOWN}"
EH 337 PRINTTAB(T+1)WVS((M(E+4
)AND240)/16)
FS 340 PRINTTAB(T)"{5 SPACES}"
{5 LEFT}"M(E+2)+M(E+3)*
256"{PUR}"
ED 345 IF(M(E+4)AND4)=0THENPRI
NTTAB(T)"OFF":GOTO350
QR 347 PRINTTAB(T)"ON"
RD 350 IF(M(E+4)AND2)=0THENPRI
NTTAB(T)"OFF":GOTO360
AR 355 PRINTTAB(T)"ON"
BX 360 PRINT"{3}"TAB(T)(M(E+5)
AND240)/16"{LEFT}"
CR 365 PRINTTAB(T)(M(E+5)AND15"
{LEFT}"
JE 370 PRINTTAB(T)(M(E+6)AND24
0)/16"{LEFT}"
DP 375 PRINTTAB(T)M(E+6)AND15"
{LEFT}"
XJ 380 PRINT"{BLU}"TAB(T)6-(LO
G(M(E/7+25)))/LOG(2):NE
XT:V=0
RP 385 PRINT"{CYN}{3 DOWN}"TAB
(14)M(21)+M(22)*8"{YEL}"
TAB(31)M(14)+M(15)*256
PS 390 IFM(23)AND1THENPRINTTAB
(15)"{CYN}1{UP}"
MB 392 IFM(23)AND2THENPRINTTAB
(17)"{CYN}2{UP}"
JK 394 IFM(23)AND4THENPRINTTAB
(19)"{CYN}3{UP}"
KM 395 PRINT"{YEL}"TAB(31)M(28
)
QE 400 IFM(24)AND16THENPRINTTA
B(15)"{CYN}LP{UP}"
SE 401 IFM(24)AND64THENPRINTTA
B(18)"{CYN}HP{UP}"
HA 402 IFM(24)AND32THENPRINTTA
B(21)"{CYN}BP{UP}"
JP 405 PRINT"{YEL}"TAB(31)M(29
)
JM 410 PRINT"{CYN}"TAB(14)(M(2
3)AND240)/16"{YEL}"TAB(
31)M(30)
JC 415 PRINT"{CYN}"TAB(14)M(24
)AND15
KA 420 RETURN
DX 425 REM{2 SPACES}** MOVE, V
OICES **
GQ 430 IFYP>16THEN570
JQ 435 POKE53248,13+XP*8:POKE5
3249,34+YP*8
BP 440 J=PEEK(56320):IFJ=127TH
EN60
BA 443 IF(JAND16)=0THEN634
EA 445 IF(JAND8)=0ANDYPC<>7THEN
YP=YP-1
GA 500 IF(JAND2)=0THENYP=YP+1:
IFYP=16THENYP=19:GOTO57
0
BD 550 IF(JAND4)=0ANDE<>0THENE
=E-7:XP=XP-13
BC 555 IF(JAND8)=0ANDE<>14THEN
E=E+7:XP=XP+13
KF 560 IFXP<>40ANDXP<>8THENPOK
E53264,0:XP=14+E/7*13

```

PROGRAMS

```

KS 561 IFXP=40THENPOKE53264,1:
XP=8
BM 562 GOTO435
JS 563 REM ** FILTER AND MOD *
*
AM 570 IFXP<>8THEN600
KC 571 REM ** MODULATION **
AB 572 IFYP=23THENYP=22
RF 573 POKE53248,13+XP*8:POKE5
3249,34+YP*8
PC 574 J=PEEK(56320):IFJ=127TH
EN60
SS 575 IF(JAND16)=0THEN634
JP 576 IF(JAND1)=0THENYP=YP-1:
IFYP=18THENXP=14+E/7*13
:YP=15:GOTO560
GK 580 IF(JAND2)=0ANDYP<>22THE
NYP=YP+1
MP 585 IF(JAND4)=0THEN600
KX 595 GOTO573
KD 597 REM ** FILTER **
CX 600 XP=26:POKE53264,0
HM 605 POKE53248,13+XP*8:POKE5
3249,34+YP*8
GA 607 J=PEEK(56320):IFJ=127TH
EN60
DR 608 IF(JAND16)=0THEN634
EH 610 IF(JAND1)=0THENYP=YP-1:
IFYP=18THENXP=14+13*E/7
:YP=15:GOTO560
MR 615 IF(JAND2)=0ANDYP<>23THE
NYP=YP+1
JD 620 IF(JAND8)=0THENPOKE5326
4,1:XP=8:GOTO572
DR 630 GOTO605
JF 633 REM ** COMPUTE **
HR 634 POKE214,YP-2:IFYP>16THE
N655
CG 640 REM ** COMPUTE, VOICES
{SPACE}**
AE 645 ONYP-6GOTO685,720,745,7
47,770,805,773,810,850
GC 650 REM ** COMPUTE, FILTER
{SPACE}OR MOD **
MF 655 IFXP=8THEN675
HB 660 REM ** COMPUTE, FILTER
{SPACE}**
PR 665 ONYP-18GOTO880,915,960,
995,997
FF 670 REM ** COMPUTE, MODULAT
ION **
EP 675 ONYP-18GOTO1035,1080,10
81,1082
JM 680 REM ** WAVEFORM **
FB 685 PRINT"{RED}"
DQ 690 J=PEEK(56320):IF(JAND1)
=0AND(M(E+4)AND128)=0TH
ENM(E+4)=M(E+4)+16
KG 695 IF(JAND2)=0AND(M(E+4)AN
D240)>16THENM(E+4)=M(E+
4)-16
AM 700 PRINTTAB(8+13*E/7)WVS(I
NT(M(E+4)/16))"{UP}":PO
KES+E+4,M(E+4)AND254
XB 705 IFJ=127THEN60
JF 710 GOTO690
FF 715 REM ** PULSE **
SQ 720 P=M(E+2)+M(E+3)*256:PRI
NT"{RED}"
MP 724 J=PEEK(56320):IF(JAND1)
=0ANDP<4076THENP=P+20
GX 725 IF(JAND2)=0ANDP>19THENP
=P-20
MX 727 IF(JAND8)=0ANDP<4095THE
NP=P+1
CE 730 PRINTTAB(7+13*E/7)P"
{LEFT}{UP}":POKES+E+2,
PAND255:POKES+E+3,INT(P
/256)
EX 735 IFJ=127THENM(E+2)=PAND2
55:M(E+3)=INT(P/256):GO
TO60
RE 740 GOTO724
SK 743 REM ** RING OR SYNC **
FA 745 PRINT"{PUR}":EO=4:GOTO7
50
JF 747 PRINT"{PUR}":EO=2
XR 750 SYS50078,EO,M(E+4),E+4:
M(E+4)=PEEK(780):POKES+
E+4,M(E+4)AND254
RX 755 IF(M(E+4)ANDEO)=0THENPR
INTTAB(8+13*E/7)"OFF
{UP}":GOTO760
KH 757 PRINTTAB(8+13*E/7)"ON
{UP}"
RF 760 GOTO600
GQ 765 REM ** A,S **
HK 770 PRINT"{3}":EO=5:GOTO774
AP 773 PRINT"{3}":EO=6
KR 774 P=(M(E+EO)AND240)/16
FS 775 J=PEEK(56320):IF(JAND1)
=0ANDP<>15THENP=P+1
HK 780 IF(JAND2)=0ANDP<>0THENP
=P-1
SA 785 PRINTTAB(7+13*E/7)P"
{LEFT}{UP}":POKES+E+EO
,(M(E+EO)AND15)+P*16
XA 790 IFJ=127THENM(E+EO)=(M(E
+EO)AND15)+P*16:GOTO600
EX 795 GOTO775
XX 800 REM ** D,R **
SR 805 PRINT"{3}":EO=5:GOTO815
XJ 810 PRINT"{3}":EO=6
JM 815 P=M(E+EO)AND15
JX 820 J=PEEK(56320):IF(JAND1)
=0ANDP<>15THENP=P+1
KF 825 IF(JAND2)=0ANDP<>0THENP
=P-1
PG 830 PRINTTAB(7+13*E/7)P"
{LEFT}{UP}":POKES+E+EO
,(M(E+EO)AND240)+P
EE 835 IFJ=127THENM(E+EO)=(M(E
+EO)AND240)+P:GOTO600
CP 840 GOTO820
QK 845 REM ** OCTAVE **
HJ 850 PRINT"{BLU}":P=6-(LOG(M
(E/7+25))/LOG(2))
SR 855 J=PEEK(56320):IF(JAND1)
=0ANDP<>7THENP=P+1
BJ 856 IF(JAND2)=0ANDP<>5THEN
P=P-1
QP 860 PRINTTAB(7+13*E/7)P"
{UP}"
SD 865 IFJ=127THENM(E/7+25)=2↑
(6-P):GOTO600
CA 870 GOTO855
CS 875 REM ** CUTOFF FREQ **
GB 880 PRINT"{CYN}":P=M(21)+M(
22)*8
XP 885 J=PEEK(56320):IF(JAND1)
=0ANDP<2028THENP=P+20
CF 890 IF(JAND2)=0ANDP>19THENP
=P-20
PD 893 IF(JAND8)=0ANDP<2047THE
NP=P+1
GK 895 PRINTTAB(14)P"{LEFT}
{UP}"
KF 897 M(21)=PAND7:M(22)=INT(P
/8):POKES+21,M(21):POKE
S+22,M(22)
FR 900 IFJ=127THEN600
CE 905 GOTO885
HA 910 REM ** VOICES **
DF 915 PRINTTAB(15)"{CYN}
{DOWN}{5 SPACES}{UP}":P
=M(23)AND7
XS 920 P=P+1:POKES+23,(M(23)AN
D248)+P:IFP=8THENNP=0
JB 930 IFPAND1THENPRINTTAB(15)
"{CYN}1{UP}"
QJ 935 IFPAND2THENPRINTTAB(17)
"{CYN}2{UP}"
DR 940 IFPAND4THENPRINTTAB(19)
"{CYN}3{UP}"
JF 950 M(23)=(M(23)AND248)+P:G
OTO600
XF 955 REM ** MODE **
QK 960 PRINTTAB(15)"{CYN}
{DOWN}{8 SPACES}{UP}":P
=M(24)AND112
KS 965 P=P+16:IFP=128THENP=0
GP 967 POKES+24,(M(24)AND143)+
P
BC 970 IFPAND16THENPRINTTAB(15)
)"{CYN}LP{UP}"
AA 975 IFPAND32THENPRINTTAB(18)
)"{CYN}BP{UP}"
FE 980 IFPAND64THENPRINTTAB(21)
)"{CYN}HP{UP}"
GJ 985 M(24)=(M(24)AND143)+P:G
OTO600
DQ 990 REM ** RESONANCE, VOLUM
E **
PD 995 EO=23:A=15:SI=16:P=(M(E
O)AND240)/16:GOTO998
KH 997 EO=24:A=240:SI=1:P=M(EO)
AND15
SH 998 PRINT"{CYN}"
CK 1000 J=PEEK(56320):IF(JAND1)
=0ANDP<>15THENP=P+1
AS 1005 IF(JAND2)=0ANDP<>0THEN
P=P-1
DS 1010 PRINTTAB(14)P"{LEFT}
{UP}":POKES+EO,(M(EO)A
NDA)+P*SI
HA 1020 IFJ=127THENM(EO)=(M(EO)
ANDA)+P*SI:GOTO600
DX 1025 GOTO1000
EK 1030 REM ** MODULATION FREQ
**
RA 1035 PRINT"{YEL}":P=M(14)+M
(15)*256
GG 1040 J=PEEK(56320):IF(JAND1)
=0ANDP<65436THENP=P+1
00
EQ 1045 IF(JAND2)=0ANDP>99THEN
P=P-100
FF 1047 IF(JAND4)=0ANDP>0THENP
=P-1
QR 1050 IF(JAND8)=0ANDP<65535T
HENP=P+1
BC 1055 PRINTTAB(31)P"{LEFT}

```

```

      {2 SPACES}{UP}"
AB 1060 M(15)=INT(P/256):M(14)
      =P-INT(P/256)*256:POKE
      S+14,M(14):POKES+15,M(
      15)
AK 1065 IFJ=127THEN60
QC 1070 GOTO1040
DC 1075 REM ** ADD1,2,3 **
DB 1080 EO=0:GOTO1085
SG 1081 EO=1:GOTO1085
FM 1082 EO=2
SC 1085 PRINT"{YEL}":P=M(28+EO
      )
RS 1090 J=PEEK(56320):IF(JAND1
      )=0ANDP<25THENP=P+1
ED 1095 IF(JAND2)=0ANDP>0THENP
      =P-1
XG 1100 PRINTTAB(31)P"{LEFT}
      {UP}"
ME 1115 IFJ=127THENM(28+EO)=P:
      POKE49248+EO*3,P:GOTO6
      0
AJ 1120 GOTO1090

```

SYNTH ML

```

C000:A9 00 8D 20 D0 8D 21 D0 D9
C008:A0 6B A9 C0 84 FB 85 FC 12
C010:A0 00 B1 FB F0 0A 20 16 DD
C018:E7 C8 D0 F6 E6 FC D0 F2 09
C020:A9 40 8D 8A 02 78 A9 5C 82
C028:8D 14 03 A9 C0 8D 15 03 D9
C030:58 A0 3F B9 5E C3 99 40 FE
C038:03 88 10 F7 A9 01 8D 15 60
C040:D0 8D 27 D0 A9 0D 8D F8 15
C048:07 A9 00 8D 1B D0 A0 18 06
C050:B9 D9 00 09 80 99 D9 00 D3
C058:88 10 F5 60 AD 1B D4 8D F7
C060:19 D4 8D 19 D4 8D 19 D4 CA
C068:4C 31 EA 08 0E 93 05 20 23
C070:20 20 20 20 A7 12 20 1D F2
C078:20 1D 20 DD 20 1D 20 1D 06
C080:20 1D 20 DD 20 1D 20 1D 0E
C088:20 DD 20 1D 20 1D 20 1D 3A
C090:20 92 A5 0D 20 20 20 20 2E
C098:20 A7 12 51 DD 57 DD 45 B8
C0A0:DD 52 DD 54 DD 59 DD 55 0C
C0A8:DD 49 DD 4F DD 50 DD 40 48
C0B0:DD 2A DD 5E DD C4 92 A5 1A
C0B8:0D 20 20 20 20 20 20 B0
C0C0:20 20 20 CB 45 59 42 4F 7E
C0C8:41 52 44 3A 0D 0D 9A 20 9D
C0D0:20 20 D6 4F 49 43 45 31 4D
C0D8:20 20 20 20 20 20 D6 11
C0E0:4F 49 43 45 32 20 20 20 8B
C0E8:20 20 20 20 D6 4F 49 43 52
C0F0:45 33 0D C0 C0 C0 C0 DA
C0F8:C0 C0 C0 C0 C0 C0 C0 7A
C100:C0 C0 C0 C0 C0 C0 C0 83
C108:C0 C0 C0 C0 C0 C0 C0 8B
C110:C0 C0 C0 C0 C0 C0 C0 93
C118:C0 C0 C0 1C 20 20 20 D7 9F
C120:41 56 45 20 20 20 20 66
C128:20 20 20 D7 41 56 45 7F
C130:20 20 20 20 20 20 20 B3
C138:20 D7 41 56 45 0D 20 20 0E
C140:20 D0 55 4C 53 20 20 F2
C148:20 20 20 20 20 20 D0 55 62
C150:4C 53 20 20 20 20 20 B6
C158:20 20 20 D0 55 4C 53 0D 94

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C160:9C 20 20 20 D2 49 4E 47 DF
C168:20 20 20 20 20 20 20 EB
C170:20 D2 49 4E 47 20 20 20 E1
C178:20 20 20 20 20 20 D2 49 8A
C180:4E 47 0D 20 20 20 D3 59 23
C188:4E 43 20 20 20 20 20 EB
C190:20 20 20 D3 59 4E 43 20 18
C198:20 20 20 20 20 20 20 1C
C1A0:D3 59 4E 43 0D 20 20 20 AB
C1A8:96 C1 54 54 4B 20 20 20 F2
C1B0:20 20 20 20 20 20 C1 54 AB
C1B8:54 4B 20 20 20 20 20 21
C1C0:20 20 20 C1 54 54 4B 0D 14
C1C8:20 20 20 C4 43 41 59 20 A6
C1D0:20 20 20 20 20 20 20 54
C1D8:C4 43 41 59 20 20 20 20 2F
C1E0:20 20 20 20 20 C4 43 41 5E
C1E8:59 0D 20 20 20 D3 55 53 B0
C1F0:54 20 20 20 20 20 20 8E
C1F8:20 20 D3 55 53 54 20 20 B0
C200:20 20 20 20 20 20 D3 39
C208:55 53 54 0D 20 20 20 D2 FC
C210:45 4C 53 20 20 20 20 99
C218:20 20 20 20 D2 45 4C 53 53
C220:20 20 20 20 20 20 20 A5
C228:20 D2 45 4C 53 0D 20 20 0F
C230:20 1F CF 43 54 56 20 20 18
C238:20 20 20 20 20 20 CF 6D
C240:43 54 56 20 20 20 20 2B
C248:20 20 20 20 CF 43 54 56 76
C250:0D 9A C0 C0 C0 C0 C0 72
C258:C0 C0 C0 C0 C0 C0 C0 DD
C260:C0 C0 C0 C0 C0 C0 C0 E5
C268:C0 C0 C0 C0 C0 C0 C0 ED
C270:C0 C0 C0 C0 C0 C0 C0 F5
C278:C0 C0 9F 20 20 20 C6 49 DC
C280:4C 54 45 52 20 20 20 20 F0
C288:20 20 20 20 20 20 20 0E
C290:20 20 20 20 20 20 9E CD C0
C298:4F 44 55 4C 41 54 49 4F 83
C2A0:4E 0D 9F 20 20 20 C0 C0 4A
C2A8:C0 C0 C0 C0 20 20 20 C4
C2B0:20 20 20 20 20 20 20 36
C2B8:20 20 20 20 20 20 9E C0 DB
C2C0:C0 C0 C0 C0 C0 C0 C0 46
C2C8:C0 0D 9F 20 20 20 C3 55 46
C2D0:54 4F 46 46 20 C6 52 45 87
C2D8:51 20 20 20 20 20 20 F6
C2E0:20 20 20 20 20 20 9E C6 0A
C2E8:52 45 51 0D 9F 20 20 20 C1
C2F0:D6 4F 49 43 45 53 20 20 EA
C2F8:20 20 20 20 20 20 20 7E
C300:20 20 20 20 20 20 20 87
C308:9E C1 44 44 31 0D 9F 20 39
C310:20 20 CD 4F 44 45 20 20 F5
C318:20 20 20 20 20 20 20 9F
C320:20 20 20 20 20 20 20 A7
C328:20 20 9E C1 44 44 32 0D 5C
C330:9F 20 20 20 D2 45 53 4F 37
C338:4E 41 4E 43 45 20 20 20 40
C340:20 20 20 20 20 20 20 C7
C348:20 20 20 20 9E C1 44 44 B6
C350:33 0D 9F 20 20 D6 4F 29
C358:4C 55 4D 45 13 00 0C 00 0A
C360:00 0F 00 00 0F 80 00 0D 33
C368:80 00 0D 00 00 0C 00 02
C370:0C 00 00 0C 00 00 0C 00 D6
C378:00 0C 00 00 7C 00 00 FC E3
C380:00 00 FC 00 00 78 00 00 89
C388:00 00 00 00 00 00 00 10

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C390:00 00 00 00 00 00 00 18
C398:00 00 00 00 00 00 20 FD 5E
C3A0:AE 20 9E B7 8E B7 C3 20 D1
C3A8:FD AE 20 9E B7 8A 48 20 61
C3B0:FD AE 20 9E B7 68 49 00 C2
C3B8:9D 00 D4 60 00 00 00 00 AF

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Todd Piltingsrud is a music major at Concordia College in Morehead, Minnesota. He always wanted a good synthesizer program, so he wrote his own. □

LISA

By Bruce M. Bowden

Little Isometric Artist, better known as *LISA*, is a way to draw three-dimensional diagrams which can be rotated and saved for future viewing on your 64's high-resolution screen.

To begin, *LISA* requires a set of vertices (corner points) and information about which of these points are to be connected to form a screen image. When the wire-frame image is drawn, you'll have the option of rotating it, seeing what it looks like at various angles, and saving the image as a straight bitmap, which may be loaded into *The Print Shop* and other drawing programs for further manipulation.

3-D Coordinates

LISA uses a mathematical description of an object that consists of three coordinate lines or axes. These lines intersect with each other at one point, called the origin. Each line or axis is at right angles, or perpendicular, to the other two. The axes, typically labeled *x*, *y*, and *z*, are lines with distance values on them, relative to the origin, which has a distance of 0. Negative values are on one side of the origin, and positive values are on the other.

To imagine the coordinate system and how *LISA* uses it, pretend that you're standing near the corner of a room, with a wall to your left and a wall in front. The point of intersection of the two walls and the floor is the origin, or zero point, of our system model. The edge where the front wall meets the floor models the positive part of the *x*-axis. The edge where both walls meet models the positive part of the *y*-axis. And the edge where the left wall and floor meet models the positive part of the *z*-axis. Remember that there are al-

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so negative parts to each axis, extending off in the opposite directions from the origin. Actual three-dimensional coordinate systems can then be abstracted from the model and applied as follows.

If you want to describe where a point is located in the room, simply give its distance from the origin along the three axes. The directions might be two feet from the origin in the x direction, then five feet in the y direction (up from the floor), and then four feet in the z direction (parallel to the left wall). The coordinates of this point, using a scale in feet, could be represented by 2, 5, and 4.

In general, then, once a convenient origin and axes have been created, any figure which can be specified as points connected by lines is easy to describe. Just figure how far across (x), how far up (y), and how far out (z) each of the points is. (I'm sure you'll remember all about Cartesian coordinates from high school math classes.)

Entering the Program

LISA is a two-part program, with one part written in BASIC and the other in machine language. To help avoid typing errors, use *The Automatic Proofreader* to enter the main program; see "Typing Aids" elsewhere in this section. Be sure to save a copy of the program when you've finished typing.

The second part of the program is a graphics package written entirely in machine language, so use *MLX*, our machine language entry program, to type it in. When prompted by *MLX*, respond with the values given below.

Starting address: C000

Ending address: C6C7

The main program automatically loads the machine language program, so be sure to save this second program with the name *LISA.ML*. Make sure that both programs are on the same disk. When you load and run *LISA*, it will set up arrays and variables before displaying the menu screen. Each option on the menu has a letter in parentheses that shows which key must be pressed to make that selection. We'll explain each of the options, but out of the order in which they appear onscreen.

Options

Option G chooses the graphics screen. If pressed before any graphics have been drawn, it will probably display garbage. Press any other key to return to the text screen.

Option D selects the demonstration figure. Press D, and after a moment's delay for generating data, the graphics screen will appear, and a design will be drawn. This demo design resembles a flying saucer or igloo with an open hatchway. Because this figure has a symmetrical shape, the hatchway serves as a reference when rotating the figure.

Whenever a calculated drawing (one which isn't simply a picture file that has been loaded) is being displayed, press either cursor key to rotate the drawing. After a moment's delay for recalculation, the object will be redrawn in its new position. Pressing any other key will return you to the text screen and main menu.

Option S saves the figure. Make sure your disk has at least 32 free blocks in order to save the picture. Because the demo picture is the first saved, its name is SLIDE00. Subsequent saves will result in SLIDE01, SLIDE02, and so on. After the save operation, you'll be returned to the text screen.

Option N is for creating a new figure. For demonstration purposes, let's draw a cube. A cube has eight corners (vertexes) and twelve edges. Our cube will measure $1 \times 1 \times 1$ and have point 1 at the origin.

Draw a Cube

If you haven't done so already, load and run the program and then press N. When asked how many points you are entering, enter 8 and press Return. Now the program goes through and asks for the x , y , and z values for each of the points. The first point will be at the origin, so its coordinates are 0, 0, 0. Enter a 0 at each request.

The program now moves on to point 2. Remember that the numbers which you use to label each point are arbitrary. What matters is how the points are connected when we supply the edge data. When I sketched out my diagram of a cube before entering the data into the program, I labeled the

point with the coordinates 1, 0, 0 as point 2. So enter 1 for x , 0 for y , and 0 for z . Now continue through with the following coordinates.

Point 3: 1, 1, 0

Point 4: 0, 1, 0

Point 5: 0, 0, 1

Point 6: 1, 0, 1

Point 7: 1, 1, 1

Point 8: 0, 1, 1

After these points have been entered, you'll be asked how many edges there are. Since a cube has 12 edges, reply by entering 12. According to the scheme by which I've numbered my points, point 1 is connected to point 5. So when asked for the starting point for edge 1, enter 1; then enter 5 for the ending point. (See the accompanying figure.)

Notice that the edge number is arbitrary, too. For example, I could just as easily have responded that edge 1 is the edge which connects point 7 to point 8. The edge number simply shows the order in which each edge will be drawn.

If I indicate that point 1 is connected to point 5 by responding to the onscreen prompts, the remaining edges are as follows.

Edge 2: 2, 6

Edge 3: 3, 7

Edge 4: 4, 8

Edge 5: 1, 2

Edge 6: 2, 3

Edge 7: 3, 4

Edge 8: 4, 1

Edge 9: 5, 6

Edge 10: 6, 7

Edge 11: 7, 8

Edge 12: 8, 5

With the edge data entered, some scaling and centering calculations are done, and the figure appears on the screen. Because of the initial point of view, the figure looks more like a hexagon than a cube. The cubical shape will become apparent when you use the cursor keys to rotate the shape.

In this example we had three edges of the cube against the three axes, and each was of unit size, but our drawing could've been anywhere in space and

of any size. The program will shift and scale the data so that the figure always fits and is centered upon the screen.

Other Options

Option E will allow you to edit the data you've entered.

Option A allows you to set the number of radians (there are pi radians per 180 degrees) by which the figure can be turned each time. The default value is a twelfth of a rotation. Enter a negative number to abort. The program will take the input and modify it so that a rotation is completed in a whole number of turns. For example, enter 2, and you'll be informed that the program will be using three steps per rotation. Press any key to return to the main menu.

Option M will let you make a slide-show set of your figure with rotation. If you followed the steps in option A above, now place a blank disk in the disk drive and press M. You'll be notified how many blocks the slides will take—96 in this case. Press a key and watch the different views being drawn and saved. Because SLIDE00 was saved earlier, the slide numbers will be 01 through 03.

Option L will load a saved picture. If you saved the demo figure earlier, press L now to reload it. You'll be prompted for the name of the picture. Enter SLIDE00, and the graphics screen will appear so that you can watch the picture load. You'll then be returned to the main menu.

Finally, option H is used for calling up a quick reference screen whenever you need help.

To quit the program, merely press the Run/Stop key.

Additional Notes

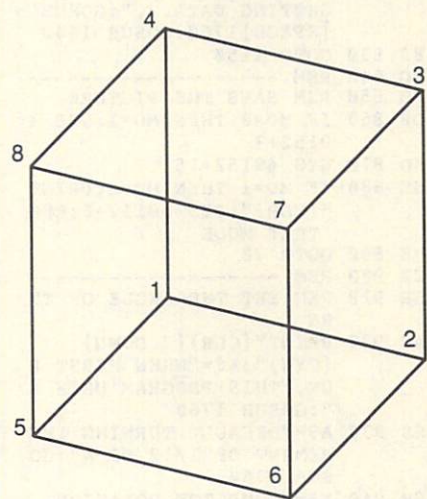
LISA was written with clear programming in mind. The BASIC code is well documented to help programmers use LISA routines in their own projects. In addition, the machine language program is a package of useful routines for high-resolution graphics: go to the graphics screen, clear the graphics screen, draw a line, return to text mode, save the graphic, load the graphic. These routines have SYS addresses referenced in the BASIC remarks.

To change the text screen colors,

change line 40 so that new color values are being poked into border and background addresses 53280 and 53281. To change the graphic screen colors, add a line to the program, following the part where the machine code has been loaded, which pokes the background color value into address 49173 and the drawing color into address 49174. The line might look like the following.

25 POKE 49173, color1:POKE 49174, color2

The color values are the standard Commodore colors, ranging from 0 to 15.



LISA

```
GD 10 REM COPYRIGHT 1991 - COMPUTE PUBLICATIONS INTL LTD - ALL RIGHTS RESERVED
QF 20 IF DK=0 THEN DK=1:LOAD"LIBRARY.ML",8,1
PP 30 Y=INT(32768/256):X=INT((32768/256-Y)*256+.5):POKE 55,X:POKE 56,Y:CLR
FC 40 DIM PT(300,2),LN(300,2),RP(300,3):POKE 53280,6:POKE 53281,6:PRINT"{CLR}"
RR 50 PI=3.14159265:NP=1:NL=1:CS=SQR(3)/2:SN=.5:AN=PI/6:MD=0:PC=0
BJ 60 :
KP 70 IF MD=1 THEN MD=0:SYS 49152+6:REM TEXT MODE
SF 80 PRINT"{CLR}{WHT}{N}":A$="LISA - LITTLE ISOMETRIC ARTIST":GOSUB 1760:PRINT"{CYN}"
MX 90 PRINT:A$="COPYRIGHT 1991
```

```
":GOSUB 1760
AS 100 A$="COMPUTE PUBLICATIONS INTL, LTD":GOSUB 1760
GF 110 A$="ALL RIGHTS RESERVED":GOSUB 1760:PRINT:PRINT
KQ 120 A$="PLEASE CHOOSE:":GOSUB 1760:PRINT
SS 130 A$="(N)EW FIGURE":GOSUB 1760:A$="(G)RAPHIC SCREEN":GOSUB 1760
FC 140 A$="(S)AVE PICTURE":GOSUB 1760:A$="(M)AKE SLIDE SET":GOSUB 1760
BH 150 A$="(L)OAD PICTURE":GOSUB 1760:A$="(M)AKE SLIDE SET":GOSUB 1760
JX 160 A$="(E)DIT":GOSUB 1760:A$="(H)ELP":GOSUB 1760:A$="(D)EMO":GOSUB 1760
BB 170 GET A$:IF A$="" THEN 170
XK 180 FL=0:B$="NGHDSAMEL"
RA 190 FOR X=1 TO LEN(B$):IF A$=MID$(B$,X,1) THEN FL=X
AM 200 NEXT:IF FL=0 THEN 170
KA 210 ON FL GOTO 230,570,630,810,850,910,1020,350,520
MR 220 REM -----
HG 230 REM INPUT A NEW FIGURE
CC 240 INPUT"{CLR}{DOWN}{CYN}HOW MANY POINTS ARE YOU ENTERING";NP
MF 250 FOR X=1 TO NP:PRINT"{CLR}{2 DOWN}":FOR Y=ASC("X") TO ASC("Z")
HE 260 PRINT"ENTER THE ";CHR$(Y);" VALUE FOR POINT";X;" : ";
RB 270 INPUT RP(X,Y-ASC("W")):NEXT Y,X
HA 280 INPUT"{CLR}{DOWN}HOW MANY EDGES ARE YOU ENTERING";NL
RR 290 FOR X=1 TO NL:PRINT"{CLR}{2 DOWN}"
XX 300 PRINT"ENTER THE STARTING POINT FOR EDGE";X;" : ";{SPACE}":INPUT LN(X,1)
AS 310 PRINT"ENTER THE ENDING POINT FOR EDGE";X;" : ";INPUT LN(X,2)
BB 320 NEXT:PRINT"{YEL}":A$="CALCULATING...":GOSUB 1760:GOTO 1150
SG 330 REM -----
DH 340 REM EDIT THE DATA
XX 350 FOR X=1 TO NP:PRINT"{CLR}{2 DOWN}":FOR Y=ASC("X") TO ASC("Z")
BQ 360 PRINT"THE ";CHR$(Y);" VALUE FOR POINT";X;" : ";RP(X,Y-ASC("W")):NEXT Y
PE 370 PRINT:PRINT"REENTER THIS POINT? (Y/N)":GOSUB 1800
KA 380 IF A$<>"Y" THEN 420
SS 390 PRINT"{2 DOWN}":FOR Y=ASC("X") TO ASC("Z")
```

PROGRAMS

```

BQ 400 PRINT"ENTER THE ";CHR$(
Y);" VALUE FOR POINT";X
;": ""
PP 410 INPUT RP(X,Y-ASC("W")):
NEXT Y
CQ 420 NEXT X:FOR X=1 TO NL:PR
INT"{CLR}{2 DOWN}"
RJ 430 PRINT"THE STARTING POIN
T FOR EDGE";X;": "";LN(X
,1)
QE 440 PRINT"THE ENDING POINT
{SPACE}FOR EDGE";X;": "
;LN(X,2)
AX 450 PRINT:PRINT"REENTER THI
S EDGE? (Y/N)":GOSUB 18
00
QR 460 IF A$<>"Y" THEN 490
KQ 470 PRINT:PRINT"ENTER THE S
TARTING POINT FOR EDGE"
;X;": ":INPUT LN(X,1)
PR 480 PRINT:PRINT"ENTER THE E
NDING POINT FOR EDGE";X
;": ":INPUT LN(X,2)
RC 490 GOTO 320
EQ 500 REM -----
CF 510 REM LOAD THE PICTURE
HS 520 PRINT"{CLR}{2 DOWN}WHAT
IS THE NAME OF THE PIC
TURE?":INPUT A$
QC 530 X=LEN(A$):POKE 53050,X:
FOR Y=1 TO X:POKE 53050
+Y,ASC(MID$(A$,Y,1)):NE
XT
PA 540 IF MD=0 THEN MD=1:SYS 4
9152+3
FF 550 SYS 49152+18:PC=0:GOTO6
00
RH 560 REM -----
EQ 570 REM GO TO THE GRAPHIC S
CREEN
JJ 580 IF MD=0 THEN MD=1:SYS 4
9152+3:IF PC THEN 1500
SM 590 GOSUB 1800
MP 600 IF MD=1 THEN MD=0:PRINT
"{CLR}":SYS 49152+6:REM
TEXT MODE
HP 610 GOTO 70
JE 620 REM -----
QE 630 REM POST HELP SCREEN
MJ 640 PRINT"{CLR}{WHT}":A$="M
AIN MENU HELP":GOSUB 17
60:PRINT"{CYN}"
SC 650 A$="CREATE A NEW FIGURE
BY CHOOSING 'N' AT":GO
SUB 1760
AC 660 A$="THE MAIN MENU AND E
NTERING POINT AND":GOSU
B 1760
PK 670 A$="EDGE DATA WHEN PROM
PTED.":GOSUB 1760
GH 680 A$="IF A FIGURE EXISTS
{SPACE}ON THE GRAPHIC":
GOSUB 1760
XG 690 A$="SCREEN, IT WILL BE
{SPACE}DISPLAYED BY":GO
SUB 1760
CK 700 A$="PRESSING 'G' AT THE
MAIN MENU.":GOSUB 1760
KM 710 A$="CHOOSING 'D' AT THE
MAIN MENU WILL":GOSUB
{SPACE}1760
SD 720 A$="CAUSE A DEMO FIGURE
TO BE CREATED,":GOSUB
{SPACE}1760
QH 730 A$="WITH ALL THE NORMAL
FIGURE OPTIONS":GOSUB
{SPACE}1760
HP 740 A$="AFTERWARD.":GOSUB 1
760
XM 750 A$="THE (L)OAD AND (S)A
VE OPTIONS WORK":GOSUB
{SPACE}1760
AH 760 A$="WITH A HIGH-RESOLUT
ION IMAGE.":GOSUB 1760
SH 770 A$="THE SLIDE SET OPTIO
N SAVES A":GOSUB 1760
PR 780 A$="FULL ROTATION SEQUE
NCE.":GOSUB 1760:PRINT
QA 790 GOSUB 1790:GOTO 70
KB 800 REM -----
JP 810 REM RUN DEMO
FR 820 PRINT:PRINT"{YEL}":A$="
GETTING DATA...":GOSUB
{SPACE}1760:GOSUB 1640
FJ 830 GOTO 1150
KG 840 REM -----
FB 850 REM SAVE THE PICTURE
DR 860 IF MD=0 THEN MD=1:SYS 4
9152+3
KD 870 SYS 49152+15
SE 880 IF MD=1 THEN MD=0:PRINT
"{CLR}":SYS 49152+6:REM
TEXT MODE
MS 890 GOTO 70
CP 900 REM -----
SR 910 REM SET THE ANGLE OF TU
RN
AP 920 PRINT"{CLR}{2 DOWN}
{CYN}":A$="WHEN FIRST R
UN, THIS PROGRAM USES A
":GOSUB 1760
SS 930 A$="DEFAULT TURNING INC
REMENT OF 1/12 OF A":GO
SUB 1760
SE 940 A$="COMPLETE ROTATION.
{SPACE}PLEASE EITHER EN
TER":GOSUB 1760
FF 950 A$="A NEW INCREMENT (IN
RADIAN), OR A":GOSUB
{SPACE}1760
DX 960 A$="NEGATIVE VALUE TO A
BORT.":GOSUB 1760
PD 970 PRINT:INPUT"ANGLE";X:PR
INT:PRINT"{YEL}":IF X<0
THEN 70
PD 980 IF X>2*PI THEN A$="TOO
{SPACE}LARGE... USING D
EFAULT":GOSUB 1760:AN=P
I/6:GOTO 790
PX 990 X=INT(2*PI/X+.5):IF X<=
1 THEN X=2
FD 1000 AN=2*PI/X:A$="USING"+S
TR$(X)+" STEPS PER ROT
ATION":GOSUB 1760:GOTO
790
DP 1010 REM -----
MD 1020 REM MAKE THE SET OF SL
IDES
PA 1030 PRINT"{CLR}{2 DOWN}
{YEL}":IF PC THEN 1050
CR 1040 A$="THERE IS NO ENTERE
D FIGURE":GOSUB 1760:G
OTO 790
CE 1050 IF 2*PI/AN > 20 THEN A
N = 2*PI/20
GJ 1060 A$="THIS SLIDE SET WIL
L TAKE"+STR$(INT(2*PI/
AN+.5)*32)
BS 1070 A$=A$+" BLOCKS.":GOSUB
1760:GOSUB 1790
DQ 1080 SYS 49152+3:FOR SX=1 T
O 2*PI/AN
EE 1090 SYS 49152+15
HG 1100 GOSUB 1570:GOSUB 1180:
NEXT
QG 1110 IF MD=1 THEN MD=0:PRIN
T"{CLR}":SYS 49152+6:R
EM TEXT MODE
PA 1120 GOTO 70
ED 1130 REM -----
PA 1140 REM DRAWING THE FIGURE
SH 1150 GOSUB 1180:GOTO 1500
DR 1160 REM -----
GA 1170 REM CALCULATING THE GE
OMETRIC CENTER
QX 1180 AX=0:AY=0:AZ=0
DQ 1190 FOR X=1 TO NP:AX=AX+RP
(X,1):AY=AY+RP(X,2):AZ
=AZ+RP(X,3):NEXT
MA 1200 AX=AX/NP:AY=AY/NP:AZ=A
Z/NP
DQ 1210 :
AQ 1220 FOR X=1 TO NP:REM CONV
ERT TO ISOMETRIC IMAGE
EC 1230 PT(X,1)=(RP(X,2)-RP(X,
1)-AY+AX)*CS
GC 1240 PT(X,2)=RP(X,3)-AZ-SN*
(RP(X,2)+RP(X,1)-AX-AY
)
RA 1250 NEXT
RA 1260 :
EJ 1270 MAX=PT(1,1):MIN=MAX:RE
M INITIALIZE EXTREMA
SE 1280 FOR X=1 TO NP:FOR Y=1
{SPACE}TO 2
RF 1290 IF PT(X,Y)>MAX THEN MA
X=PT(X,Y)
CR 1300 IF PT(X,Y)<MIN THEN MI
N=PT(X,Y)
CQ 1310 NEXT Y,X
JR 1320 SR=199/(MAX-MIN):REM T
HE SCALE RATIO
RH 1330 AR=152/115:REM THE ASP
ECT RATIO
ES 1340 OS=160+MIN*SR*AR:REM X
-OFFSET TO CENTER THE
{SPACE}DRAWING
RA 1350 FOR X=1 TO NP:FOR Y=1
{SPACE}TO 2
GG 1360 PT(X,Y) = (PT(X,Y)-MIN
)*SR
PD 1370 NEXT Y,X
KP 1380 IF MD=0 THEN MD=1:SYS
{SPACE}49152+3:REM SWI
TCH TO THE GRAPHICS SC
REEN
SH 1390 SYS 49152+12:REM CLEAR
SCREEN
HD 1400 FOR X=1 TO NL
BM 1410 X1 = INT(PT(LN(X,1),1)

```



```

*AR+OS+.5):Y1 = INT (PT
(LN(X,1),2)+.5)
AC 1420 X2 = INT (PT (LN(X,2),1)
*AR+OS+.5):Y2 = INT (PT
(LN(X,2),2)+.5)
JS 1430 V(2)=INT (X1/256):V(1)=
INT ((X1/256-V(2))*256+
.5)
GM 1440 V(4)=INT (Y1/256):V(3)=
INT ((Y1/256-V(4))*256+
.5)
AE 1450 V(6)=INT (X2/256):V(5)=
INT ((X2/256-V(6))*256+
.5)
MD 1460 V(8)=INT (Y2/256):V(7)=
INT ((Y2/256-V(8))*256+
.5)
FB 1470 FOR Y=0 TO 7:POKE 5300
0+Y,V(Y+1):NEXT
AQ 1480 PC=-1:SYS 49152+9:REM
{SPACE}DRAW THE LINE
XM 1490 NEXT:RETURN
DD 1500 GET A$:IF A$="" THEN 1
500
EX 1510 IF A$="{RIGHT}" THEN A
N = ABS (AN):GOSUB 1570
:GOSUB 1180:GOTO 1500
DB 1520 IF A$="{LEFT}" THEN AN
= -ABS (AN):GOSUB 1570
:GOSUB 1180:GOTO 1500
FJ 1530 IF MD=1 THEN MD=0:PRIN
T "{CLR}":SYS 49152+6:R
EM TEXT MODE
JR 1540 GOTO 70
DC 1550 :
QS 1560 REM ROTATING THE OBJEC
T
KC 1570 FOR X=1 TO NP
HH 1580 XX=RP(X,1):YY=RP(X,2)
CP 1590 RP(X,1)=XX*COS(AN)-YY*
SIN(AN)
FC 1600 RP(X,2)=XX*SIN(AN)+YY*
COS(AN)
QX 1610 NEXT:MD=1:RETURN
AG 1620 :
DM 1630 REM GENERATING DATA FO
R DEMO FIGURE
XF 1640 NP=1:NL=1:A=10:B=5
ME 1650 FOR TH=0 TO 3:FOR PH=0
TO 9:GOSUB 1710
FA 1660 LN(NL,1)=NP:LN(NL,2)=N
P+1:LN(NL+1,1)=NP:LN(N
L+1,2)=NP+10:NL=NL+2:N
P=NP+1
SE 1670 NEXT PH:NL=NL-1:LN(NL-
1,1)=NP-1:LN(NL-1,2)=N
P+9:NEXT TH
PQ 1680 TH=4:FOR PH=0 TO 9:GOS
UB 1710
QH 1690 LN(NL,1)=NP:LN(NL,2)=N
P+1:NL=NL+1:NP=NP+1:NE
XT PH
QK 1700 NP=NP-1:NL=NL-1:LN(NL,
1)=NP:LN(NL,2)=NP-9:RE
TURN
AK 1710 RP(NP,1)=A*COS(TH*PI/1
0)*COS(PH*PI/5)
SA 1720 RP(NP,2)=A*COS(TH*PI/1
0)*SIN(PH*PI/5)
GG 1730 RP(NP,3)=B*SIN(TH*PI/1
0):RETURN

```

```

AS 1740 :
HP 1750 REM CENTER PRINT
SA 1760 IF LEN(A$)<38 THEN FOR
LP=1 TO 20-LEN(A$)/2:
PRINT CHR$(32);:NEXT
CJ 1770 PRINTA$:RETURN
HB 1780 :
SX 1790 PRINT:PRINT "{YEL}":A$=
"PRESS ANY KEY":GOSUB
{SPACE}1760
DM 1800 GET A$:IF A$="" THEN 1
800
HD 1810 RETURN

```

LISA.ML

```

C000:4C 7D C0 4C 21 C0 4C 5B E3
C008:C0 4C CE C0 4C 64 C0 4C A4
C010:54 C6 4C A0 C6 06 07 00 5D
C018:00 53 4C 49 44 45 30 30 54
C020:00 20 7D C0 AD 15 C0 8D 36
C028:20 D0 A2 84 86 FC A2 00 F7
C030:86 FB A0 00 AD 16 C0 0A 59
C038:0A 0A 0A 0D 15 C0 91 FB 1E
C040:C8 A6 FC E0 87 F0 09 C0 50
C048:00 D0 F3 E6 FC 4C 3E C0 41
C050:8C 17 C0 AE 17 C0 E0 E8 47
C058:D0 E4 60 20 A7 C0 A9 93 B0
C060:20 D2 FF 60 A9 00 85 FB 01
C068:A9 A0 85 FC A9 00 A8 91 97
C070:FB C8 D0 FB E6 FC A6 FC 71
C078:E0 C0 90 F3 60 AD 11 D0 98
C080:09 20 09 10 8D 11 D0 AD B0
C088:16 D0 18 29 DF 8D 16 D0 11
C090:AD 18 D0 18 29 F0 09 08 B1
C098:8D 18 D0 18 AD 00 DD 29 D4
C0A0:FC 09 01 8D 00 DD 60 AD C1
C0A8:11 D0 18 29 DF 8D 11 D0 A4
C0B0:18 AD 18 D0 18 29 F0 09 0A
C0B8:06 8D 18 D0 18 AD 16 D0 25
C0C0:29 EF 8D 16 D0 AD 00 DD 01
C0C8:09 03 8D 00 DD 60 20 6E 60
C0D0:C1 18 AD 42 C6 8D 4E C6 E2
C0D8:AD 43 C6 8D 4F C6 AD 44 E8
C0E0:C6 8D 50 C6 AD 45 C6 8D 3D
C0E8:51 C6 20 B5 C5 C9 03 F0 70
C0F0:1B C9 05 F0 17 18 AD 47 DD
C0F8:C6 C9 00 D0 03 20 23 C1 FD
C100:20 6E C1 AD 46 C6 8D 4C F6
C108:C6 4C 41 C3 18 AD 46 C6 31
C110:C9 00 D0 03 20 23 C1 20 F3
C118:6E C1 AD 47 C6 8D 4D C6 3B
C120:4C C3 C1 AD 08 CF 8D 6C D4
C128:C1 AD 0C CF 8D 08 CF AD 50
C130:6C C1 8D 0C CF AD 09 CF E3
C138:8D 6C C1 AD 0D CF 8D 09 7C
C140:CF AD 6C C1 8D 0D CF AD AE
C148:0A CF 8D 6C C1 AD 0E CF ED
C150:8D 0A CF AD 6C C1 8D 0E 85
C158:CF AD 0B CF 8D 6C C1 AD DC
C160:0F CF 8D 0B CF AD 6C C1 91
C168:8D 0F CF 00 00 AD 08 D9
C170:CF 8D 4E C6 AD 09 CF 8D 34
C178:4F C6 AD 0C CF 8D 50 C6 E7
C180:AD 0D CF 8D 51 C6 20 F7 CE
C188:C5 8D 46 C6 AD 52 C6 8D 59
C190:42 C6 AD 53 C6 8D 43 C6 8B
C198:AD 0A CF 8D 4E C6 AD 0B 3C
C1A0:CF 8D 4F C6 AD 0E CF 8D 98

```

```

C1A8:50 C6 AD 0F CF 8D 51 C6 CA
C1B0:20 F7 C5 8D 47 C6 AD 52 D6
C1B8:C6 8D 44 C6 AD 53 C6 8D CD
C1C0:45 C6 60 18 AD 43 C6 6A 98
C1C8:8D 3E C3 AD 42 C6 6A 8D 85
C1D0:3D C3 18 A9 00 8D 3F C3 F9
C1D8:AD 46 C6 C9 00 D0 05 A9 31
C1E0:01 8D 3F C3 AD 08 CF 8D 27
C1E8:48 C6 AD 09 CF 8D 49 C6 96
C1F0:AD 0A CF 8D 4A C6 AD 0B 74
C1F8:CF 8D 4B C6 20 BF C4 AD D4
C200:48 C6 8D 4E C6 AD 49 C6 38
C208:8D 4F C6 AD 0C CF 8D 50 E6
C210:C6 AD 0D CF 8D 51 C6 20 62
C218:B5 C5 C9 05 D0 01 60 AD 6C
C220:3F C3 C9 00 F0 1B 18 AD 41
C228:3D C3 6D 44 C6 8D 3D C3 D9
C230:90 03 EE 3E C3 AD 3E C3 95
C238:6D 45 C6 8D 3E C3 4C A3 B4
C240:C2 AD 44 C6 8D 50 C6 AD 70
C248:45 C6 8D 51 C6 AD 3D C3 14
C250:8D 4E C6 AD 3E C3 8D 4F 4F
C258:C6 20 B5 C5 C9 03 F0 17 AF
C260:20 F7 C5 AD 52 C6 8D 3D 8D
C268:C3 AD 53 C6 8D 3E C3 A9 A8
C270:01 8D 3F C3 4C A3 C2 AD 22
C278:44 C6 8D 4E C6 AD 45 C6 A6
C280:8D 4F C6 AD 3D C3 8D 50 B8
C288:C6 AD 3E C3 8D 51 C6 20 40
C290:F7 C5 AD 52 C6 8D 3D C3 09
C298:AD 53 C6 8D 3E C3 A9 00 CF
C2A0:8D 3F C3 AD 3F C3 C9 01 AD
C2A8:F0 03 4C 2F C3 AD 4D C6 1A
C2B0:C9 00 F0 0B EE 4A C6 D0 E8
C2B8:13 EE 4B C6 4C CC C2 CE 43
C2C0:4A C6 AD 4A C6 C9 FF D0 A5
C2C8:03 CE 4B C6 AD 3F C3 CD 19
C2D0:46 C6 F0 1C 18 AD 3D C3 C0
C2D8:6D 42 C6 8D 3D C3 90 03 74
C2E0:EE 3E C3 18 AD 3E C3 6D C2
C2E8:43 C6 8D 3E C3 4C 2F C3 C8
C2F0:AD 3D C3 8D 50 C6 AD 3E 25
C2F8:C3 8D 51 C6 AD 42 C6 8D EB
C300:4E C6 AD 43 C6 8D 4F C6 1C
C308:20 F7 C5 8D 40 C3 AD 52 ED
C310:C6 8D 3D C3 AD 53 C6 8D 18
C318:3E C3 AD 40 C3 CD 3F C3 01
C320:F0 08 A9 00 8D 3F C3 4C 94
C328:2F C3 A9 01 8D 3F C3 EE 5D
C330:48 C6 D0 03 EE 49 C6 20 22
C338:BF C4 4C FF C1 00 00 00 68
C340:00 18 AD 45 C6 6A 8D BC 8F
C348:C4 AD 44 C6 6A 8D BB C4 58
C350:18 A9 00 8D BD C4 AD 47 CA
C358:C6 C9 00 D0 05 A9 01 8D 21
C360:BD C4 AD 08 CF 8D 48 C6 3A
C368:AD 09 CF 8D 49 C6 AD 0A A6
C370:CF 8D 4A C6 AD 0B CF 8D BF
C378:4B C6 20 BF C4 AD 4A C6 8F
C380:8D 4E C6 AD 4B C6 8D 4F F5
C388:C6 AD 0E CF 8D 50 C6 AD 86
C390:0F CF 8D 51 C6 20 B5 C5 42
C398:C9 05 D0 01 60 AD BD C4 6A
C3A0:C9 00 F0 1B 18 AD BB C4 90
C3A8:6D 42 C6 8D BB C4 90 03 3E
C3B0:EE BC C4 AD BC C4 6D 43 69
C3B8:C6 8D BC C4 4C 21 C4 AD 09
C3C0:42 C6 8D 50 C6 AD 43 C6 0C
C3C8:8D 51 C6 AD BB C4 8D 4E 79
C3D0:C6 AD BC C4 8D 4F C6 20 62

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C3D8:B5 C5 C9 03 F0 17 20 F7 32
C3E0:C5 AD 52 C6 8D BB C4 AD FF
C3E8:53 C6 8D BC C4 A9 01 8D A5
C3F0:BD C4 C4 21 C4 AD 42 C6 4C
C3F8:8D 4E C6 AD 43 C6 8D 4F 2E
C400:C6 AD BB C4 8D 50 C6 AD 05
C408:BC C4 8D 51 C6 20 F7 C5 54
C410:AD 52 C6 8D BB C4 AD 53 56
C418:C6 8D BC C4 A9 00 8D BD 72
C420:C4 AD BD C4 C9 01 F0 03 B2
C428:4C AD C4 AD 4C C6 C9 00 C7
C430:F0 0B EE 48 C6 D0 13 EE E5
C438:49 C6 4C 4A C4 CE 48 C6 FE
C440:AD 48 C6 C9 FF D0 03 CE 40
C448:49 C6 AD BD C4 CD 47 C6 6C
C450:F0 1C 18 AD BB C4 6D 44 47
C458:C6 8D BB C4 90 03 EE BC 97
C460:C4 18 AD BC C4 6D 45 C6 01
C468:8D BC C4 4C AD C4 AD BB DC
C470:C4 8D 50 C6 AD BC C4 8D AD
C478:51 C6 AD 44 C6 8D 4E C6 26
C480:AD 45 C6 8D 4F C6 20 F7 B1
C488:C5 8D BE C4 AD 52 C6 8D 4E
C490:BB C4 AD 53 C6 8D BC C4 BE
C498:AD BE C4 CD BD C4 F0 08 09
C4A0:A9 00 8D BD C4 4C AD C4 04
C4A8:A9 01 8D BD C4 EE 4A C6 12
C4B0:D0 03 EE 4B C6 20 BF C4 F0
C4B8:4C 7D C3 00 00 00 18 58
C4C0:A5 01 29 FE 85 01 38 A9 BC
C4C8:C7 ED 4A C6 8D B4 C5 A9 DB
C4D0:00 8D B0 C5 A9 A0 8D B1 CC
C4D8:C5 AD B4 C5 4A 4A 8D 41
C4E0:B2 C5 A9 00 8D B3 C5 A2 D3
C4E8:06 18 AD B2 C5 2A 8D B2 01
C4F0:C5 AD B3 C5 2A 8D B3 C5 50
C4F8:CA D0 EE A2 05 18 AD B2 BA
C500:C5 6D B0 C5 8D B0 C5 90 87
C508:03 EE B1 C5 18 AD B3 C5 08
C510:6D B1 C5 8D B1 C5 CA D0 5B
C518:E4 AD 48 C6 8D B2 C5 AD 67
C520:49 C6 8D B3 C5 A2 03 18 C5
C528:AD B3 C5 6A 8D B3 C5 AD 4B
C530:B2 C5 6A 8D B2 C5 CA D0 BF
C538:EE A2 03 18 AD B2 C5 2A B3
C540:8D B2 C5 AD B3 C5 2A 8D 69
C548:B3 C5 CA D0 EE 18 AD B2 6B
C550:C5 6D B0 C5 8D B0 C5 90 D7
C558:03 EE B1 C5 18 AD B3 C5 58
C560:6D B1 C5 8D B1 C5 18 AD 23
C568:B4 C5 29 07 18 6D B0 C5 F2
C570:8D B0 C5 90 03 EE B1 C5 AD
C578:18 AD 48 C6 29 07 8D B2 24
C580:C5 A9 07 38 ED B2 C5 AA 2E
C588:18 A9 01 E0 00 F0 04 B0 8E
C590:CA D0 FC 8D B2 C5 AD B0 E6
C598:C5 85 FB AD B1 C5 85 FC 6F
C5A0:AF 00 B1 FB 0D B2 C5 91 C2
C5A8:FB A5 01 09 01 85 01 60 CC
C5B0:00 00 00 00 00 AD 4F C6 58
C5B8:CD 51 C6 F0 08 B0 03 A9 1A
C5C0:04 60 A9 03 60 AD 4E C6 E8
C5C8:CD 50 C6 F0 05 B0 F3 A9 B3
C5D0:04 60 A9 05 60 A9 00 8D 33
C5D8:53 C6 18 AD 4E C6 6D 50 56
C5E0:C6 8D 52 C6 90 03 EE 53 AB
C5E8:C6 18 AD 4F C6 6D 51 C6 DD
C5F0:6D 53 C6 8D 53 C6 60 20 50
C5F8:B5 C5 C9 03 F0 22 AD 51 F6
C600:C6 8D 53 C6 38 AD 50 C6 0B

```

```

C608:ED 4E C6 8D 52 C6 B0 03 E3
C610:CE 53 C6 38 AD 53 C6 ED 6C
C618:4F C6 8D 53 C6 A9 01 60 25
C620:AD 4F C6 8D 53 C6 38 AD DD
C628:4E C6 ED 50 C6 8D 52 C6 29
C630:B0 03 CE 53 C6 38 AD 53 AB
C638:C6 ED 51 C6 8D 53 C6 A9 2C
C640:00 60 00 00 00 00 00 E5
C648:00 00 00 00 00 00 00 D5
C650:00 00 00 00 A5 01 29 FE 60
C658:85 01 A9 19 85 FB A9 C0 DF
C660:85 FC A9 0F A2 08 A0 FF 8C
C668:20 BA FF A9 07 A6 FB A4 BE
C670:FC 20 BDFE A2 00 A9 A0 45
C678:85 FC A9 00 85 FB A9 FB A8
C680:A0 BF A2 40 20 D8 FF EE F9
C688:1F C0 AD 1F C0 C9 3A 90 AF
C690:08 A9 30 8D 1F C0 EE 1E 63
C698:C0 A5 01 09 01 85 01 60 21
C6A0:A9 3B 85 FB A9 CF 85 FC D6
C6A8:A9 0F A2 08 A0 00 20 BA A3
C6B0:FF AD 3A CF A6 FB A4 FC 59
C6B8:20 BD FF A9 00 A2 00 A0 8B
C6C0:A0 20 D5 FF 60 00 00 00 64

```

Bruce Bowden is one of *COMPUTE's* programmers. He can be reached on QuantumLink as GazetteBMB. □

BUG-SWATTER

The machine language listing for *Song Machine* (October 1991) contained several errors. In order to correct them, load and run *MLX* and respond with *Song Machine's* original starting and ending addresses. Then select Load File from the *MLX* menu and load the corrupted copy of *Song Machine*.

When the *MLX* Command Menu returns, select Enter Data. When prompted for a starting address, give the address listed below and then enter the first block of data. Press Return on an empty line to return to the Command Menu. Select Enter Data again for the second block of data, using its starting address. When both blocks of data have been entered, save the program with a new name before exiting *MLX*.

A similar problem occurred with *Add Check* (October 1991). It can be corrected in the same manner.

Starting address: 0C69

```

0C69:00 85 FE 18 A5 30 69 28 2D
0C71:85 30 A5 31 69 00 85 31 A7
0C79:18 A5 32 69 28 85 32 A5 45
0C81:33 69 00 85 33 E8 E0 0D F1
0C89:D0 A9 60 A2 00 A0 00 A9 D6
0C91:60 20 D2 FF C8 C0 28 D0 A6
0C99:F8 E8 E0 05 D0 EF 60 20 FB
0CA1:44 E5 A0 00 B9 76 93 20 58

```

```

0CA9:D2 FF C8 C0 1E D0 F5 60 D0
0CB1:8E EF 02 AE F3 03 E0 01 A6
0CB9:F0 52 AE D7 02 E0 01 B0 78
0CC1:11 AE D8 02 E0 01 B0 0A BF
0CC9:AE D9 02 E0 01 B0 03 4C 1B
0CD1:4D 84 A2 0F 8E 18 D4 4C C1
0CD9:52 84 A2 00 8E 18 D4 AE BD
0CE1:D7 02 E0 00 F0 2C CA 8E DE
0CE9:D7 02 E0 00 F0 24 AE D8 D8
0CF1:02 E0 00 F0 26 CA 8E D8 A4

```

Starting address: 19E1

```

19E1:91 8E 83 03 C8 C8 C8 C8 E4
19E9:C8 A2 00 B9 35 03 9D 89 3F
19F1:03 E8 C8 CC 34 03 B0 03 D7
19F9:4C 5E 91 8E 88 03 E0 04 1B
1A01:B0 C4 88 C0 00 F0 BF B9 D8
1A09:35 03 C9 56 D0 F4 C8 B9 DC
1A11:35 03 C9 31 F0 09 C9 32 5E
1A19:F0 20 C9 33 F0 37 60 AD 0D
1A21:A7 02 8D 7A 03 AD A8 02 25
1A29:8D 7B 03 AD A9 02 8D 7C 2B
1A31:03 AD AA 02 8D 7D 03 4C 7C
1A39:E0 91 AD AB 02 8D 7A 03 F0
1A41:AD AC 02 8D 7B 03 AD 8D 81
1A49:02 8D 7C 03 AD AE 02 8D 5B
1A51:7D 03 4C E0 91 AD AF 02 41
1A59:8D 7A 03 AD B0 02 8D 7B 52
1A61:03 AD B1 02 8D 7C 03 AD EA
1A69:B2 02 8D 7D 03 20 D8 8F DA
1A71:C9 0D F0 AA 18 AD 76 03 FD
1A79:6D F5 02 85 FB AD 77 03 03
1A81:6D F6 02 85 FC 18 AD 78 DE
1A89:03 6D F5 02 85 FD AD 79 72
1A91:03 6D F6 02 85 FE A0 00 0B
1A99:B9 84 03 99 7F 03 C8 CC 2C
1AA1:83 03 D0 F4 4C 1B 92 60 16
1AA9:AD 83 03 8D 7E 03 20 D8 E7
1AB1:8F C9 0D F0 F2 18 AD 76 9A
1AB9:03 6D F5 02 85 30 AD 77 69
1ACL:03 6D F6 02 85 31 18 AD A0
1AC9:78 03 6D F5 02 85 32 AD 40
1AD1:79 03 6D F6 02 85 33 A0 CD

```

ADD CHECK

Starting address: 0861

```

0861:34 03 AD 34 03 A2 35 A0 F2
0869:03 20 BD FF A9 02 A2 08 5D
0871:A0 02 20 BA FF 20 C0 FF 04
0879:A9 0D 20 D2 FF A2 F0 20 9B
0881:C6 FF 20 CF FF 20 D2 FF 1C
0889:20 CF FF 20 D2 FF C9 30 F9
0891:D0 0D 20 CF FF 20 D2 FF 74
0899:C9 0D F0 0B 4C 93 08 A9 0B
08A1:FF 8D B2 02 4C 93 08 AD F9
08A9:B2 02 C9 FF F0 48 A2 02 BC
08B1:20 C6 FF 20 E4 FF 85 FB B3
08B9:85 FD 20 E4 FF 85 FC 85 F3
08C1:FE A9 00 8D BA 02 8D BB 49
08C9:02 A0 00 20 E4 FF 18 AD 0A
08D1:BA 02 69 01 8D BA 02 AD 06
08D9:BB 02 69 00 8D BB 02 18 EC
08E1:A5 FD 69 01 85 FD A5 FE EF
08E9:69 00 85 FE 20 07 FF C9 F8
08F1:00 D0 03 4C CC 08 A2 00 27
08F9:20 C6 FF A9 02 20 C3 FF 7E

```

REVIEWS

THE TERMINATOR

Not many games leave players with the desire to stalk the streets brandishing an AK-47 rifle. The cartoon violence in most action adventure games these days shows opponents disappearing in flashes of light or simply falling in a neat heap on stone floors. You don't find such effects in *The Terminator*.

Based on the relentless action film, *The Terminator* mirrors its 1984 namesake, offering a wealth of destructive potential. You can play either the killer cyborg from the future or the cunning tactical expert Kyle Reese, who must protect the Terminator's target, Sarah Conner, the mother of an unborn revolutionary.

Gun stores and army depots await in central Los Angeles. Pick up bulletproof jackets, automatic weapons, and even a Stinger missile—but mounting this offense (and defense) takes time—time in which your opponent might decide to end the conflict.

As the Terminator, strategy doesn't much concern you. Simply pick up your rifles and hunt down Sarah Conner. But even a twenty-first-century cyborg isn't indestructible. Reese will do everything he can to stop you—a lot rides on his success. And those LA police officers are no wimps.

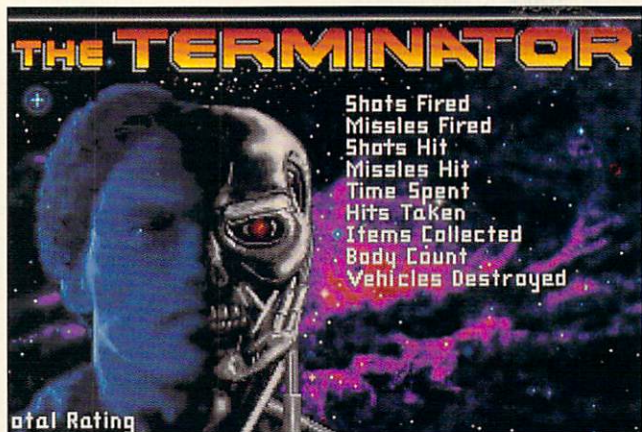
When you zero in on civilians or law enforcement officers, a closeup of your hit appears onscreen. The wounded don't just fall; bullets knock them off their feet and force out blood. Bethesda claims these scenes were so popular early on that it now offers a separate disk with more of these closeups.

If you prefer strategy over pure violence, make Reese your choice. He'll need more time to plan and gather supplies, but the blows dealt de-

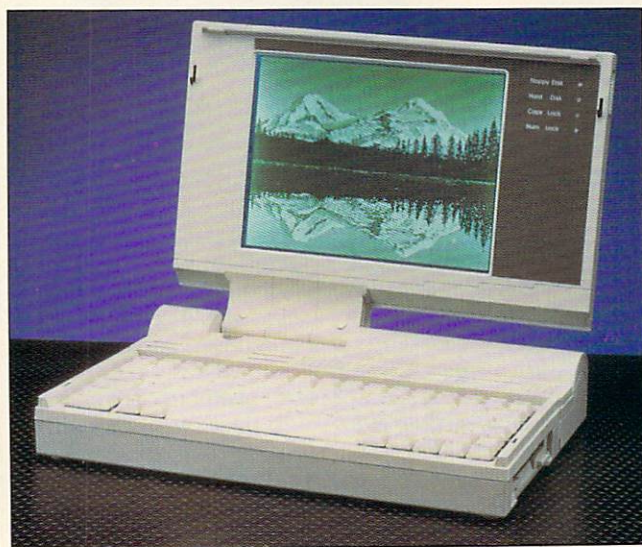
liver greater satisfaction than what you would get by playing a remorseless cyborg. Sarah Conner stands by your side when you begin. Protect her well. She can carry supplies if you become too weight-

through their eyes (if they can still see). Step into a weapons store or shooting range and a 256-color screen appears.

Kill or destroy one of your opponents and you'll be treated to full-screen action cine-



Everyone's favorite killer cyborg is back to wreak havoc in *The Terminator* from Bethesda Softworks.



On the leading edge costwise, the elegant and lightweight *Leading Technology 9800NB* runs at 20 MHz and uses a Cirrus Logic VGA controller.

ed down with weaponry and ammunition, and remember that she'll teach her unborn son the ways of a rebel.

Unlike other recent 3-D games, this product puts you in direct control of the characters. You see the world

matography. These great shots make up for the less than superb point-of-view game graphics in which characters sometimes disappear seemingly at will or walk through walls.

When you play the part of

the Terminator, a heads-up display overlays your optical vision, providing accurate target acquisition information. Just be aware that the faster the pace, the slower the action. This means greater frustration in attack mode, so choose less detail even on a faster than average machine.

The Terminator sports impressive sound. In addition to providing sound card support, this game lends the internal speaker some respectability via Real Sound technology. Be sure to remove any TSR programs and use expanded memory. Otherwise, *The Terminator* is sluggish and prone to nondescript buzzes and graphical errors.

Even with the occasional annoying bugs, *The Terminator* offers magnificent detail in its graphics and movement options. There's nothing like taking a few shots at your target as you make a strategic withdrawal from the ever-present police force. Load that 9-mm Uzi and take aim. The fate of humanity rests on your shoulders.

JONATHAN BELL

IBM PC and compatibles (80286 or faster recommended); 640K RAM; EGA or VGA; requires hard drive; supports Ad Lib and Sound Blaster; joystick optional—\$54.95

Animated Combat Sequence Disk—\$24.95

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LEADING TECHNOLOGY 9800NB

The steady stream of new 386SX notebooks is starting to look like the circus act where one clown after another spills out of a car. After a while, you lose count and

they all begin to look alike.

To grab our attention these days, savvy notebook manufacturers have to offer one or more unique features or a substantially lower price. While the 9800NB has a few interesting features, its primary claim to fame is cost. Leading Technology computers are sold at highly competitive prices in many of the mass-market discount chains. But even if the price is right, should you buy it?

First, let's look at what's good about this machine. It runs at 20 MHz (many 386SX notebooks still run at 16 MHz), takes as much as 8MB of RAM (more than most), uses the Cirrus Logic VGA controller (still the best one for converting color to 32 shades of gray), gets a healthy 2-2½ hours on a battery charge with the built-in power-saving features, weighs only 6.6 pounds, includes an easy-to-use DOS shell, and can plug into an optional expansion chassis.

With these features, the 9800NB stands out from the crowd. In addition, if you care about looks, it has a stylish, almost machine-like appearance that's quite attractive.

Other features work well but are slightly flawed. The keyboard has a nice springy feel, although I didn't care for the reverse L placement of the arrow keys (other notebook computers use the more intuitive upside-down T shape.) And while the 40MB Seagate hard drive is reasonably fast, I couldn't get it to work with *Stacker 1.1*.

What doesn't work at all? Only one thing, although it could be a major problem for many notebook users. Because there's no provision for an internal modem and the 9800NB has only one serial port, you can't use a mouse and a modem at the

same time. That means you can't use *Windows* communications programs unless you use them with keyboard commands (good luck!).

On the other hand, if you don't think you'll be using your notebook to go online or you're happy with your current text-based communica-

of cereal in single-serving boxes, probably only two or three were kinds you really liked. This all brings us to *FastLynx LapPack*, "the complete software system for the laptop computer."

Packaged in a box large enough to hold a football, *FastLynx LapPack* offers ten

fer of information between desktop and laptop computers; and *Mergelt! Phonelist*, a well-designed phone-number-and-address database. You also get *FastLock*, which provides hard drive security by requiring a password to boot up, and *EZC Smart Cursor*, which (drum roll, please) allows you to change the shape of your cursor!

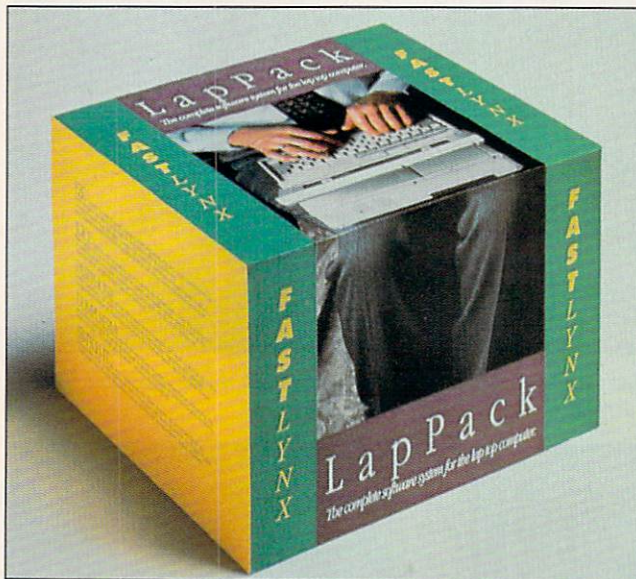
Obviously, some of *FastLynx LapPack's* programs are more valuable than others, and no bundle—even a package with this many programs—can possibly please all users.

For instance, *The Maximizer* would probably interest a business user who must keep in close contact with clients (besides an appointment calendar and stripped-down ledger function, it includes ready-made letters to be mailed for birthdays and anniversaries), but it would be of little use to just about anyone else.

The enclosed CompuServe starter kit will prove valuable to a telecommunications newcomer, but for someone already using CompuServe or someone without a modem, this part of the package isn't of much use.

Most of the *FastLynx LapPack* programs are easy to install, easy to learn, and quite efficient, however. Both *CO/Session*, which lets one PC control another via modem, and the previously mentioned *FastLynx* program make it easy for your laptop to interact with your desktop computer, and *Switch-It* allows for quick entrances and exits between programs—much like going back and forth between windows in a word processing program.

SitBack backs up your files automatically, and *FastJuice* provides the often



FastLynx LapPack includes ten programs for your laptop computer.

tions program, this shouldn't be a problem. To sum up, if you can find the 9800NB for a great price, this could be the notebook for you.

DAVID ENGLISH

Leading Technology 9800NB, 2MB of RAM, VGA screen, 20MB hard drive—\$2,249

LEADING TECHNOLOGY
10430 SW Fifth St.
Beaverton, OR 97005-3447
(503) 646-3424

Circle Reader Service Number 325

FASTLYNX LAPPACK

If you saw double features as a kid, you probably wouldn't have minded skipping one of the movies some of the time. If you bought sampler packs

software packages for a suggested price of \$299.95, which the Rupp Corporation claims would cost \$1,049.00 if purchased separately. Is it a bargain in a big box, then, or an overabundant bundle?

To begin with, it's hard to consider something with no word processor, spreadsheet, or full communications program "a complete software system."

On the other hand, *FastLynx LapPack's* ten programs generally work well, providing a variety of functions—though some are more useful than others.

The package includes *The Maximizer*, a contact management program for business professionals; *FastLynx*, which allows easy trans-

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Circle Reader Service Number 182

REVIEWS

indispensable service of monitoring your laptop's battery charge. Just weigh your needs before letting *FastLynx LapPack* substitute for careful software shopping.

So is *FastLynx LapPack* a ten-pack of your favorite Chocolate-Frosted Sugar Bombs or a disappointing medley of Bombs, Nutty Berries, and Nothing but Bran? Probably the medley, but maybe a boxful of favorites if you're lucky. Check the ingredients first. Then purchase with care.

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Circle Reader Service Number 326

PERSONAL COMPUTING FOR WOMEN

What's the advantage women have in learning to use a PC? "Women can type." If that line doesn't convince you not to buy this superfluous course in personal computing, keep reading. I'll convince you.

My first question is why a beginners' guide to PCs should be gender-specific. Author Maria Hoath's observations such as "When we start our cars we don't know how the gas gets to the engine" and questions like "Remember how befuddled you were when your VCR arrived?" tell all.

Women are innately computerphobic, she claims. Why? We're afraid we "might press the wrong key and erase everything."

When I finally got through the pages of endless male bashing, "case histories" of women who have actually used personal computers (imagine that), and "facts" that ironically emphasize Hoath's lack of confidence in her own gender, I was halfway through the book.

Nowhere does she list a single source of information to support her statements, and yet she offers strange assertions like "software is usually regional in its popularity—what people use in one state may be unknown in another state." Tell that to the manufacturers.

Unfortunately, Hoath devotes only 26 pages to what should have been the focus of her effort—personal computers. While not in-depth, her information is at least useful to a novice, but mysteriously enough, she deems that part of the book optional. Go figure.

In Maria Hoath's world, every boss is a condescending male, and every woman an aimless airhead, perplexed by the complex. "This is an awful lot of techy terms, isn't it?" I can almost see her wink. At \$9.95 for 152 pages of nothing, this book is an expensive joke.

JILL CHAMPION

Author: Maria Hoath 152 pages—\$9.95

WRITE BYTE PUBLISHING
P.O. Box 835
Alpharetta, GA 30201-9998
(404) 740-0659

Circle Reader Service Number 327

"TALKING" ONCE UPON A TIME . . . VOLUME III: JOURNEY THROUGH TIME

My nine-year-old daughter used *Once upon a Time* to write a book. What she didn't know was how much spelling, grammar, and linear logic she was learning in the process. *Once upon a Time* combines word-processing and drawing software in a unique educational experience that kids will think is nothing but fun. Volume III of *Once upon a Time* lets kids actually create books set in medieval times, in the Wild West, or in outer space—all on the PC. Volume I offers Farm Life, Down Main Street, and On Safari scenarios. The variety of stories and pictures that kids can actually create within each scenario is almost entirely up to them.

Referring to *Once upon a Time* as a drawing program is misleading. The child doesn't actually draw anything on the screen. Instead, he or she selects an appropriate background (four per scenario including a blank) and then places any number of picture elements, selected from an on screen list, anywhere on that background. The upper two-thirds of the screen is the child's selected background. The bottom third offers a list of commands that can be

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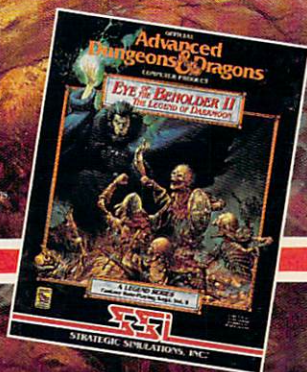


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selected by simply moving a highlight bar. Backgrounds can be switched, for example, by simply highlighting the Background command and hitting the Return key. The Draw option allows the child to place a picture element directly on the background he or she has selected. The F1 key displays a list of all available picture elements for the selected scenario. In a flash of brilliance, the creators of *Once upon a Time* have set things up so that the child types in the name of each selected picture element before it will appear on the background. The child thus reads the list and learns the words. Each of the three scenarios allows selection from roughly two dozen different picture elements. In the Medieval Times scenario, for example, the child can put wizards, horses, knights, tables, and much more on backgrounds illustrating a castle's interior, hills and a distant village, or a blank or black screen. Using the computer's arrow keys, a child can place each selected element anywhere on a background. Highlighting the appropriate command at the bottom of the screen and typing in the element's name allows your child to flip, delete, or move elements.

Most amazing, however, is the program's ability to actually speak the name of each picture element, crisply and clearly, through the computer's existing speaker. The child simply highlights a picture element on the on screen list and then hits F2, and its name is spoken. This, of course, makes *Once upon a Time* an even better reading and spelling aid than it might have otherwise been. It's certainly convenient, too, since you don't

need any additional hardware or software to perform this nearly miraculous feat.

When I said my daughter wrote a book, I wasn't kidding. *Once upon a Time* also has some attractive word-processing capabilities. They will at first seem limited, but this is a program for children ages 7-12. Kids that age don't want or need comprehensive features such as block move or search-and-

that I've seen in a long time.

ALAN R. BECHTOLD

IBM PC and compatibles; 384K RAM; CGA, EGA, MCGA, VGA, Tandy 16-color, or Hercules; joystick or mouse—\$49.95

Also available for Apple II series (non-talking)—49.95, Apple IIgs—\$59.95, and Macintosh—\$49.95

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Volume III of *Once Upon a Time* lets kids explore medieval time, the Wild West, outer space, and the universe of their own imaginations.

replace. They just want to write, and *Once upon a Time* lets them do just that.

No, my daughter didn't sell her book to a major publisher and make enough money to buy me a new car, but she was happy and busy for hours, writing her story and creating pictures to go with it, then coloring the final printed results. She learned a lot of new words and organizational skills in the process. Now she's bugging me to get off the computer and let her start on her next creation, and she hasn't caught on that she's learning while she creates. That's why I think *Once upon a Time* is one of the best examples of quality educational software

EPSON EQUITY 386SX/20 PLUS

When was the last time you were dazzled by a computer? In addition to power, speed, and a commitment to the needs of the average user, Epson's EQUITY 386SX/20 PLUS offers remarkable graphics based on Edsun's CEG anti-aliasing chip.

The power and speed come from the 20-MHz 386SX microprocessor, 2MB of fast zero-wait-state DRAM (Dynamic Random Access Memory), a 100MB hard drive (a 40MB drive is available), and a 32K SRAM (Static Random Access Memory) cache. For computation-inten-

sive applications, the cache optimizes system performance by holding oft-used instruction sequences, allowing the microprocessor to use them without any wait states. While the DRAM offers fast performance with its 80-ns rating, the SRAM wins the race with its blazing 25-ns rating.

If you need more speed, and especially if you plan to run *Windows*, I recommend adding more memory. This Epson allows you to expand RAM to 16MB maximum, 14MB on the system board alone with Single In-line Memory Modules (SIMMs).

You have room for three drives altogether, two mounted horizontally and one (unexposed, for a hard drive) mounted vertically. While Epson offers a choice of VGA monitors (monochrome, regular, and extended) and operating systems (MS-DOS 3.3, 4.01, and 5.0), I was surprised to find that you pay extra for them. Epson will, however, throw in *Microsoft Windows* software free with every purchase of the operating system for this computer, and Epson also gives you Bitstream's *Facelift*, a font-generation program for *Windows* that allows you to create scalable fonts for your printer and screen.

Epson's commitment to the needs of the computer user is apparent in its documentation and in the design of the computer. I give Epson an A for its excellent User's Guide, which offers attractive design, a multitude of illustrations, thoroughness, and readability. In addition to the usual information on set up and use of the computer, this manual covers safety, installation of options, system diagnostics, troubleshooting, and more. Throughout, Epson includes boxes with notes, cautions, and other information deserv-

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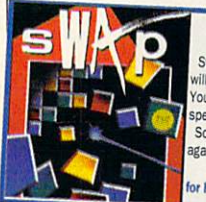
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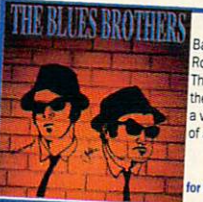
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ing special attention. There's also a glossary of computer terms at the end of the guide.

The first time you set the computer up, you'll need to run Epson's setup program, which defines your configuration. This is probably the only part of the guide you'll need to consult if you have some computer experience under your belt. If you need more guidance, Epson covers everything from finding an appropriate location for your computer to connecting system components and running through your options in the setup program. Your options include setting a password, enabling or disabling the cache, turning your speaker on or off, and setting the keyboard repeat rate.

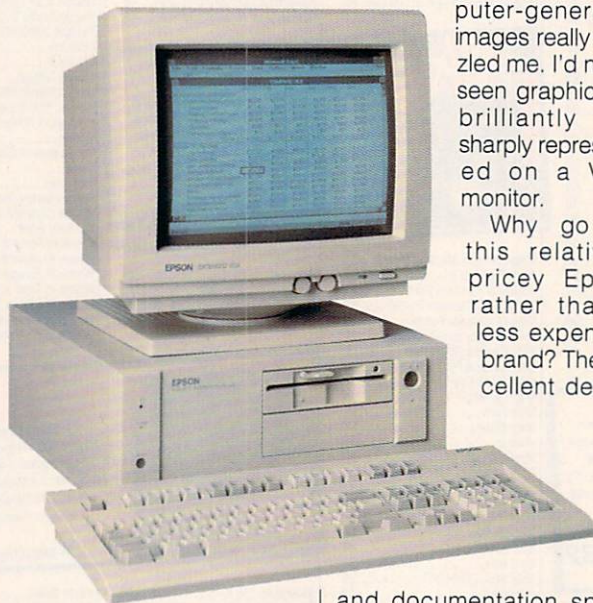
Access to the EQUITY system box couldn't be easier. Forget about screwdrivers—just turn a wheel lock, push in two releases on the back of the box, and tilt the top up and off. At six inches high, this box offers plenty of room for installation and adequate ventilation. If you need access to the right portion of the system board, you can easily lift out the drive bay/power supply subassembly—once again, without using a screwdriver.

This EQUITY gives you four full-size card slots—three 16-bit and one 8-bit. Because the video output, mouse port, serial port, parallel port, and video adapter port are integrated into the system board, you really don't need many slots.

On the front of the box, you'll find a power button on the right, out of the way of the keyboard but recessed to help you avoid hitting it accidentally. To the left you'll find a hard disk access light. Below it is a light to let you know when the computer is in turbo (20-MHz)

mode, and below that is a small, recessed reset button. Accidental reboots should be a thing of the past; you have to aim and deliberately try to hit this one.

The 101-key keyboard served my purposes well, and I didn't find anything remarkable to distinguish it



from most other keyboards.

The built-in VGA adapter with 512K of video memory supports up to 800 × 600 pixels in 16 colors or up to 640 × 480 pixels in 256 colors. With a CEG chip, however, you have an apparent resolution of at least 1563 × 1280, and that's with a standard VGA monitor. Here's how it works: The CEG chip uses a technique called anti-aliasing to blend colors between adjacent pixels, getting rid of the jagged edges typical of most displays. You see rounder curves and, according to Epson, you have access to a color palette of more than 700,000 shades.

There are now CEG display drivers for *Windows*, *PageMaker*, *Excel*, *Ami Pro*, and several other programs.

(For a current listing, contact Edsun Laboratories, Marketing Department, 564 Main Street, Waltham, Massachusetts 02154; 617-647-9300.)

I used the *Windows* CEG driver and was impressed with many of the features as well as the CEG screen blanker. A CEG demo with photographs and computer-generated images really dazzled me. I'd never seen graphics so brilliantly and sharply represented on a VGA monitor.

Why go for this relatively pricey Epson rather than a less expensive brand? The excellent design

and documentation speak well for the computer, and Epson has a reputation for durability and dependability. Also, you can bet that Epson will be around for some time. If you depend heavily on your computer and need that kind of reliability and reputation, this is a computer to consider. And if you want the marvels of the CEG chip now, this Epson is the way to go.

MIKE HUDNALL

Epson EQUITY 386SX/20 PLUS with 2MB RAM, 32K SRAM cache, 3½-inch 1.44MB drive, and 100MB drive—\$2,799

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NEC GRAPHICS CDs

Where can a desktop publisher go in search of stock art? Where can you find useful black-and-white and color photographs, images, and clip art? NEC provides the answer to this question with its wide-ranging collection of graphics CDs that includes *Photo Gallery* (black-and-white photos), *Image Folio* (color photos), *Clip Art 3-D*, and *Image Gallery* (conventional clip art). *Type Gallery PS*, another product, provides attractive, professional typefaces.

Photo Gallery comes with a book illustrating each of the hundreds of professionally photographed images available through this program, categorized by content. The images are in TIF format with gray scale information, so they're easy to use with most desktop publishing and word processing programs that can import art.

Because this collection was designed for broad use, the art looks generic. However, you're virtually guaranteed that *something* here will meet your needs.

If you're generating a publication for personal use, for use within your company, or for nonprofit use, you can reproduce any of the images as often as you please. However, if you're publishing for profit, you'll have to pay UNIPHOTO Picture Agency, the photo service owning the copyright to the photographs, for use of the images above the cost of the CD product. (This also applies to the *Image Folio*, which contains color photos.) Color versions of many of the photos are available from UNIPHOTO.

One thing you should be aware of before purchasing this package is the graini-

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ness of gray scale images when they're reproduced on a laser printer. Photos are more appropriate for use in typeset documents, and laser printers are more appropriate for proofing photos prior to typesetting (making sure you're using the right photo in the right place, that the picture is right side up, and so on). If your final output is on a laser printer, you might be better off either using conventional vector clip art or using the photos for scanning purposes to create your own vector clip art.

I often use photographs in desktop publishing as raw material for scanning and tracing. A product like *Photo Gallery* reduces the need for scanning. By and large, however, the images aren't good candidates for tracing—they aren't usually high-contrast images with simple content. More often, black-and-white photography gets its power from complex shadings that defy all but the most gymnastic of scanning software. The images work with any graphics package that uses the TIF format.

Type Gallery PS allows you instant access to any 3 typeface families out of 116—a family is a collection of roman, bold, italic, and bold italic fonts—on the CD. Once you've accessed three, to access additional typeface families you have to pay NEC a premium (on top of the \$399 price of the product) between \$49 and \$249, depending on the size of the family. These typefaces must be used with a PostScript device.

Image Gallery offers a similar arrangement. For the price of the CD, you're allowed access to any 6 of the 20 categories of clip art provided on the disc. Additional categories (like Fashion and Food, containing an average

of 210 images each) will be unlocked for \$99 each.

Image Folio gives you access to over 4000 color images in "VGA resolution"—320 x 200 pixels. *Clip Art 3-D* comes with 2500 three-dimensional clip art images.

ROBERT BIXBY

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Circle Reader Service Number 330

PANASONIC KX-P1123 PRINTER

How do you choose the right printer? Price comes first on many lists and often determines the quality and number of features you'll get. If you can afford a price tag of \$400, you should take a look at Panasonic's new KX-P1123, a quality printer with a number of attractive features.

Just right for home, office, or school, this 24-pin printer offers multiple fonts, an easy-to-use push-button front panel, and simple installation.

Available fonts include Courier and Prestige in draft or LQ modes and proportional spacing and script modes. In addition, you can take advantage of the printer's bold, italic, double-height, double-width, and double-strike capabilities. Control centering attributes, set the margins, create three macros, or return to factory settings—all at the push of a button.

The KX-P1123 doesn't stop with an array of fonts.

This printer adapts well to fanfold paper as well as to single sheets and envelopes in a variety of sizes and weights.

Special features such as printing in landscape mode, creating macros to store different print formats, dumping the data in hex format, and designing and downloading custom characters make this printer worthy of your attention. Less spectacular but no less important are the paper park and perforation cut functions that avoid paper waste and advance the paper to the tear position.

The unit comes with a 10K buffer, but for an additional \$60, you can add a 32K buffer chip that comes with easy-to-follow instructions.

Even with all the extras, it only took me around 20 minutes to start printing in different fonts and producing quality forms from the command line and with *Express Publisher*. The easy-to-understand manual with all of its diagrams and explanations helped to speed things up. The KX-P1123 package also includes a maintenance and troubleshooting guide.

I spent most of the 20 minutes of installation time trying to load the fanfold paper. Of the three methods of paper installation, the rear-feeding method proved by far the hardest to conquer. Since the tractors roll during paper loading, precision positioning of the fanfold sheets took several attempts. The paper would catch on one tractor but not the other. Once it was installed properly, I had no further trouble with the paper.

Although not the fastest printer I've used, this Panasonic printer is no sloth either. Printing at 240 cps in draft mode and 53 cps in LQ mode might cause a few delays, but a print spooler could remedy that bottleneck.

The KX-P1123 prints bit-image graphics at 240 dpi. There were a few jaggies, but that's to be expected in any dot-matrix printout whether it's text or graphics.

Don't look for compatibility problems from this printer. The two emulation modes, Epson LQ-850 and IBM ProPrinter X24, should work with almost any software package.

With a two-year limited warranty and technical support and customer service departments a toll-free call away, the KX-P1123 belongs on every cost-conscious shopper's list of printers to evaluate.

JOYCE SIDES

Panasonic KX-P1123—\$369.95

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TEENAGE MUTANT NINJA TURTLES WORLD TOUR— ELECTRIC CRAYON DELUXE

Circling the globe with the Ninja Turtles may not be everyone's idea of a great time, but most youngsters ages 3 and up will enjoy the trip. Each of the 30 pictures in this computer coloring book features the Turtles visiting a major tourist attraction and includes a description of the site.

Choose from 16 colors in EGA mode, and mix these for a total of 256 different shades. A mouse works best for clicking on a color and filling an area. Drawings may be erased and tried again. Completed masterpieces can be saved and printed in different formats.

Les Manley in:
Lost in L.A.

"SHE STOOD NAKED,

HER WET BODY BATHED IN BEVERLY

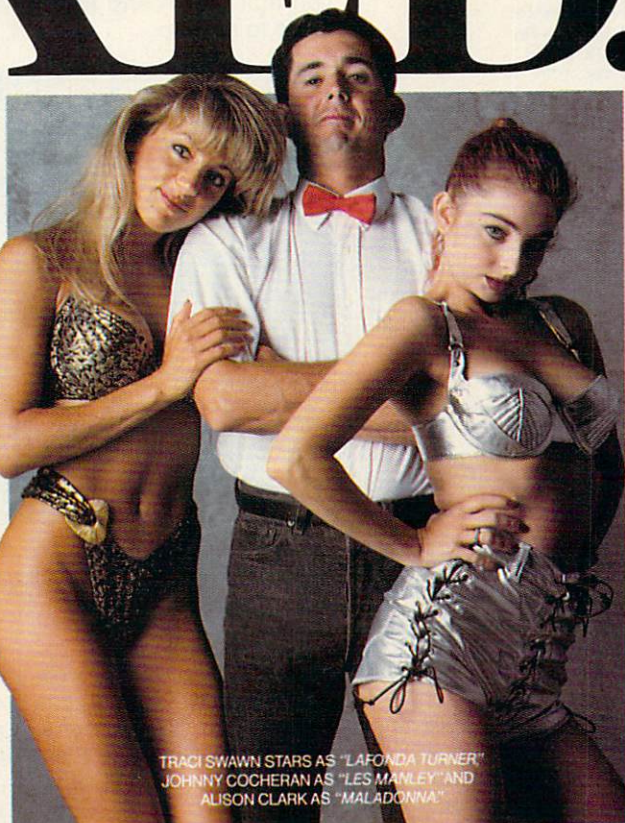
HILLS MOONLIGHT. THE STRANGER CREEPT
OUT FROM THE SHADOWS TOWARDS THE POOL. LIKE

THE STARLETS WHO HAD VAN-
ISHED BEFORE HER, SHE WAS
OBLIVIOUS TO HIS MENACING

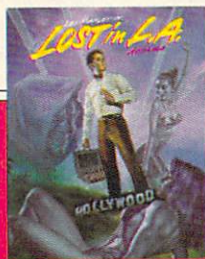
PRESENCE. HER
SCREAM WAS NOT
HEARD! THE HIPPEST
STARS IN HOLLYWOOD
ARE BEING KIDNAPPED.
AND ONLY ONE MANLEY
CAN SOLVE THE CRIME
OF THE CENTURY. *LES
MANLEY IN LOST IN L.A.*[™]
PLUNGES THE HERO OF
SEARCH FOR THE KING[™]
INTO A MEGA-MYSTERY
THAT SPANS ALL OF LA
LA LAND. MEET GOR-
GEOUS BABES, BODY
BUILDERS, ROCK STARS,
OUT-OF-WORK ACTORS—

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TRACI SWAWN STARS AS "LAFONDA TURNER"
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ALISON CLARK AS "MALADONNA"



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Circle Reader Service Number 201

Cowabunga, dudes! For kids, this one's a hit!

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Circle Reader Service Number 332

FLOW CHARTING 3

Having drawn hundreds of system flow charts with a pencil and template in my auditing work, I found the prospect of computerizing this tedious task especially attractive. Happily, Patton and Patton's *Flow Charting 3* whips up a high-quality flow chart with only a little effort on your part.

The designers exercised commendable restraint in refraining from trying to be all things to all users with *Flow Charting 3*. Instead, they concentrated on the essentials, added only a few frills, and produced a workmanlike product that will do the basic job for almost anyone.

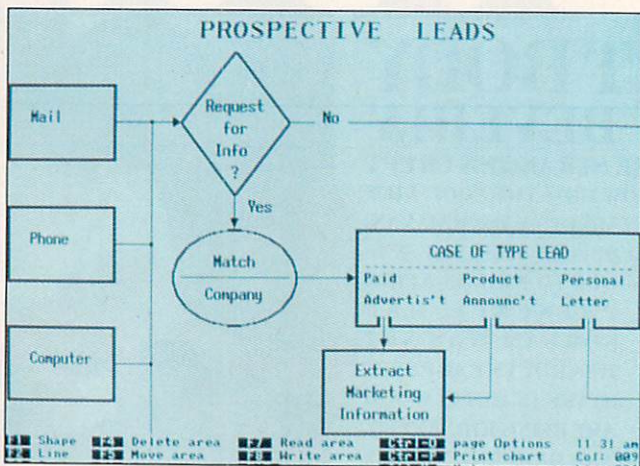
A keyboard-based program, *Flow Charting 3* uses function keys, Ctrl- and Alt-key combinations, and some clever, effective shortcut keys to handle its specialized tasks. You won't do any freehand work in this program, since it's optimized for standard flow charting. The mouse functions seem to be an afterthought, but for a few chores such as basic cursor repositioning, your hand automatically moves to the mouse.

Flow charts use a standard symbol set: rectangles for processes, diamonds for decisions, and so on. *Flow Charting 3* gives you 35 ba-

sic symbols, each coming in up to 12 sizes and shapes (tall or squat rectangles, for instance). Looking through the illustrations of each symbol in Appendix C, I couldn't imagine a flow charting function that Patton and Patton failed to include.

and direct approach. Upon finishing the tutorial, I felt ready to create virtually any flow chart.

With *Flow Charting 3*, you can quickly create a flow chart you'll be proud to present to any board of directors. And years from now,



Flow Charting 3 from Patton and Patton Software allows for simple or complex onscreen logic tracking.

Once you choose your symbols, you need to connect them with lines. Simple and direct, line drawing has provisions for arrowheads, multiline connectors, and bypasses. Lines—thin, thick, hollow, and dashed—require but a moment to add.

Ten text styles—normal, bold, wide, fat, tall, Greek, subscript, superscript, micro, and title—complete your chart. You don't have a wealth of possibilities to indulge your creative urges, but you can include everything needed in a good flow chart.

Flow Charting 3 supports about 75 printers, from 9-pin dot-matrix to laser. You can print flow charts in portrait or landscape orientation, and larger charts can be spread over up to six pages.

The manual's tutorial section impressed me particularly with its detailed advice

when you wonder how that program or process you designed works, you'll have a neatly printed flow chart to remind you at a glance.

RICHARD O. MANN

IBM PC and compatibles, 512K RAM, CGA, EGA, VGA, or Hercules; mouse optional—\$250

PATTON AND PATTON SOFTWARE
485 Cochrane Cir.
Morgan Hill, CA 95037
(408) 778-6557

Circle Reader Service Number 333

MACE EXPRESS RECOVERY

In spite of the many advances PCs have made over the years in the areas of power and reliability, they still have an Achilles heel: the disk drive.

Because of head crashes, mechanical wear and tear, or just plain rough handling, disks fail, leaving you unable

to boot from your hard drive or staring at the dreaded *File Not Found* message.

Now there's help. Fifth Generation Systems' *Mace Express Recovery* package, with its powerful utility *Emergency Room*, can detect and correct many drive-related problems.

This powerful program can correct such problems as damaged boot sectors, partitions, file allocation tables, and directories. It doesn't require any technical knowledge to use, and calling *Mace Recovery* easy-to-use is something of an understatement.

To check or repair a disk, simply type *ER*, indicate the drive you wish to repair, and the recovery proceeds automatically. In the unlikely event that the recovery fails, you can completely undo any changes that were made to the disk.

In such cases, Fifth Generation Systems' technical support line can probably offer advice on further steps you can take to successfully recover the disk.

Mace Recovery doesn't succumb to "feature-itis"; it performs one function, and it performs it well. Installing and using it couldn't be simpler; the manual tells you everything you need to know in just 21 pages. Owning *Mace Recovery* is like having an insurance policy for your PC; it's something you hope you never need, but if you do, it can be a lifesaver.

RICHARD RAPP

IBM PC and compatibles, 512K RAM; mouse optional—\$69

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To enter the Contests and become eligible for the Cash Prizes, fill out the following user registration form and mail it with a check or money order for \$10.00 (Ten Dollars) to Enigma Software, Inc. 5130 E. Charleston Blvd., Suite 5, Las Vegas, NV 89122.

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Hidden Treasure Registration Order Form CMJ-1

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Circle Reader Service Number 129

OFFICIAL RULES
1. To be eligible for entry and Cash Prizes in any of the first eleven Contests, each contestant must be a Registered User for that month's game series. To be eligible for the Grand Prize and the final contest, each contestant must be a Registered User for all of the previous eleven games, the final game in the "HIDDEN TREASURE" game series and sent in the correct solutions to each of the eleven games. To become a Registered User for any game in the series, the only requirement is to mail in the \$10 (Ten dollar) purchase price and the completed registration card for that series. Starting February 3, 1992, the first game in the "HIDDEN TREASURE" series will be mailed to all Registered Users whose registration card has been received by Enigma Software, Inc. as of January 31, 1992. Register Now... Each of the following monthly games in the series will be mailed on the first Friday of the corresponding month. Solutions must be postmarked no later than the last day of the month in which the series was released. The deadline closing date for each monthly contest is the last day of the month in which the series was released. Any solutions received after the deadline closing date will confirm eligibility for any of the Cash Prizes in the last series BUT NOT THE CURRENT MONTH'S CONTEST... Respond today... and good luck in all of the Contests!!!

drawing for their eligible prize category and remaining contestants automatically go to the next available prize level i.e., if two contestants tie for first place, the random drawing will determine the winner and the remaining contestant will be a second place prize winner. UNCLAIMED PRIZES WILL NOT BE AWARDED.
3. There are 1,100 monthly Cash Prizes available to be won as follows: For each of the first eleven monthly contests there will be 100 (One Hundred) Cash Prizes awarded as follows: (1) First Prize \$400; (2) Second Prizes \$200 each; (3) Third Prizes \$100 each; (4) Fourth Prizes \$50 each; (5) Fifth Prizes \$25 each. The total CASH PRIZES for the final months contest is \$40,000. The first 600 (Six Hundred) solutions received at our office from Registered Program Users will be eligible for the final month's Cash Prizes totaling \$40,000. The first contestants to send in the correct solutions will determine the Winners. ***POSTMARK DETERMINES THE DATE*** In case of ties, winners will be selected in a random

All game solutions must be received by the last day of the corresponding month. No responsibility assumed for lost, late, misdirected, incomplete, illegible, mutilated or postage-due mail.
5. No substitution or transfer of prizes permitted. Taxes are sole responsibility of winners. Limit one prize per household or family per month.
6. Winners may be asked to sign affidavits of eligibility, advertising and liability releases, which must be received by specified date or prize will be forfeited. By participating, winners agree to use of their names/voices/likenesses in publicity and advertising without additional compensation.
7. Contests are open to the Continental U.S. residents, except employees and immediate families of Enigma Software, Inc., J.V. Enterprises, Layton & Layton-GPA Firm, Diversified Systems group, Inc., their affiliates, subsidiaries, agencies and any printers and/or other suppliers or distributors of any elements of this game. Void in Alaska, Hawaii, Puerto Rico, U.S. Virgin Islands and wherever prohibited by law.
8. The names, cities and states of residence of prize winners will appear in a printed list. For list of monthly prize winners (available after the 15th of each month following the close date of the current series), send self-addressed, stamped #10 envelope and the words: Current Months Winners List to Enigma Software, Inc., 5130 E. Charleston Blvd., Suite 5, Las Vegas, NV 89122.
9. If Game Disk is damaged in mailing, immediately call (702) 452-1941 and you will be given information on replacement of game disk or procedures for accessing through modem communications.

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384K RAM EGA/VGA Color Graphics

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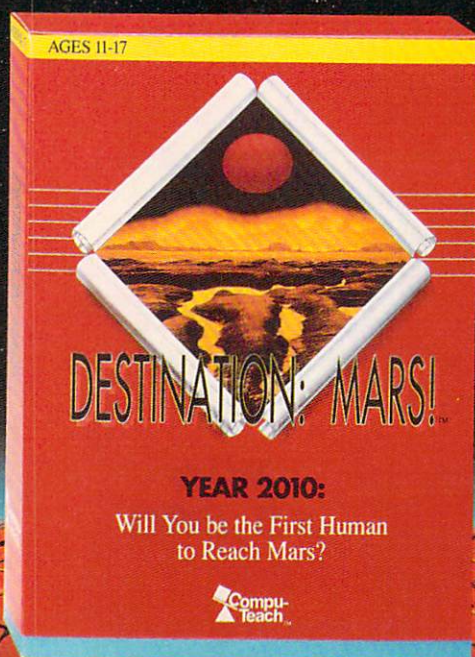
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DVORAK ON TYPING

Remember your high school typing class? These days, learning to type doesn't have to mean noisy typewriters and scowling teachers. Interplay's *Dvorak on Typing* fills in with an assortment of drills and a game. When Dvorak instructs, you can work against the clock or just type with no set limits on time.

Dvorak on Typing also offers the old tried and trues of traditional typing manuals—only better. For instance, during the Letters segment, the screen shows you which finger to use and where to find the key on the keyboard.

For a break from drills, you can play a game where you're a knight facing different foes. You'll have difficulty watching the game, though, since you must read and type in text from the bottom of the screen. This puts a bit of a damper on the fun, but you still log typing time.



Here's a twist on chivalry—control a knight by typing.

Features include a Reports option that displays your accuracy rating and words per minute for each session. You can also see your most recent "problem" keys. Another option activates a voice to offer encouragement.

Absolute beginners might still find a teacher's guidance helpful—as a matter of fact, this program would be great for the classroom. However, if you want to sharpen

your typing skills at home, *Dvorak* lends rote drills some computer clout.

CHANTELLE OLIGSCHLAEGER

IBM PC and compatibles; 512K RAM for CGA, EGA, Tandy 16-color, or Hercules; 640K for MCGA or VGA; supports Ad Lib and Sound Blaster—\$49.95

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3710 S. Susan, Ste. 100
Santa Ana, CA 92704
(714) 549-2411

Circle Reader Service Number 335

THUNDERSTRIKE

Defense industries and television networks control the world. The more exciting the military action on the tube, the better the ratings. Sound familiar? No, it's not a replay of the Persian Gulf War. It's *ThunderStrike*, an addictive arcade game set 247 years in the future.

ThunderStrike straps you into your choice of five futuristic fighter aircraft. You patrol a desolate landscape in an airborne arrowhead, on the lookout for enemy craft and drones capable of destroying your pyramid-shaped installations. As with most arcade games, it's much easier to kill than be killed, but the threat that your craft might be destroyed is real enough to give the game an edge.

Meaningful changes occur in each round, with your craft upgraded or downgraded based on your defense rate, hit rate, and television ratings. The last depends on

THUNDERHAWK™

THE ULTIMATE HELICOPTER COMBAT SIMULATOR!

Hey Hotshot! It's 1995 and the Pentagon has just unveiled it's brand new gunship - AH-73M Thunderhawk - and guess who's been selected to put her through her paces? That's right - you.

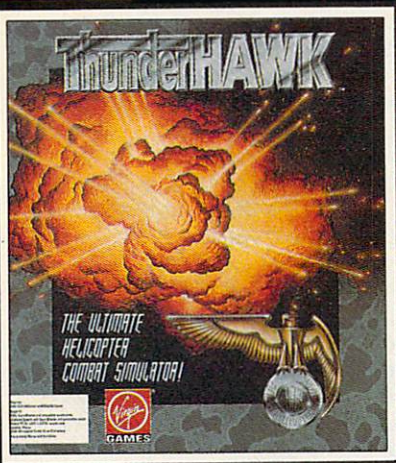
Here's what the Thunderhawk combat helicopter simulator has that the others don't:

Campaign scenarios with a multitude of missions

A true world to interact with - not just a cockpit - but other locations and characters that respond to your actions

A helicopter armed with the latest in weaponry, electronic countermeasures, functioning displays and computer-aided targeting systems

Realistic missions reflecting actual military conflicts and contingency plans



AMIGA SCREENSHOTS SHOWN

Zip up your flightsuit, adjust your sunglasses and control your nerves, 'cause this one makes Nam look like a day at the beach!

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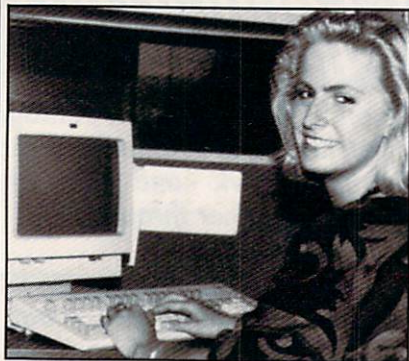
DEVELOPED BY **CORE DESIGN LIMITED**

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REVIEWS

whether your maneuvers and dogfights are exciting enough to draw in the viewers.

ThunderStrike is a compelling, highly playable game that suffers from only a few annoying aspects. Even if you install *ThunderStrike* on a hard drive, you still need its boot disk to start it up every time you play. Furthermore, the game provides no save feature, so each time you play you must start from scratch. Still, once the action begins, it's hard to quit. This compelling action earns *ThunderStrike* high marks.

EDDIE HUFFMAN

IBM PC and compatibles, 512K RAM, EGA or VGA; supports Ad Lib and Roland sound cards; mouse or joystick optional—\$39.95

Also available for Amiga—\$39.95

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Circle Reader Service Number 336

HEBREW PLAY HOUSE/ MILK AND HONEY CHALLENGE/ MY ISRAELI ATLAS

A traditional Hebrew form of study in which two students learn by asking each other questions, *haver* has worked for centuries. Tekoa, publisher of *Havruta: A Jewish Encyclopedia*, continues this tradition of study by substituting your computer for a study partner.

The *Havruta* software series consists of several interactive lessons on Jewish life and culture, Israel, Hebrew language, Jewish history, and holidays. Each package offers lessons, games, and quizzes. Applications typically have file editors to enable parents and teachers to customize exercises for individual students. The Hebrew language programs require no special hardware.

Hebrew Play House teaches basic Hebrew vocabulary for items found in and around a typical home. Youngsters play several games, and in the process they learn to recognize and spell Hebrew words for furniture, pets, and kitchen utensils. Activities include construct-

ing images with clip art objects, entering Hebrew names for pictures (the program comes with a Hebrew keyboard chart), reconstructing an illustration by positioning its missing parts, and matching an object with its Hebrew name. Youngsters must be able to read Hebrew without vowels in order to play.

In another package—*Milk and Honey Challenge*—children (ages 10 and up) meet Israel and its people with help from 15 prepared study units. Topics include geography, history, culture, current events, famous personalities, Hebrew vocabulary (using transliterated English), and the Diaspora. A built-in editor lets teachers and parents prepare customized study materials.

The fast-paced activities encourage youngsters to memorize a series of facts. For example, *Order It* requires players to arrange events in correct chronological order, while *Match It* challenges contestants to link a specific item with its counterpart on a list. If players do not complete an activity before time runs out, the game starts over, and drill continues at a slower pace. In *Milk and Honey's* hangmanlike game called *The Menorah* (an eight-branched candelabrum), players must answer a question correctly before all eight candles burn out. The contestant with the most candles left at the end of the game wins.

Lots of fun, *Milk and Honey Challenge* helps kids learn by playing seven entertaining games. These activities motivate youngsters to work through lessons.

My Israeli Atlas, the final program reviewed, encourages people to visit Israel by computer. This enjoyable electronic geography package includes four colorful maps, several clip art images, and eight interactive games. It features 28 prepared study units organized into six major subject areas: Israel (general), Northern Part, Samaria (North Judea), Judea and Negev, Jerusalem Sites, and Places to Visit. Individual lessons focus on important cities and resort towns, historical sites, the old city of Jerusalem, biblical origins, and Israel's neighbors. Parents and teachers can create new lessons using the program's built-in lesson editor.

Youngsters select a unit for study and then choose an activity from the

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drill menu. Lively games let students become more familiar with the country's geography, important places, and English names for Hebrew locations. Challengers need not know Hebrew to play. *My Israeli Atlas* even includes a road map of modern Israel.

Don't let the early copyright dates of this series mislead you; Tekoa's Judaic computer encyclopedia still provides an imaginative supplement to conventional Jewish studies textbooks. While some users might find the CGA graphics a bit disappointing, *Havruta's* entertaining activities make it fun to learn difficult concepts.

CAROL HOLZBERG

IBM PC and compatibles; 128K RAM; CGA, EGA, MCGA, VGA, or Tandy 16-color—\$39.95 each

My Israeli Atlas also available for Apple II series and Apple IIGs—\$39.95

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PULSTAR SXP

One-stop shopping—that's what I like best about this complete package, and that would be even more important if I were new to computing. The Pulstar hardware includes all the important pieces: a fair-sized hard drive, a modem, SuperVGA, high-density floppy drives, a mouse, a joystick port, and more.

My Pulstar odyssey began with a long installation of all the software. I prefer to have bundled software copied to the hard drive at the factory, a service that many manufacturers provide. With so many programs in the package—*Quattro Pro*, *Chessmaster 2100*, *DeluxePaint II*, *Publish-It!*, *Word for Word Professional*, and *Mavis Beacon Teaches Typing*, to name a few—installation takes time.

If you want to install the programs selectively, though, this is a more efficient approach. You get only what you want on the hard drive, saving room for data files.

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Percent of hair loss: _____ Medically prescribed treatments

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_____ Vitamins

_____ Other _____

The installation program was easy to use, so there wasn't much to do but swap disks.

Without reasonable performance, all the attachments in the world wouldn't matter. But the Pulstar performed well above acceptable standards and even excelled in several respects. The 40MB hard drive seemed to outperform its 28-millisecond rating.

The video card and monitor combination outshone the video combo on my personal system. Video output was one of the best I've seen for a system in this price range.

I loved the crisp feel of the keyboard. The 2400-baud Hayes-compatible modem worked like a charm, too.

The issue of footprint size sometimes divides users into two camps. I like a big box that dissipates heat and lets you easily install cards. Some users with limited desk space think the smaller, the better. Consider the small and sleek Pulstar for your office if you

pitch your tent with the pro-downsizing crowd.

With a 386SX microprocessor running at 16 MHz, the Pulstar ran noticeably slower than the 386DX running at 25 MHz that I'm used to, but I didn't find the SX's performance a handicap. The system performed so well as an integrated unit that I never really noticed the lower clock speed. On almost every count, it kept up with me.

Should you consider this system for yourself? That depends. Those new to computing will get everything they need, and this system won't be obsolete next year. Furthermore, it will be some time before you're out buying software or hardware add-ons. If you want a reasonably priced system and don't need a speed demon, then the answer, once again, is yes. This computer performs admirably and will probably meet all of your needs. The only person who might look

elsewhere is someone who needs top performance. Not too many of us do, so this great package gets my vote for serious consideration.

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Pulstar SXP—\$1,995

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HOW TO CHOOSE THE RIGHT COLLEGE

For many high-school students and their parents, the process of choosing a college frustrates instead of exhilarates. The College Knowledge Series from Education Information Systems offers welcome advice to help you make this important decision.

Of the three programs I've

used, *How to Choose the Right College* is the most useful in helping you pinpoint a college that meets specific needs. The program lists 4450 colleges with detailed information about each, such as majors offered, student body size, work opportunities, financial aid availability, intercollegiate sports programs, and lots more.

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Circle Reader Service Number 202

der by tuition, student body size, or application due date.

Main menu choices include Overview of Colleges Today, Match Criteria to Database, State Search (colleges in a specified state), Personal Letter Writer, How to Finance College Education, and How to Evaluate Colleges.

One feature not fully developed is Major Fields of Study. The fields aren't broken down into specifics. For instance, the sciences major is broken down into 10 or 15 options such as Life Sciences and Biology, but not into a specific field like marine biology, even though over 1200 schools offer degree programs in biology or life sciences.

You shouldn't depend completely on a computer program to pick your college, but they often yield valuable aid. At \$79.95, the price tag is a little steep, but if you have the money to spare and you don't



Graph-in-the-Box Executive makes creating down-and-dirty business graphics as easy as pie charts.

have the resources to find this information yourself, it can be money well spent.

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GRAPH-IN-THE-BOX EXECUTIVE

Creating simple charts and graphs with a personal computer doesn't necessarily prove to be as easy as it sounds. Hard-to-learn packages designed for creating presentation graphics—like *Microsoft PowerPoint* and *Aldus Persuasion*—are geared more toward the presentation professional and often come equipped with more power—and work—than most of us really need.

Those with more modest graphing needs will find *Graph-in-the-Box Executive* a good choice. A TSR (Terminate and Stay Resident) program that sits in RAM until you need it, *Graph-in-the-Box Executive* lets you pluck information from virtually any application and use that data in a chart or graph.

Say, for instance, while working in *WordPerfect*, that you want to convert a table of numbers into a bar chart. You summon *Graph-in-the-*

Box Executive by typing Alt-G, and then highlight the *WordPerfect* table using either the cursor keys or your mouse. A copy of the information then moves into *Graph-in-the-Box Executive's* data table, and from there you can convert the data into 15 types of charts, including bar, pie, scatter, and line charts and various combinations of those.

Graph-in-the-Box Executive's clear documentation simplifies virtually every task. Advanced users will really appreciate the program's technical reference documentation, which anticipates quite a number of problems you might expect to encounter with any type of graphics program, including this one—incompatibilities with other terminate-and-stay-resident programs and applications, for example.

Unfortunately, what you stand to gain in convenience with this program, you tend to lose in output quality. Graphs created with *Graph-in-the-Box Executive* lack the polished appeal of those created using more sophisticated software, even when you choose to print them on a laser printer. In addition, your output choices—printer and plotter—don't include creating slides.

If what you're after is mere down-and-dirty graph and chart creation, *Graph-in-the-Box Executive* should serve well as a useful—though somewhat limited—tool.

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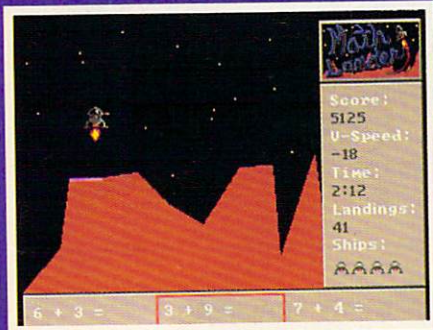
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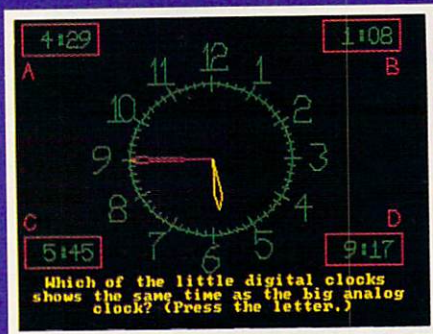
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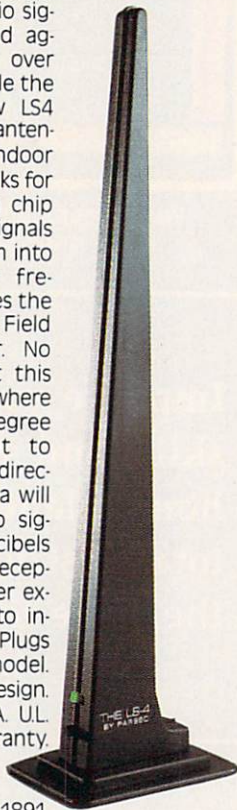
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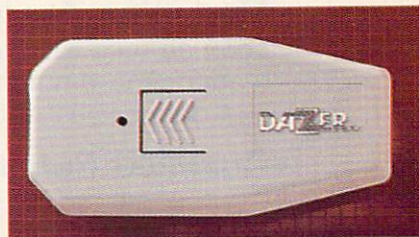
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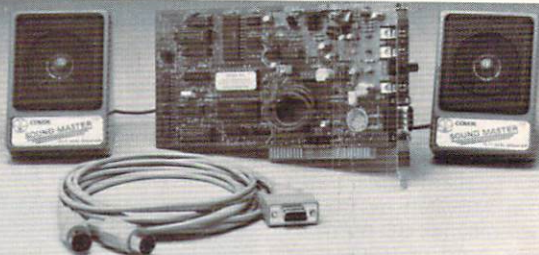
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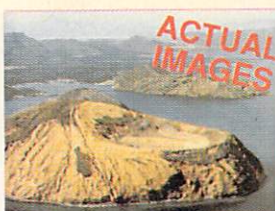
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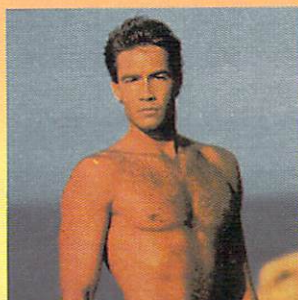


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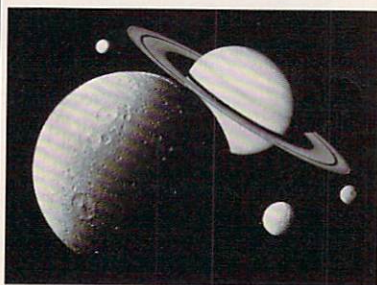
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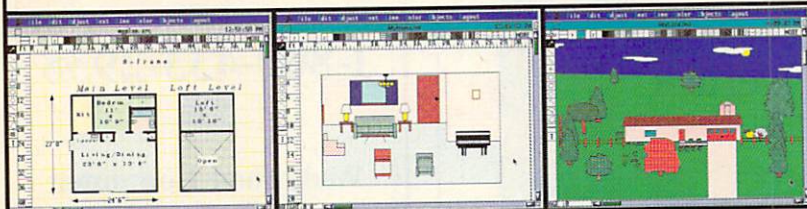
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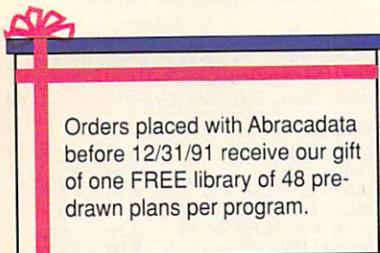
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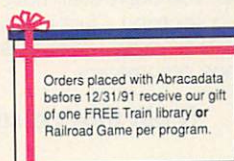
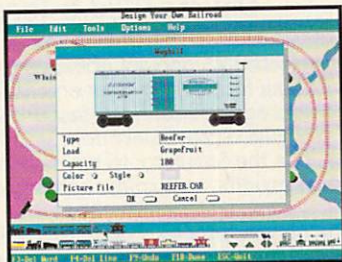
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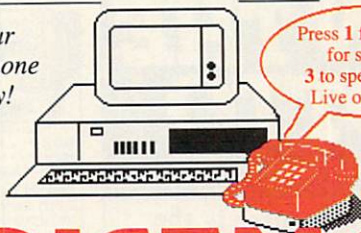
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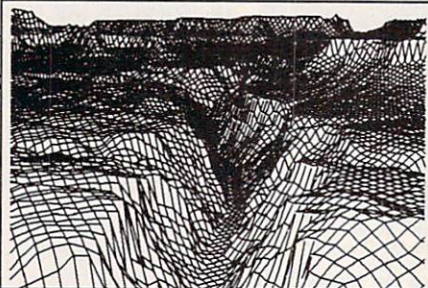
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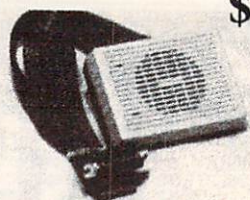


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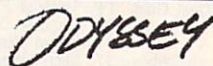
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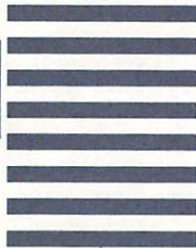
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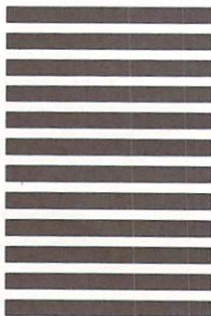
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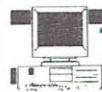
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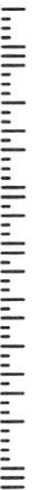
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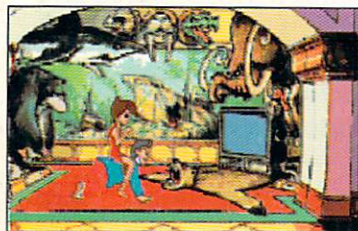
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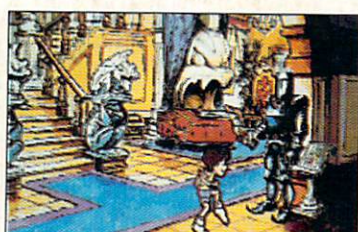
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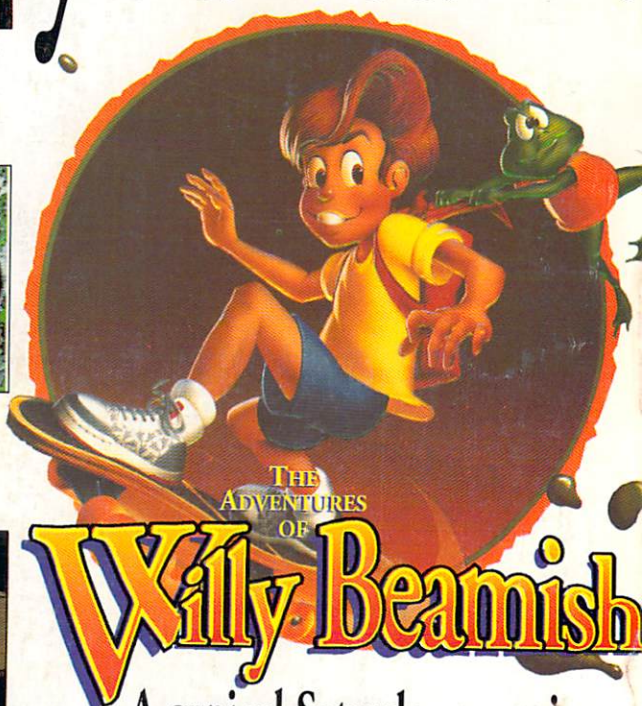
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