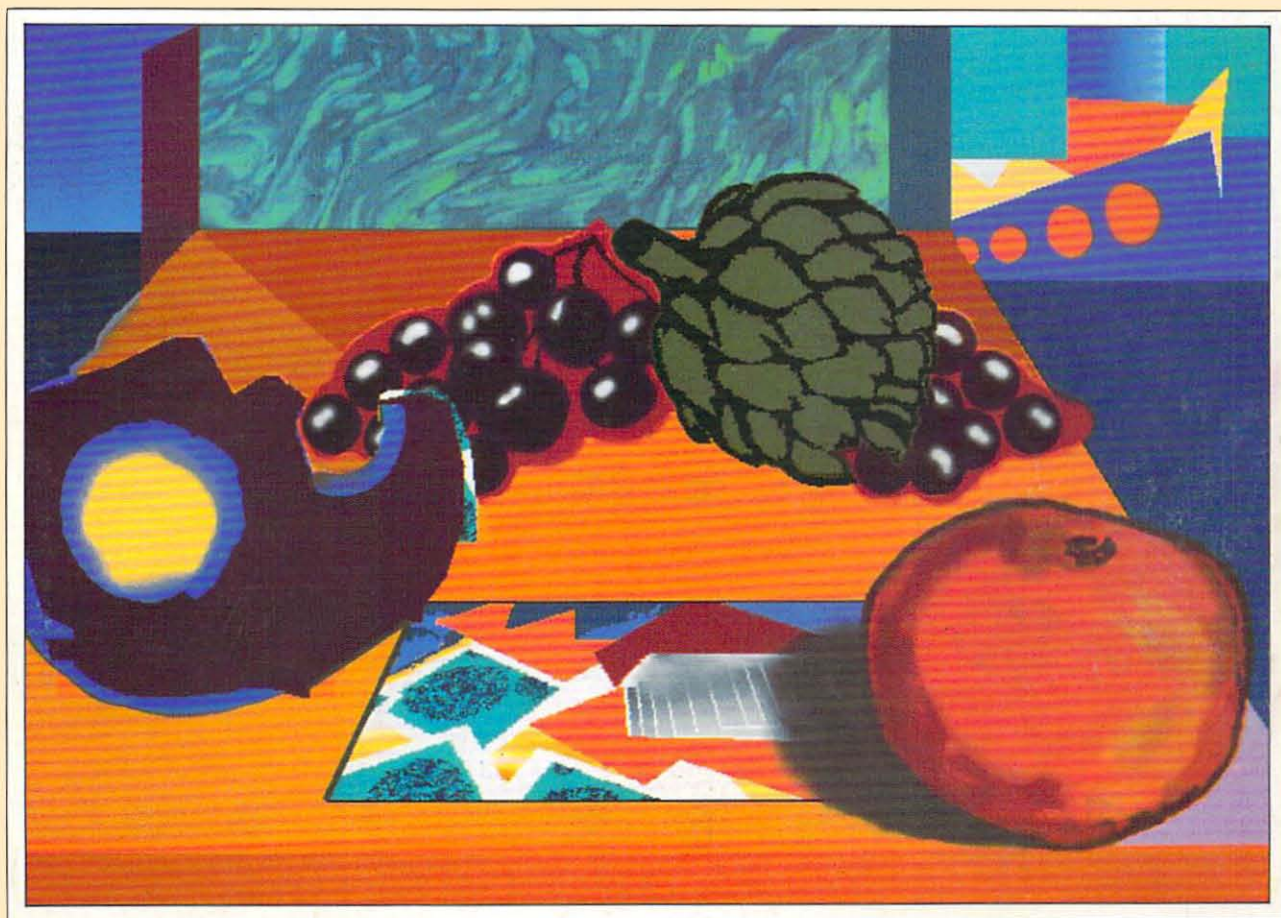


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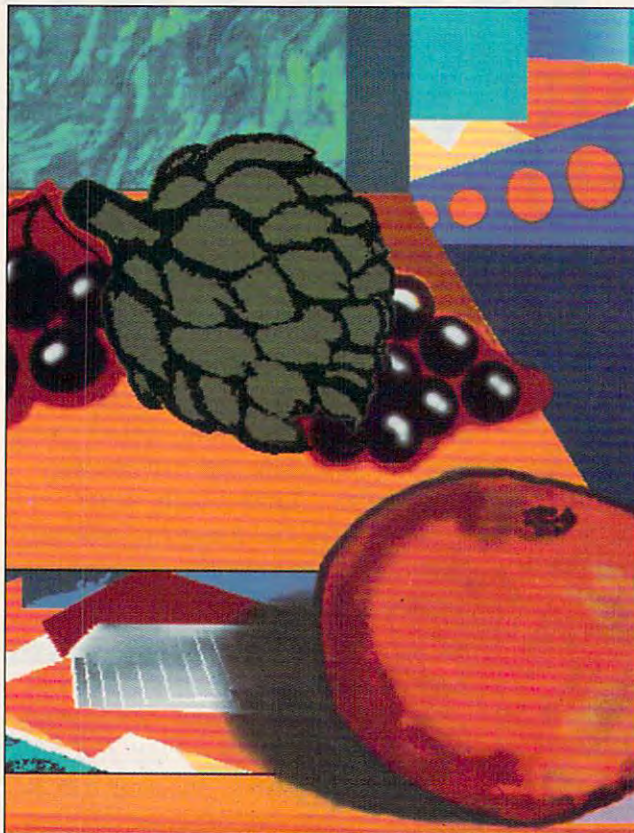
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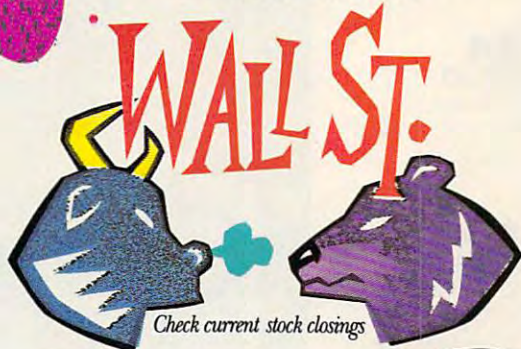
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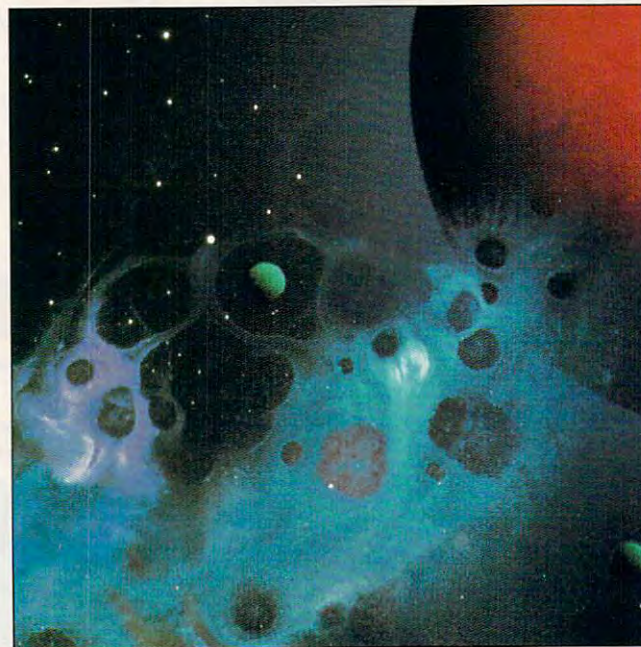
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Peter Scisco

If you're familiar with Woody Allen, you might remember a scene from *Annie Hall* in which our intrepid but angst-ridden protagonist compares his current love relationship to a shark. "It has to keep moving forward," he says, "or else it dies." The joke comes when Alvie Singer closes his metaphor: "I think we have a dead shark on our hands."

It's a very funny line, first because of the incongruity of comparing love to a meat-eating fish (who can hear that line and not think of *Jaws*?) and second because of its small glimmer of truth.

Magazines, like sharks and love, also must move forward. (I think only network television reinvents itself faster.)

This issue of *COMPUTE* marks another stage in our evolution toward becoming a computer magazine of the nineties, which promise to be a decade in which value replaces vanity and activism replaces avarice. The personal computer can play an important role in all of this as the

tool for people who've chosen to be active participants in the Information Age.

Employers, coworkers, and neighbors look to *COMPUTE* readers for advice in choosing, evaluating, and buying computers, software, printers, and all the rest of the devices that complement today's sophisticated PCs. Industry analysts and researchers point to the consumer market as the fastest growing segment of the computer market. Just visit your neighborhood electronics store or the office superstore down the highway, and you're likely to see stacks of computer products laid out like so many stereos and typewriters.

The reasons behind this shift range from falling prices to changing social attitudes. Fully equipped 386SX PCs sell for under \$1,900; 286-based PCs, low-end Macs, and hard-drive equipped Amigas sell for less than \$1,000. Professionals looking for quality family time are choosing to bring work home or telecommute. Other workers, victims of a tight economy, are striking out on their own, using the PC as a support staff for a variety of home-based services and other businesses.

You might be an old hand at blazing trails through the often confusing and contradictory world of computer technology, or you might be new to the silicon jungle. But no matter where you fall in that range, one thing is certain—once you bring that PC home, your world unfolds into an expanding universe of possibilities.

In looking through this issue of *COMPUTE*, you'll see a lot of new images. But you'll also find some old favorites. For example, we've brought our *COMPUTE* Choice reviews back to the departments where they belong, where we

can showcase these worthy products and give them the in-depth treatment they deserve. Our Test Lab section boasts a new design and layout. Inside, you'll still find the information and benchmark testing to guide you toward making the best buying decisions based on your needs, not on manufacturers' spec sheets.

Our Home Office department will continue to examine strategies to make you more productive with your PC, whether you're a home-based entrepreneur or running an extended office and telecommuting to company headquarters. In Discovery, you'll read of creative uses for the computer and learn how to use all this new technology to give your kids an edge in the classroom. In Entertainment, you'll get a close look at the latest in electronic games, from executive play toys to virtual reality.

Along the way, *COMPUTE* will showcase artists who are using computers to create the images, music, and writing that will define for the history books a generation of techno-savvy electronic eclectics.

The way people use computers and the possibilities of computer technology determine the shape of *COMPUTE*.

If you don't own the fastest, most powerful computer in the world, if you've used your computer only for word processing and number crunching, we'll help you upgrade your system and discover new uses like video, multimedia, and desktop publishing. If you use your computer in isolation, as a vessel of technology, we'll help you set sail into the world of telecommunications where you can join an armada of PC users who are exploring a new world of electronic communities. □

Our new presentation is designed to showcase the people and ideas that make *COMPUTE* the magazine it is.



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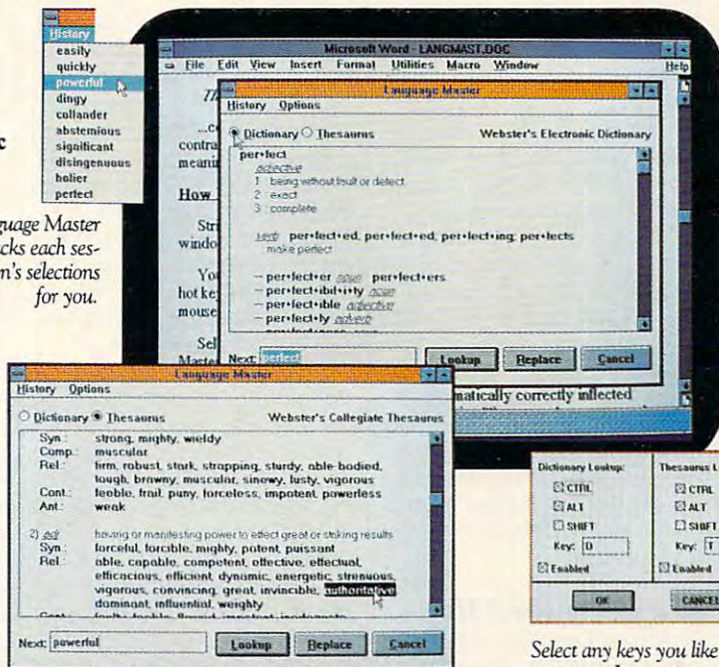
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NEWS & NOTES

Alan R. Bechtold

A Difference of Opinion

The federal judge who at first ruled Ashton-Tate's *dBASE* copyright claim invalid in 1990 has reversed his own decision. According to the *Wall Street Journal*, software publishers and industry legal eagles did a double take because such rapid reversals are a rarity in the U.S. judicial system. The reversal doesn't spell instant relief for Ashton-Tate, however, who must still defend its *dBASE* copyright in a lawsuit filed by Fox Software, publisher of the popular *Foxbase dBASE III*-compatible software packages and utilities. The decision should give Ashton-Tate a bit more legal ground when the suit reaches court. Judge Terry J. Hatter gave no reason for his sudden reversal.

Leading Edge hopes to live up to its name with the introduction of N3/SX and N3/SX20 notebooks.

Into the Notebook Fray

Until now, Leading Edge Products resisted the urge to enter the notebook PC market—but it couldn't resist forever. The company just unveiled the

N3/SX and N3/SX20, its first two entries in the notebook market.

The new Leading Edge notebook PCs weigh just 6.9 pounds each. Both feature 9-inch diagonal sidelit triple supertwist LCD displays with 640 × 480 VGA resolution capable of generating 32 shades of gray. Each comes equipped with an 84-key keyboard with an embedded numeric keypad, 12 function keys, and inverted-T cursor keys with key spacing designed for ease of use.

The N3/SX features a 386SX processor running at 16 MHz and support for an 80387 coprocessor. It comes standard with 1MB of memory, expandable to 5MB, a 1.44MB floppy drive, and a 20MB hard drive. A proprietary slot is dedicated for an optional 9600-bps fax and data modem. The unit is powered by either an AC power adapter or ni-cad batteries. The unit retails for \$2,595.

The N3/SX20 has the same features as the N3/SX with the exception of a 20-MHz processor and either a 30MB or 60MB hard drive. The 30MB version retails for \$2,895; the 60MB version retails for \$3,195. For more information, contact Leading Edge Products, 117 Flanders Road, Westborough, Massachusetts 01581; (508) 836-4800.

Apple Suit Broadened

According to Microsoft corporate spokespersons, Apple Computer wants to broaden the scope of its lawsuit against Microsoft and Hewlett-Packard to include Microsoft *Windows* 3.0. The original lawsuit, filed by Apple in March 1988, alleges that *Windows* 2.03, which was the *Windows* version on the market at that

time, infringed on Apple's copyrights. *Windows* 3.0 was released in May 1990.

Microsoft claims the intent to amend the complaint was disclosed in a phone call from Apple's general counsel. Since the original filing of the lawsuit, Microsoft maintains that it hasn't infringed on any Apple copyrights and that it will continue to fight these allegations vigorously.

More Troubles for Microsoft?

Lawsuits from Apple aren't the only things Microsoft has to worry about lately. According to Microsoft officials, the staff of the Federal Trade Commission has decided to expand the scope of its nonpublic investigation of the company. The FTC plans to examine third-party allegations that Microsoft "has monopolized or has attempted to monopolize the market for operating systems, operating environments, computer software, and computer peripherals for personal computers."

Until April 10 of this year, the focus was on an alleged horizontal agreement between Microsoft and IBM. The agreement was purportedly reflected in a joint press release issued at Comdex in November 1989. That press release discussed future directions of OS/2 and *Windows*.

Reconcilable Differences

You want to buy a Sharp Electronics Wizard palmtop organizer to help you stay on schedule, but what will that mean for the schedule on your desktop PC? Will you be forced to keep *two* computer schedules updated and reconciled? The answer is *No*, thanks to Borland's *Sidekick* 2.0 and the new Sharp Organizer Link II.

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with a cable included with the Sharp Organizer Link II package for connecting palmtop organizers to desktop PCs. Special software, which is loaded on the desktop PC, manages the transfer of schedules directly into *Sidekick's* Time Planner feature. *Sidekick's* Reconciliation feature then compares the two schedules and reconciles any discrepancies, consolidating them into a common file.

The Time Planner, which includes an appointment book, calendar, and to-do list, can automatically track and execute actions such as sending MCI Mail messages or activating a pager. In addition to the Time Planner, *Sidekick* has an address book, notepad, and calculator. The Wizard includes an address book, telephone directory, world clock, notepad, and calculator.

A Home Computer That Means Business

Radio Shack's newest personal computer, the Tandy 1000 RLX, is a home computer designed to meet the demands of many small businesses. This IBM-compatible PC carries the extra power of a 10-MHz 80286 microprocessor and one 3½-inch 1.44MB floppy drive. A second 3½-inch drive bay accepts either a floppy drive or a 20-40MB hard drive. The system also has one PC-compatible expansion slot.

The 1000 RLX includes Tandy's *DeskMate* and *DeskMate Home Organizer's* 24 easy-to-use home management applications. Pull-down menus and pop-up dialog boxes, along with the point-and-click convenience of Tandy's mouse, permit quick and easy performance of most tasks. Both the hard and floppy disk configurations include high-resolution VGA graphics, a voice message option in

DeskMate's Information Center, a two-button mouse, two joystick connectors, microphone and stereo headphone jacks, and a realtime clock with battery backup. All internal components are designed to function without an internal fan, meaning the 1000 RLX runs cooler and quieter than most computers on the market today.

Suggested retail prices are \$799.95 for the 1000 RLX and \$1,199.95 for the 1000 RLX hard drive model. Monitors are additional.

900 Ways to Fix It

Epson America has found a convenient way to charge customers for help with the installation, configuration, and operation of their computers. A new 900 telephone line (900-988-4949) supplements the end-user assistance regularly provided by Epson authorized resellers. The 900 line is open Monday-Friday, 10 a.m.-7 p.m. Callers are connected with an Epson support representative after a pre-recorded message, which states that after an initial minute of free time, the caller will be billed at a rate of \$2 per minute.

End users who need assistance locating the nearest Epson Customer Care Center should call (800) 289-3776.

IBM Goes to Hollywood

The latest Hollywood premiere isn't an action-packed star-studded motion picture. It's IBM's new presentation graphics software. Dubbed *Hollywood*, the package allows business professionals to create high-quality hardcopy, transparencies, slides, and onscreen presentations.

Hollywood runs in Windows 3.0. Text- and graphics-based presentations are easily created using the pro-

gram's integrated outliner, templates, color schemes, fully scalable fonts, and charting, drawing, and painting tools. The program also features a sophisticated screen-show capability. A spreadsheetlike interface makes entering data for presentations easier, and the runtime screen-show module lets users create presentations that include sophisticated transition effects, which can be distributed and displayed without *Hollywood* but still within licensed use.

Hollywood requires an IBM PC, PS/2, or IBM-tested compatible with at least an 80286-based processor (386 or higher is recommended), a hard drive, and 1.6MB of RAM (2MB or more is recommended); DOS version 3.3 or higher; *Microsoft Windows 3.0*; an IBM or Microsoft mouse or compatible; and any *Windows 3.0*-supported color video adapter. Suggested retail price is \$495.

For product information and a demonstration disk, call (800) IBM-7699.

Too Much Silicon?

What could be more perfect for the beach than a computer made entirely of sand? World-famous sand sculptor Todd Vander Pluym created the sand computer as a stage for an international awards presentation honoring technical computer solutions. The idea was a natural. "The raw material of the silicon chip—the foundation of the modern computer—is sand," said Vander Pluym. Unfortunately, the computer isn't exactly portable, weighing about 25 tons. The all-sand work of art was also doomed to break down quickly, but fortunately it held up long enough to stage the awards ceremony.

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Another Eastern block falls.

There's a new 'TRIS on the block. Its name is WORDTRIS. And if you love TETRIS, this latest fast-action, falling block, Soviet game will boggle your mind.

This time the falling pieces are letter blocks. Form them

into words and score points. As each block falls, it pushes down the blocks below, producing an ever-changing kaleidoscope of letters where scoring opportunities appear - and vanish - at the blink of an eye.

Create words horizontally or vertically, but don't put all your

every time a word lines up, *poof!* those letters disappear, and the blocks below pop up to fill the spaces. So whenever you earn points you stir up the alphabet soup. And suddenly that falling M has no HOME to go to.

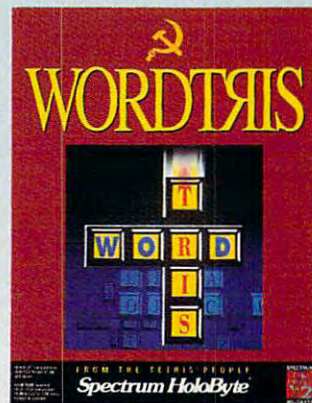
WORDTRIS keeps raining vowels and consonants until you've collected enough words to move to the next level, or the well fills up. Of course, each successive round ups the ante as the blocks fall ever faster. But you can choose your difficulty level to match your skills, and select from single player, cooperative, competitive, head-to-head or tournament modes. The built-in 30,000 word dictionary verifies even the most obscure word.

Set the difficulty level at 10 and you'll find WORDTRIS harder to keep up with than the changes in Eastern Europe.

WORDTRIS. Another great game from the TETRIS people.



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Credit-card-size memory cards store data in Hewlett-Packard's new palmtop.

Awards were Robert Heppe of Washington, D.C., who helps the United States keep tabs on satellites—where they are and where they're going; Paul Gustafson of Chicago, Illinois, who helps industries cut costs by increasing workloads on their existing mainframe computers; Luc Mercier of Brussels, Belgium, who helps governments and international industries track down bugs, viruses, and other problems in computer networks; Eric Booth of Lanham, Maryland, who has discovered ways to stretch the life of satellite software through reuse; and Paul Chapman of Belmont, Massachusetts, who employed higher mathematics to reduce the amount of steel used in manufacturing processes.

Travel Agent on a Disk

If you've had it with red-eyes or 500-mile flights that should only take an hour but require four connections and three layovers, don't despair. Now you can figure out your own flight itinerary and then have your travel agent book the flights and make all the other necessary arrangements.

Now you can view more than 250,000 direct and single-connection flights to and from 1200 destination cities right on your own PC, without a modem. *Flight Disk*, from Official Airline Guides (OAG), is a collection of floppy disks featuring information on direct and connecting flights for the most frequently traveled city pairs in the United States, Canada, Mexico, and the Caribbean.

The computer makes all the information—over 700 pages' worth—contained in the *OAG Desktop Flight Guide* for North America available electronically at a glance. Previous editions of *Flight Disk* contained schedules for about

110,000 flights and 600 destinations.

Flight Disk is offered on a subscription basis for a yearly fee of \$199 plus \$15 for postage and handling, or \$99 plus postage and handling for subscribers to the *OAG Desktop Flight Guide*, North American edition. New issues are published monthly.

Anyone interested in a free 30-day trial of *Flight Disk* can call (800) 323-3537.

One Million Served

Borland International's *Quattro Pro* spreadsheet software is selling like hot cakes. Since its introduction nearly two years ago, over 1 million copies of the program have been sold.

The growing worldwide spreadsheet market might account for some of Borland's success with *Quattro Pro*. Winning an unprecedented 37 international industry awards doesn't hurt, either. Since 1989, Borland's share of the worldwide spreadsheet market has grown from 8 percent to 20 percent. In the U.S., its share has doubled, growing from 12 percent to 24 percent in the same time period.

Check Out This Palmtop

Just when you thought computers couldn't get any smaller, Hewlett-Packard unveils a new palmtop PC that's about the size of a standard checkbook. Weighing just 11 ounces, the 95LX comes with DOS 3.22, *Lotus 1-2-3*, and an array of organizer tools, all loaded in ROM and ready to use. Other very useful features include an advanced financial

calculator and communications capabilities.

The 95LX has a QWERTY keyboard and uses credit-card-size memory cards to store data. A modem port and printer port are also included. It retails for \$699.



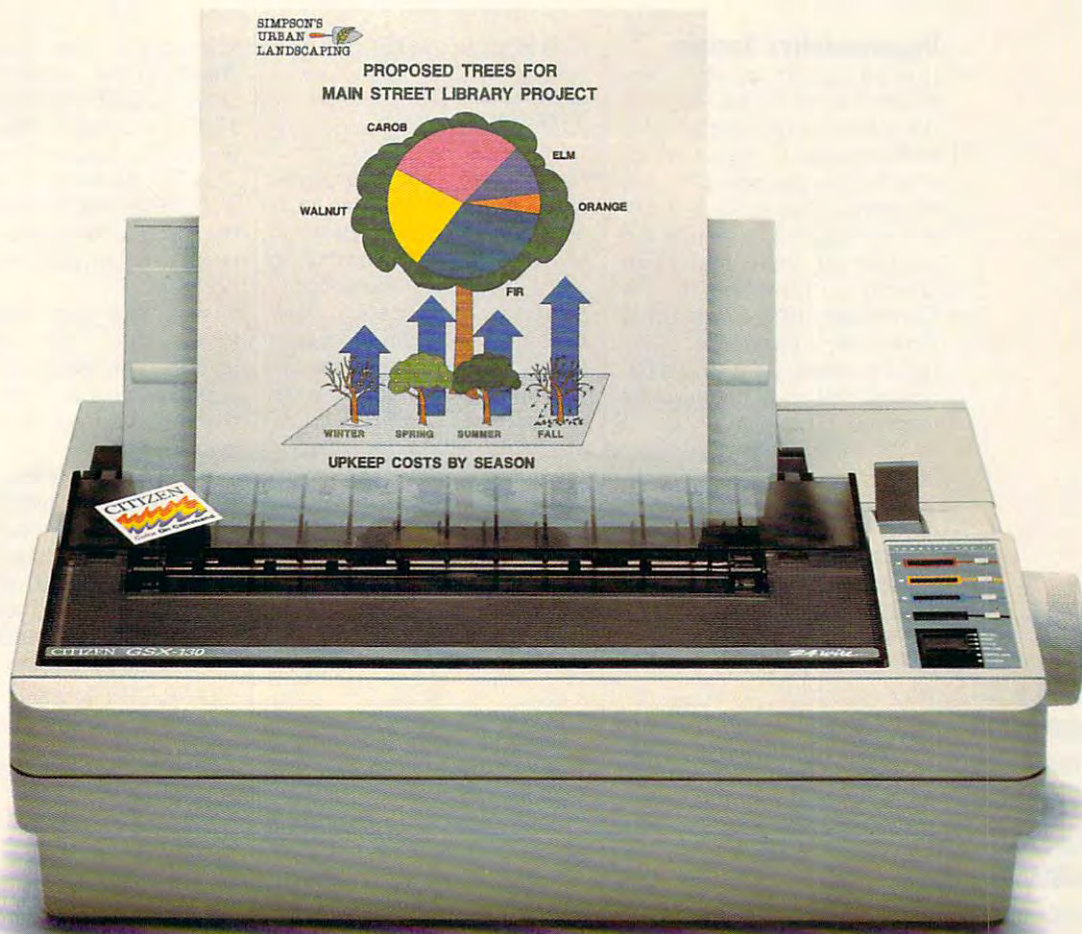
For more information, contact Inquiries Manager, Hewlett-Packard Company, 1000 NE Circle Boulevard, Corvallis, Oregon 97330; (503) 752-7736.

TV for Computer Lovers

Serious computer users are often too busy watching their monitors to spend much time watching television. When the subject is computers, however, it's a different matter. The PBS series "Computer Chronicles" is apparently one of the best television programs around with a focus on computers. The program was recently named Best Computer Television Program of 1990 at the Sixth Annual Computer Press Association Awards. The show won out over some tough competition, including ABC's "Business World" and CNN's "Future Bytes."

Alan R. Bechtold is editor of *Info-Mat Magazine*, an electronic news weekly published by BBS Press Service. □

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Representative Sample

I could see it coming a few months ago: *COMPUTE* has gone IBM on us, rendering itself useless to those of us who had subscribed for the very reason that it featured other computers. I think that the subtitle of your magazine should be changed to *The Complete IBM-Compatible Computer Resource*. You can't possibly be giving a fair representation of the negative mail you're receiving.

LELAND JONES
DALLAS, TX

COMPUTE still covers the Amiga and 8-bit Commodore computers. Issues of COMPUTE are created for these computers in a very complex binding process and sent to readers who subscribe to Amiga Resource or Gazette. If you're not getting the issues you want to read, write to us, and we'll notify the subscription service that you want your subscription changed. Or for more rapid response, call (800) 727-6937 and request that your subscription be changed to the multiple-subscriber edition. We try to publish a representative sample of mail in "Feedback," as well as letters that will be helpful to other readers. It's true that we receive some letters from Amiga and 8-bit Commodore owners confused by the changes in COMPUTE. Thanks for giving us the opportunity to explain how we handle the special sections.

Hard Disk Headache

When I run CHKDSK on my 20MB hard disk, it shows 98,304 bytes in bad sectors. Will a reformat of the hard drive remove the bad sectors? Also, when I first purchased my computer, it would automatically boot from the C drive. Now it requires a system disk in drive

A to boot up. What did I do wrong?

ALFRED M. BELL
ARLINGTON, VA

Reformatting your hard disk won't eliminate the bad sectors, and you wouldn't want to eliminate them because using those marginal sectors could endanger your data. Hard disk manufacturers thoroughly test their products for defects and areas that may not reliably hold data. If defects are found, a bad track map is created and affixed to the top of the drive. During low-level formatting, those marginal areas are roped off so no data can be stored there.

Bad tracks usually comprise less than 1 percent of a disk's total surface—in your case, it's about half that much. In the normal course of operations on a hard disk, a few bad sectors are nothing to worry about.

Your inability to boot from drive C indicates that, for some reason, your system has lost the information that tells it drive C is a boot disk. This is a fairly common problem. The easiest solution is to use a commercial disk-utility program to identify and repair the problem. No hard disk owner should be without such software.

It also may be possible to repair the damage on your own, but first make a backup of the hard disk for safety. Next, boot from a floppy disk and use the command SYS C: to place new copies of the system files on the hard disk. If this fails to get your hard disk back to normal, you'll have to reformat the disk to make it bootable again. Before going ahead, make sure you have backups so you can restore your data.

Up a Tree

We at the Aldridge Company

appreciate your review of *Tree86* in the article on DOS shells (*COMPUTE*, November 1990). I believe you found one of the major strengths of *Tree86*—its small size. All of *Tree86* fits on one 5¼-inch disk, and it can be run from a floppy, making it extremely portable.

We'd like your readers to know that the multiple screens Mr. Bechtold found lacking will be available in the next release of the program.

Another of *Tree86*'s strong points is its intuitiveness and ease of use. This is accomplished through its pull-down menus accessed with hot keys. The fact box included in the article indicated that *Tree86* used function keys and no menus, which is an error. We'd like to let your readers know.

VALERIE BURSON, VICE PRESIDENT
THE ALDRIDGE COMPANY
HOUSTON, TX

In Search of Works

I need the phone number and address for GeoWorks.

E. WILLIAMS
HUNTINGTON BEACH, CA

The address is GeoWorks, 2150 Shattuck Avenue, Berkeley, California 94707. The telephone numbers are (800) 772-0001 for orders and (415) 644-0883 for the company's offices.

You Put What You Get

I can't figure out how to use GET and PUT in GW-BASIC. Also, I'd like to create a menu that will pop up and then disappear. How can I do that?

SETH FULMER
PALM, PA

This little program will grab whatever is in the upper left corner of the screen and smear it in various ways across the screen (note that you have to type or draw

Amiga and 8-bit Commodore coverage, removing bad sectors, using GETs and PUTs, contacting GeoWorks, and more.

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FEEDBACK

something in the upper left corner for this program to work). The PSET, XOR, and OR options were used with PUT. You could also use the AND and PRESET options. Note that you have to dim an array variable to use it with GET, but when you use GET and PUT, you leave off the subscript.

The second half of the program creates a menu and services it. Of course, a menu program like this only works while BASIC is running. If you want to create a similar program that would work in DOS, you should create it in C or a compiled BASIC.

```
10 DIM A%(1000)
20 SCREEN 2
30 GET(0,0)-(123,123),A%
40 FOR I = 0 TO 75
50 PUT(I,I),A%,PSET
60 NEXT
70 FOR I = 0 TO 75
80 PUT (75+I,75-I),A%,OR
90 NEXT
100 FOR I = 0 TO 75
110 PUT (150+I,I),A%,XOR
120 NEXT
130 CLS
140 PRINT CHR$(201);FOR I = 0
    TO 11:PRINT CHR$(205);:
    NEXT:PRINT CHR$(187)
150 PRINT CHR$(186)+"1. Go to
    DOS"+CHR$(186)
160 PRINT CHR$(186)+"2. Exit
    menu"+CHR$(186)
170 PRINT CHR$(200);FOR I = 0
    TO 11:PRINT CHR$(205);:
    NEXT:PRINT CHR$(188)
180 GET(0,0)-(144,32),A%
190 CLS
200 PRINT "press any key to show
    menu"
210 AS = INKEY$
220 IF AS="" THEN 210
230 CLS
240 PUT(0,0),A%,PSET
250 AS=INKEY$
260 IF AS="" THEN 240
270 IF AS="1" THEN
    CLS:SHELL:CLS
280 IF AS="2" THEN CLS:END
290 GOTO 250
```

PC or Not PC

In the January 1991 issue of *COMPUTE*, in the "Feedback" column, you stated that TSR-management programs called *Mark* and *Release* were published in the January 1990 issue of something called *COMPUTE's PC Magazine*. Is that something different from *COMPUTE*? I'm interested in the disk you mentioned. Please get me more information.

THOMAS C. SKIDMORE
SALT LAKE CITY, UT

Up until May 1990, *COMPUTE* published four separate magazines: *COMPUTE!*, *COMPUTE's PC Magazine*, *COMPUTE's Gazette*, and *Amiga Resource*. *COMPUTE's PC Magazine*, along with the others, was "folded into" *COMPUTE* when *COMPUTE Publications* was purchased by *General Media*. *COMPUTE's PC* was a bimonthly magazine-disk combination.

For any past issue of *COMPUTE's PC* (including disk), send an \$8 check or money order payable to *COMPUTE*. The address is *COMPUTE Single Copy Sales*, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. Specify that you want the January 1990 *COMPUTE's PC* and disk.

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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Education can be a powerful thing. Use your computer as a doorway to knowledge—online.

BRAIN WAVES

BY SHERRY ROBERTS

We've heard that the computer is an educational tool for so many years that it's almost a cliché. But the next generation of education programs—called *online education* or *computer-based distance learning*—is anything but dull and hackneyed. This is education on the brink—technology tapped and harnessed to bring learning to people who are too busy to attend traditional school or who don't have access to conventional campus environments.

For example, an American soldier enrolled in an online college course at NOVA University in Florida continued to file assignments and attend electronic classrooms via his computer while stationed in the Persian Gulf.

"The whole goal is to reach as many people as possible with quality instruction," says Margaret Morabito, founder of the Computer-Assisted Learning Center (CALC), which offers continuing education, self-enrichment, and college-level courses for long-distance students of all ages on the online service GENie. "There are so many barriers to learning in the offline world. Online is an excellent medium for overcoming those barriers."

In the offline world, there are businesses with inflexible hours, jobs with strenuous travel demands, and children that require babysitters. For the handicapped, the offline campus may be a chore to navigate. For students living in out-of-the-way locales—a ranch in the Australian outback or a small burg in Alaska—the offline campus may be hundreds of miles away.

Although online education appeals to a broad spectrum of people, from elementary students to senior adults,

THE IMAGE BANK

the greatest growth in this area has been undergraduate and graduate computer-based degree programs for working men and women.

Now a Fortune 500 executive can finish her doctoral degree without ever setting foot in a classroom; she can do her homework between business meetings or on a flight to Japan; she can attend class from a hotel room half a world away—as long as she packed her computer and modem.

Online education can be as unstructured as someone putting out a call for help with homework on CompuServe's Student Forum or as rigid as one of the curriculum-based degree programs offered by schools such as the University of Phoenix, NOVA University, or the New York Institute of Technology.

The whole concept of computer-based distance learning is so new that everyone involved is a pioneer. No two educational institutions have organized their programs the same way. The only common denominator is the use of computer and modem.

CALC, for example, requires students to attend something called *real-time classrooms*. Unless a student has a medical or technical excuse, the student is expected to meet with the instructor and other students online at an assigned time. The University of Phoenix, on the other hand, does not require online students to log on for a specific class; students log on and off at their convenience to retrieve assignments, turn in homework, and confer with the teacher or other students.

NOVA University teams teleconferencing in the electronic classroom with videotapes of live classrooms and attendance at on-campus institutes.

The cost of CALC courses ranges from free to \$40, plus connect time at \$6 an hour. Tuition for online courses offered by accredited universities ranges from \$100 to \$250 per credit hour. Some programs charge an additional communications fee, which covers course and access setup and online hours; others allow students to purchase blocks of online hours.

School supplies are high-tech but basic: a computer (any kind), a modem, and telecommunications software, usually provided by the school. Online courses also require textbooks just like their campus counterparts.

On Your Schedule

Flexibility—the ability to attend class wherever and whenever they wish—is the main reason students enroll in online degree programs.

Lorraine Wright, an internal auditor for AT & T in Atlanta, Georgia, says the online program of the University of



Prodigy provides online Weekly Reader to give younger users news and fun.



Science is one general interest area that's attractive to both kids and adults.



No mystery: you can always find Carmen Sandiego on Prodigy, teaching geography.

Phoenix was the only way to get her master's degree in business administration. "My job requires 50 to 80 percent travel, but now that I have a laptop, I can go to school. There's no way I could make the traditional classroom setting."

When Wright first heard about computer-based learning from a coworker, she had her doubts about the quality and the serious intention of such programs. She quickly learned, though, that online learning is no easy cruise.

She estimates she spends 15–20 hours a week studying offline—five hours of reading each weekend and 12–13 hours of work on two papers due each week. The first six weeks of class, she downloaded 500 pages of class material and student comments. "Because of the communication mode, I think you spend more hours

per week on classwork [than in the traditional classroom course]," Wright says. "But that is the price you pay for flexibility."

Students also choose online courses because of the diversity of their classmates. The computer has facilitated the creation of truly global classrooms where students from Singapore study with students from Seattle and the student in the electronic desk next to you could be an airplane pilot, a CEO, or a retired schoolteacher.

"I like the networking with classmates," Wright says. "I've met people in my class from all over the United States from different companies and backgrounds. If I were in any of their towns, I'd feel comfortable enough to call them up and visit with them."

Students and teachers alike say there is a noticeable lack of shyness in electronic classrooms. "It is a very liberating and democratic environment," explains Tom Bishop, director of marketing for the University of Phoenix Online program. The university, which has 13 campuses throughout the Southwest, began offering computer-based degree programs in 1989.

"It is the content of the student's contributions that is important," Bishop says, "not the student's physical characteristics."

CALC's Morabito agrees, "When you're online, you don't have the physical presence, the facade that you must put on. No one knows that you didn't dress up to come to class or that you're handicapped and in a wheelchair or what kind of car you drive. Everyone is treated on the same basis, and it opens people up."

As computer-based education has developed, participants have noticed indirect benefits; students report a dramatic increase in communications and analytical thinking skills. The logistics of attending class via computer discourages rambling monologues (on the part of either student or teacher) and eliminates the potential for off-the-cuff answers.

Dr. Edward A. Becker, director of Graduate Accounting Programs at NOVA University, describes four communication skills: reading, writing, speaking, and listening. He theorizes that today's highly technological and complex work environment requires a fifth communication skill: computer literacy.

Students taking computer-based courses, by necessity, learn how to use a computer. Few of them are hackers. Often they turn to their teacher or fellow students for help when technology is about to get the better of them. Schools provide students with support while they learn the basics of comput-

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Editor, a new style checker from the Modern Language Association, helps writers eliminate problems such as wordiness, poor usage, and punctuation errors—over 16,000 common writing problems in forty categories. Used for eight years in college writing labs, Editor enables both students and experienced writers to improve their composition styles.

Unlike other editing software, Editor's text-analysis system emphasizes thoughtful revision, not quick fixes; Editor helps writers improve their research papers, as well as their everyday correspondence.

THE AUTHORS

Elaine C. Thiesmeyer
Rochester Institute of Technology
John E. Thiesmeyer
Hobart and William Smith Colleges

EDITOR READS FILES PRODUCED BY MANY WORD PROCESSORS

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- XYWRITE
- many others

Editor can also read standard ASCII text files.

SYSTEM REQUIREMENTS

- IBM PC or compatible systems in the 80x86 family
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- one floppy-disk drive
- any IBM-compatible printer

Users simply exit from their word processors and then run Editor from DOS. (Users need only a basic familiarity with DOS commands—e.g., copying and renaming files, formatting disks, creating a subdirectory on a hard disk.)

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Among Editor's many convenient features:

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- Usage dictionaries can be modified and expanded by the user.
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Writing Sample as Formatted by Editor

- <1> Literature professors are caught up in a historical motion that challenges them to confront ethical questions raised by their teaching practises.
- <2> Some writers claim that critical theory's day has past it's zenith; others complain that alot of students have read "more works on theory than works of literature".
- <3> Those who teach theory in the classroom claim that each and every student should have a conscious awareness of the ideologies underlying works of literature.
- <4> In the case of the universities, this is leading to a situation in which the two sides are becoming more completely polarized, to say the least.

Editor's Analysis of Writing Sample

- FIX
<2> has past
POSSIBLE COMMON PHRASE MISSPELLED; "passed"? [m]
- <2> it's
POOR USAGE; contraction or misspelled possessive [U]
- <2> alot
SPELLING ERROR; and note that "a lot" is informal [I] [s]
- <2> "
MISPLACED QUOTATION MARKS [q]
- TIGHTEN
<3> each and every
TAUTOLOGY [T]
- <3> conscious awareness
TAUTOLOGY [T]
- <4> in the case of
WORDY PHRASE [W]
- POLISH
<1> practises
NONSTANDARD SPELLING [n]
- <4> this is
POSSIBLE VAGUE DICTION; can you clarify "this"? [V]
- <4> to say the least
OVERWORKED OR TRITE PHRASE [O]
- CONSIDER
<1> historical
COMMONLY MISUSED TERM; "historic" means notable [M]
- <2> critical
COMMONLY MISUSED TERM; "crucial"? [M]
- <4> more completely
POSSIBLE ILLOGICAL EXPRESSION [X]
- Editor has four usage dictionaries: FIX, TIGHTEN, POLISH, and CONSIDER. Many users run FIX first, since it catches the most egregious errors.
- Bracketed codes refer users to online help and to samples in the manual.
- Writers who find that Editor flags a term they always use correctly may delete that term from Editor's usage dictionaries. A scholar who often writes about critical theory, for instance, may want to remove the term "critical" from the CONSIDER dictionary.

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er use—from how to log on to the school's system to how to get a transcript of last week's session from the school's library.

The Price for Flexibility

The most commonly heard complaint about online education is the lack of the "warm fuzzy factor" and face-to-face interaction. Participants miss the human touch and sometimes dislike dealing with an inanimate object.

Schools say they make a special effort to maintain contact with students in online programs so that they feel neither stranded nor isolated. When students yearn for the sound of the human voice, they frequently pick up the telephone and call classmates and teachers. Several members of a University of Phoenix study group that live in New England drove to a mutually convenient location for a get-together.

"It is much warmer and more human than most people would expect," Bishop says. "Humor comes through even in the typewritten word."

NOVA University solves the problem by integrating into its programs chances for students to meet their online classmates and mentors in person. NOVA requires master's and doctoral students to attend either week-long institutes or weekend seminars in Fort Lauderdale, Florida. NOVA students and teachers also rub elbows at symposia held every three months at regional sites, such as Phoenix, Cincinnati, Atlantic City, and Jacksonville.

Degrees of Value

The New York Institute of Technology started the American Open University, its computer-based distance learning program, eight years ago. Dr. Ward Deutschman, director of the American Open University, says today the program is "clearly a success."

He says his online programs have only a 10–15 percent attrition rate as compared to the 50–80 percent attrition rate ordinarily found in traditional distance learning programs or correspondence courses.

Interaction is the element that makes online learning more than a modern day correspondence course. "We have found that connectivity between student and faculty, the fact that a student can get a response to his question in a day or two and that he is expected to interact online, makes a difference," Deutschman says.

Even if the computer does help keep some students in school, so to speak, is it all for naught? Are degrees earned via computer considered as valuable as those earned on campus?

Deutschman admits that the tradition-

al world of academia has yet to welcome computer-based education with open arms.

"Some institutions that haven't been involved with distance education look at anything different with a jaundiced eye," Deutschman says. "The plus side of this is that institutions offering distance learning are really attending to the quality of instruction they are giving. They are investing enormous amounts of time and effort into ensur-

ing that their quality of education is scrupulously maintained."

Frequently schools defend the quality of instruction in their online programs by using the same faculty to teach both campus and online courses. Or schools hire experts in their fields to teach particular online courses. NOVA University has the investment director for Travelers Insurance and an expert from the Internal Revenue Service on its accounting faculty.

ONLINE WITH THREE UNIVERSITIES

Working adults make up the majority of online students for a simple reason: They're always working.

The purpose of online education is to improve access to learning for people who can't attend traditional classrooms because of their jobs or other circumstances. Here are three academic institutions whose online programs are all directed to adults.

University of Phoenix

The University of Phoenix Online program not only requires all students to be "working adults" but insists that all members of the faculty be working professionals in their fields of expertise.

Incorporated in 1976 in Arizona, the university has 13 campuses and learning centers in Arizona, California, Colorado, New Mexico, Utah, and Puerto Rico. It is accredited by the North Central Association of Colleges and Schools.

The university started its Online program in 1989 and has 340 students. Degrees that can be earned through Online include a bachelor's degree in business administration, a master's in organizational management, and a master's in business administration.

Online's electronic classroom is open 24 hours a day, seven days a week, allowing students to control the time and place of their individual participation. Students go online at their convenience to retrieve assignments, turn in or upload homework, and participate in class discussions.

Programs are built upon the experiences of the working professional so students can apply what they learn as they learn it. Frequently, papers and projects must relate to the student's own workplace.

"We find that adults demand that the education they are consuming have immediate relevancy," says Tom Bishop, the university's director of marketing. "It's not just a hobby."

American Open University

American Open University is the distance learning arm of the New York Institute of Technology in Central Islip, New York. Six hundred students from throughout the United States, Singapore, Malaysia, and Europe are pursuing degrees at AOU through their computers.

AOU, which is accredited by the Middle States Association of Colleges and Schools, offers Bachelor of Science degrees in general studies, business administration, and behavioral sciences. It also offers a Bachelor of Professional Studies degree in general studies.

Students receive a course learning package which includes a textbook, a detailed syllabus, and assignments. Homework assignments and special projects are sent in by the student through the computer. In computer conferences, a mentor directs the learning activities just as an instructor in a conventional classroom does. Students can read, review, and write messages to the instructor and other students through the computer.

NOVA University

NOVA University began offering online education in 1983. It is a multifaceted program that integrates computer conferencing, videotapes, and the traditional component: the face-to-face classroom environment.

Accredited by the Commission on Colleges of the Southern Association of Colleges and Schools, NOVA has 300 online students. The university offers doctoral degrees in information systems, information science, computer education, and training and learning. It also offers a master's in computer-based learning.

Students also may take some accounting courses online. By the end of 1992, NOVA expects to be able to offer online an entire master's degree in accounting.

NOVA has perhaps the greatest variety in its delivery system. NOVA students not only are expected to spend a great deal of their time on computer, either in realtime electronic class or sending in homework electronically, but they also use videotapes of actual classroom sessions filmed on NOVA's campus in Fort Lauderdale, Florida.

Concerned that students might miss the human contact of classroom-based education, NOVA requires attendance at two week-long institutes or weekend seminars held on campus. The university also offers symposia at four sites throughout the country to share in person the latest research on that term's topic, to encourage students to share their own research, and to provide face-to-face answers to students' questions.

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FROM HOME SCHOOLING TO HELP WITH HOMEWORK

Every Monday night at 8:00 12-year-old Danny Brumleve switches on his computer and goes to school. This session he is taking a course on C programming from the Computer-Assisted Learning Center (CALC) on GENie. Last session he aced English 203, also from CALC.

Danny's mother, Dorothy, describes her son as "very bright, severely gifted." Last year she decided to remove Danny from private school and try a year of home schooling while he awaits acceptance into a special high school. She organized tutors, arranged a Latin course for Danny, and browsed through GENie.

Dorothy Brumleve, a computer programmer, considers the CALC courses a valid part of Danny's curriculum. "I think it's a unique opportunity. He's too young to enter junior college, yet he's taking comparable courses on CALC." CALC offers courses that can earn college credit from Edison State College.

Danny says the courses are fun. And the Urbana, Illinois, ninth grader says, "I learn a lot more this way."

Dorothy Brumleve is quite satisfied with online education and proud of her son. "It attracts a different audience, a student that really wants to learn, a student that's not there for the party. Because there isn't a party. The student has to be motivated to keep up when he doesn't have the daily contact with a teacher."

Home schooling information also is found in one of CompuServe's 240 forums: the Education Forum.

Although CompuServe does not offer curriculum-based online classrooms, it is a source for online students to get help with their homework. The CompuServe Information Service, which was introduced in 1979, offers members access to 1400 databases, including Peterson's

College Guide to accredited or approved U.S. and Canadian colleges, as well as Grolier's Academic American Encyclopedia, a reference source updated four times a year.

CompuServe's Science/Math Education Forum has a data library with practice problems to help students study for college board examinations. The Students' Forum is where it's happening for middle schoolers; junior high students exchange ideas with teachers and other students and receive homework assistance.

With 800,000 CompuServe members worldwide, the potential for help is limitless. As Debra Pedersen Young of CompuServe says, "Who knows who is going to answer your question? It could be someone in the U.K. or someone next door."

Homework help is also available, and independent study is encouraged on the Prodigy network. Although it, like CompuServe, doesn't offer curriculum-based programs, Prodigy features online learning situations. Besides gathering information through Prodigy's reference databases and posting calls for help on its bulletin boards, students could supplement their studies with features from old favorites such as *National Geographic* and *Weekly Reader*.

America Online also boasts a number of homework options, including regularly scheduled homework sessions each weeknight, private tutoring, boards on developing study skills, an Exam Prep Center with tips for taking exams, and an exam exchange where students and teachers can upload and download exams to use or practice with. There are many other options currently online or in development intended to assist students and make learning fun.

grees will become increasingly valuable as employers gain experience with online graduates. "The development of analytical skills, as a result of the medium, changes the way people can conduct themselves in the workplace. Employers are going to be very pleased in the kind of results they get with people in this program."

The Quality Goes In

Educators running online programs know that such programs will never replace traditional classroom learning. Online education is seen as an alternative service for a special group.

They predict, however, that technology-based education will have an impact on classroom-based education. They expect it, in some ways, to enhance campus learning.

Campus students, Deutschman says, may pressure schools to provide the same technological access to teachers that online students have. Online students typically can ask their professors a question via modem and get an answer in a day or two, while the campus student with a question is at the whim of his schedule and his professor's office hours.

But perhaps the greatest success of these groundbreaking education programs is that some educators have stopped talking about computers and begun using them. At last, in the case of online education, the computer has become an educational tool as essential as pencil, paper, and textbooks.

As Becker says, "We've been using lecture techniques to teach from the beginning. Then, when Gutenberg invented the printing press, we began using textbooks and lecture. All the studies tell us that there are more ways to teach effectively—one is videotapes, and one is computer.

"Everybody is looking at [online learning], and everybody is talking about it. The future is wide open; we're only limited by our imaginations." □

The University of Phoenix requires that its instructors not only have the appropriate academic accreditation but be currently practicing professionals in their fields.

The other attack on legitimacy comes from critics who question how those who administer online programs know who's doing the homework and, ultimately, earning the degree. Many schools require online students to take midterm and final examinations in the presence of a proctor who has been approved by the school. Or, as in the case of NOVA, they actually require the student to show up on campus for brief but important seminars and institutes.

There is a feeling among those involved with online education that special recognition ought to be given to those who earn a degree via computer. Take a look at the online student, says Deutschman: The person has to

be self-disciplined, motivated, and able to work without a support group. "If [people] can be successful in distance learning, then you know they've got something," Deutschman says.

In fact, Bishop predicts online de-

SOURCES

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Vienna, VA 22182
(703) 448-8700

American Open University
(New York Institute of Technology)
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Central Islip, NY 11722
(800) 222-6948

CompuServe
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(614) 457-8600

NOVA University
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(800) 541-6682

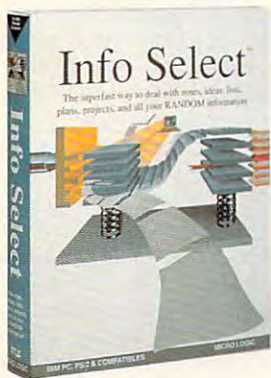
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ARGH Version 3.0

ARGH, the first *SharePak* program for September, is a collection of sliding block puzzles. How hard can that be?

Well, playing is actually easy: You just run the game from DOS and type the letter of the block you want to move. When you finish, the program sounds a beep, alerting you that you've successfully completed the puzzle.

Sounds easy, huh? Sure, it's easy to play, but it's not so easy to master. Simple as it sounds, the idea translates into hours of fun.

To play *ARGH* version 3.0, you'll need 256K of RAM, DOS 2.1 or higher, and any type of monitor.

Gapper

Talk about a game that will both captivate and addict its

audience, try *Gapper*.

There's nothing fancy about this game—arrow keys move you around while you avoid the blob.

Once you've captured all the rectangles on the screen by traversing their perimeters, you're done with the screen. But count on this: The next screen will be harder, more challenging, and more fun.

Gapper's CGA graphics are simple. The pieces move smoothly, and control is graceful. A high-score feature lets you face the ultimate challenge: Can I beat yesterday's score?

To play, you'll need 256K of RAM, DOS 2.1 or higher, and a color monitor.

PRO Football Picks

Don't you hate losing? Well, it's time to improve your odds. The next time you want to pick the winning team, use this fantastic program.

PRO Football Picks' author claims a 60-percent win record—not bad considering that all you have to do is run the program, enter the weekly statistics, and let the program make the picks.

The program is well-planned and easy to use. Simple keypresses control the menus, and mouse support is offered for all menus and dialog boxes. And you don't have to be a propeller-head or spend hours reading a manual to use it.

Without knowing anything about it, I made my selections in five minutes. Did I win? With magazine lead times the way they are, it's now early June, but you can be sure I'll find out in September.

For this game you'll need 512K of RAM, DOS 2.1 or higher, and any monitor.

PRO-SCRIBE

Do you write well? Could your prose be improved? Some-

times it's just plain fun to have your writing style analyzed. Whatever the case, don't consider your writing complete until you've run it through this full-featured grammar-analysis program.

PRO-SCRIBE begins by reviewing your text for complexity. Your writing is assigned a grade level, and you're shown a chart that graphically illustrates its complexity. Your writing pattern is also analyzed, and you're shown how closely it corresponds to *PRO-SCRIBE's* "ideal" pattern. For the ultimate in refinement, you can do a line-by-line analysis and track down lines that need rewriting.

PRO-SCRIBE also lists the complex words you've used, including a count of how many times you've used each word. Synonyms can be listed so you can easily find a replacement for any word you're not satisfied with. You can even add jargon to *PRO-SCRIBE's* vocabulary to keep it from pointing out words and expressions it doesn't recognize that are specific to your audience.

A graphical chart with your writing statistics lets you see the big picture. It includes an overall summary, a grade level and Flesch index, personal sesquipedalian words (those with many syllables), and statistics on writing style elements. That's plenty of information for you to assess your text and make changes if you desire.

PRO-SCRIBE should be welcome, too, for any professional writer. It's smaller than many similar commercial programs and doesn't require an excessive amount of disk space, yet it's packed with all the features of commercial writing-analysis programs and more.

To run *PRO-SCRIBE*, you'll need 256K of RAM and any type of monitor. □

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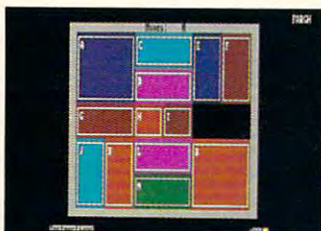
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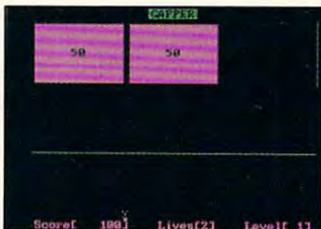
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PRO Football Picks



PRO-SCRIBE



Gapper

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COMPUTING FOR THE
PHYSICALLY CHALLENGED

BREAKING COMMUNICATIONS BARRIERS

BY GAIL DUTTON

Remember writing term papers? It seemed like a major chore in high school and college. Just imagine writing one blindfolded or without touching your PC, and you'll have an idea of what it's like for blind and quadriplegic students and professionals. Imagine writing it in, say, Chinese, a language foreign to you, and you'll understand the challenge aphasic patients—those who've lost the ability to use and process language—face when trying to communicate even simple requests.

Fortunately, software and hardware solutions are available, although they aren't widely known. Often the solution is simply a matter of locating the right pieces and integrating them into a computer.

Scanning and Voice Synthesis for the Visually Impaired

One system pieced together by two Yale University students relies upon a voice synthesizer and a scanner to let visually impaired students and staff have full access to the information stored in Yale's Sterling Library (where the system is housed) and any other written resources available. Built by Matthew Weed, a blind political science and history major, and Victor Grigorieff, a computer science and psychology major, the system is based on a Macintosh IIx, although it can run on earlier models, since each Mac program has a similar interface. It uses only commercially available software and hardware.

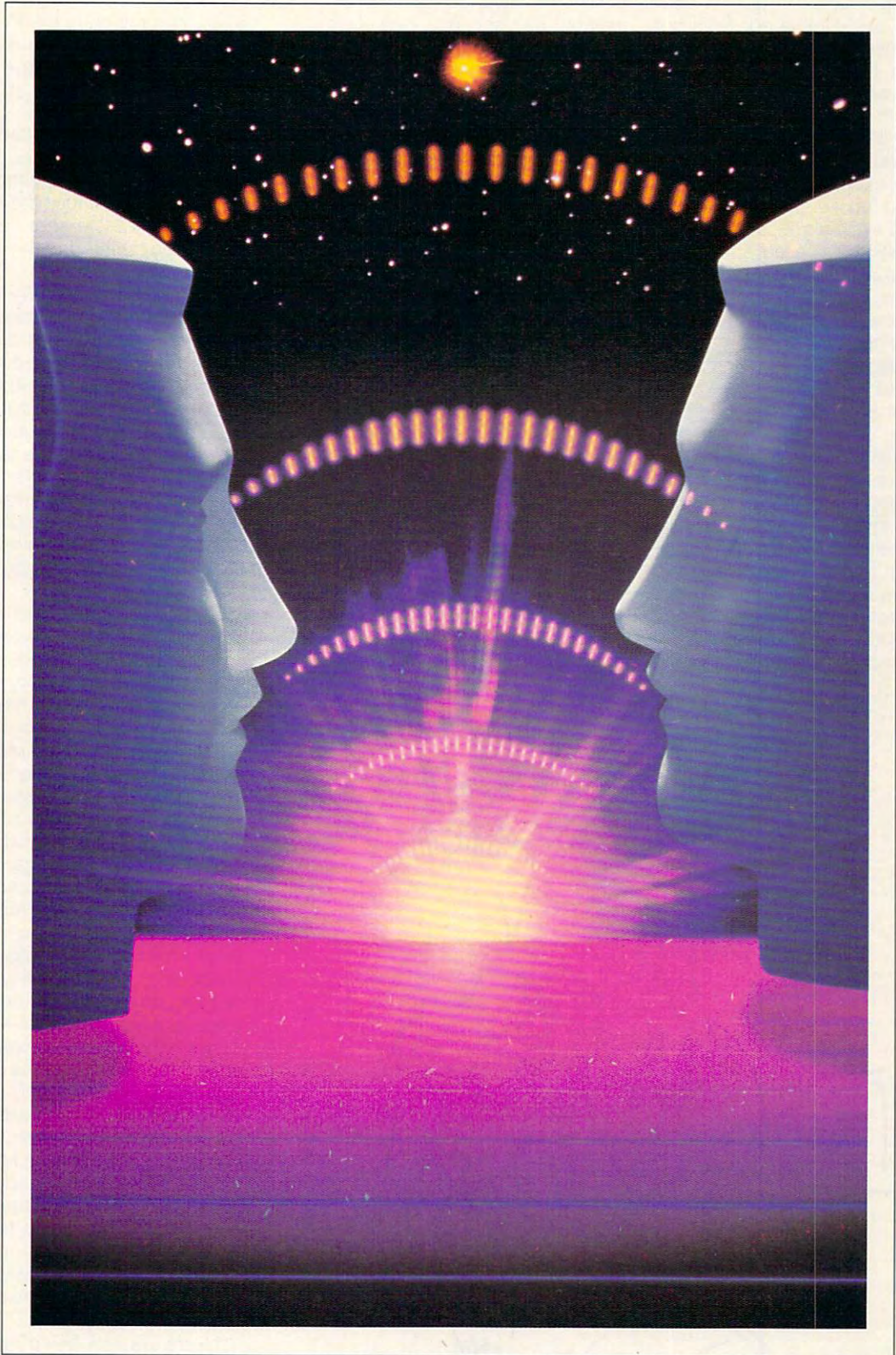
Because the Macintosh interface has remained consistent, visually impaired users only have to learn one set of concepts to run several different programs. The Mac also has

the flexibility Weed and Grigorieff require. With it, they can convert from Mac to IBM text files as needed so users can copy files for use on their own computers.

In addition to the Macintosh IIx, the system uses the Hewlett-Packard ScanJet Plus, *OmniPage* and *outSPOKEN* software for scanning and voice synthesis, *inLARGE* for magnifying text, a word processing package, and a 19-inch monochrome monitor. With *outSPOKEN*, the visually impaired can use graphical interfaces 95 percent as effectively as sighted users. And system glitches are minor; for example, the ScanJet Plus sees the number 2 as a tilde and the letter *l* as an *n*, but it's about 99.5-percent accurate.

The ScanJet Plus is used to scan books, research reports, journal articles, and other printed documents into the Macintosh at a rate of two side-by-side pages per 40 seconds. The text is then converted to sound using *OmniPage* and *outSPOKEN*. To listen to the file, the user opens the menu with a mouse or keystrokes and selects the options from the choices spoken by the voice synthesizer.

When the file appears, the voice synthesizer reads it aloud either one line at a time or one word at a time as the user cursors from line to line or word to word. Either method can become tiresome, so Weed often instructs the computer to speak faster—up to twice as fast as the average human reads aloud. With *outSPOKEN*, the user can also control type fonts, vocal pitch, and volume, and it offers a word dictionary for user-defined pronunciation, a graphics dictionary for identifying common signs and symbols, and



THE IMAGE BANK

a Find command for locating information on the screen.

By using this system, Weed's need for hundreds of audiotapes and the hours it takes to search them for specific quotes are eliminated. He's cut the time required to write a term paper from four or five hours per page to about 35 minutes per page.

The system is as advantageous for dyslexics as it is for blind users, Grigorieff says. With *inLARGE* software, individual letters, words, and lines can be enlarged up to three inches in height on the system's 19-inch monitor. Words can still be spelled and words or sentences spoken, making it easier to read new words. To help users keep their places, the system speaks the word the cursor is on and presents text with a ragged right edge and a serif typeface. *inLARGE* also offers a full-screen crosshairs cursor to make it easier to locate. Grigorieff says the system's potential is limitless.

Visually impaired users can access networks such as ARPANet, Internet, and Bitnet—invaluable aids in technical work. Eventually, Weed and Grigorieff hope an interuniversity electronic library will be established so scanned versions of references can be loaned just like printed versions of documents. Right now, though, Weed says copy-

right laws are a problem. At Yale, there are only about a dozen potential users, and the possibility that any one book that's scanned will be used again is slim, he says. So to save computer memory, he's spending part of his summer erasing the books that have already been scanned into the system.

Yale's system was built last fall with a \$15,000 grant from Yale University. Because costs are dropping, Weed estimates the same system could be built today for a little more than \$10,000.

Design by Voice and Movement

All the way across the country, Jeff Burnett, an architecture professor at Washington State University, and Technical Applications Group colleagues have built a system that allows quadriplegics to work on electronic CAD projects with the same levels of expertise as their able-bodied colleagues. This system, Burnett says, also works with anything graphically oriented, including spreadsheets.

The project, as yet unnamed, transparently links a DOS machine to the powerful UNIX systems that are needed for CAD and to a telephone. That configuration can then be booted automatically and controlled by speech recognition technology and an infrared headpointer. The system is "glued" to-

gether with custom software.

Users can boot up the machine by triggering a sensor—either a pressure pad or a special reflector—that can only be triggered by their wheelchairs when they roll up to the PC. Once the machine is booted, the menu comes up and can be used either by issuing voice commands or by using a headpointer as a mouse.

The software was written specifically for a headpointer made by Millennium Stride Computers, although others can be used. Because the headpointer uses infrared sensors, users don't have to be tethered to their computers with electronic cables.

The pointer is actually a reflective tape mounted on eyeglasses or even on a pencil tucked behind one ear. It's tracked with an infrared device mounted atop the computer—just the opposite of a TV remote control.

To select a menu function, users move their heads so the tape's reflection hits the desired icon; then a word is spoken that's the equivalent of clicking a mouse button. The adaptive interface allows users to move the window around rather than moving their heads in awkward positions.

The system has a small vocabulary, oriented toward CAD work, that isn't context sensitive. Individual users can load a personal vocabulary or label documents by spelling the needed words with the phonetic alphabet. To load the word *angle*, for example, the user would say, "Alpha, November, golf, Lima, echo." Burnett's system uses a Votan voice recognition board, one of the most functional available.

When the phone rings, an answering machine or the computer picks up the call, stopping the CAD program in its place. The user can converse using either a microphone and speaker combination or, for more privacy, a headset. To hang up the phone, the computer's voice recognition system listens for the words *hang up* and a confirming utterance. Upon hang-up, the user can resume CAD work instantly.

"If users are familiar with CAD, they can be functional on this system within one day, and in only a few weeks, after creating macros and editing the vocabulary, can compete in the same arena and at the same level as their able-bodied colleagues," Burnett says. In practice, success can depend very much upon the user's personal motivation.

Users are now being trained on this system at the University of Washington Center for the Handicapped in Seattle. After the training, they leave with hardware and software tailored specifically to their own work environment.



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Images Instead of Alphabet

Researchers at Tufts University School of Medicine in Boston are using computers to tackle a different problem: how to help patients who have lost the ability to use language—usually as the result of a stroke. The type of brain damage called *aphasia* affects the portion of the brain where words and speech are processed, leaving patients with the ability to comprehend much of what others say but unable to reply. They can't formulate thoughts into coherent phrases or sentences. Roughly one-fourth of the half-million people who suffer strokes each year also develop aphasia, according to Cheryl Goodenough-Trepagnier, associate professor of rehabilitation medicine at Tufts.

Aphasic patients can, however, learn to organize symbols into a coherent order to form thoughts and sentences. In the 1970s, patients learned to use cards with symbols to express their thoughts. Now those symbols have been expanded and loaded onto an Apple computer, simplifying their use.

Trepagnier's system, called *NewVic*, features hundreds of symbols—still called *cards* and *decks*—arranged in categories of people, actions, objects, modifiers, and prepositions. Eight symbols are displayed per computer screen. Patients use a mouse to select cards, scroll through the screens, and move from screen to screen. Decks are flexible enough that they can be designed to allow speed and vocabulary size to match a patient's abilities.

Some people pick up the system almost immediately, while others take a few weeks and still do very well with it. Although they don't know what the limits are, Trepagnier says the patients most likely to benefit are those who take to the system immediately and who are functionally impaired. "We're just beginning to be able to develop an appropriate communication medium for people with severe aphasia. The big problem is slowness," she says, "because people are trying to lay out messages through very impaired motor abilities. I haven't clocked it, but it's faster than three words per minute [for patients who are fluent with *NewVic*]. One of our major concerns is finding a way to communicate at a rate other people can tolerate, so users actually get to engage in conversation."

Another difficulty is in designing symbols to match verbs since aphasics often have more trouble conceptualizing verbs than nouns. Trepagnier currently uses pictures to suggest verbs but wants to develop an approach where

patients can animate a figure through an action, actually setting the images in motion. For example, eating an apple could be shown by choosing a hand, apple, and head; putting the hand and apple together; dragging them to the head; and clicking a mouse key. To say, "The girl is running," a user could choose a picture of a girl, click the mouse at her feet, and move the mouse rapidly across the pad. The computer would show it as a girl running across the screen.

Of course, aphasics can only use *NewVic* if they have it with them. Hopefully someday a true portable machine with a touchscreen will be available, similar to some of the lightweight portables that have surfaced in recent months.

Trepagnier plans to make her system and basic documentation available to the public this year. It uses the *NewVic* software she developed and runs on a Macintosh SE or SE30, or any other Macintosh machine with at least 512K of RAM.

What About Tomorrow?

Great strides have been made in recent years to bring the challenges of

the physically impaired to the forefront of the American consciousness. In fact, many other products geared toward the disabled, in addition to the ones mentioned in this article, are actually on the market now, but most are known only within small circles.

Computer technology promises to make life easier for the disabled. Personal fulfillment and overcoming stumbling blocks have always been the key goals of the personal computer. Now the technology that has leveraged our productivity and filled our leisure hours is helping the silent to speak, the blind to see, and the paralyzed to manipulate their worlds, and it's enabling technicians and research laboratories to perform computer-aided miracles.

Perhaps tomorrow, finding special hardware and software for the physically challenged will be as simple as checking out a disk at the local library or heading to the nearest electronics store for the latest equipment. □

Gail Dutton is an independent writer specializing in science and technology. Her articles have appeared in Science, Sea Frontiers, The World & I, IEEE Software, and other publications. She is based in southern California.

PRODUCT LISTING

For more information on the products discussed in this article, contact the manufacturers and publishers at the addresses listed below.

Software

inLARGE

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outSPOKEN

\$395

Berkeley Systems
1700 Shattuck Ave.
Berkeley, CA 94709
(415) 540-5536

NewVic

\$500

Department of Rehabilitation Medicine
Tufts University School of Medicine
Cheryl Goodenough-Trepagnier, Ph.D.
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Boston, MA 02111
(617) 956-5036

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Hardware

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Zygo Industries
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Nod Headpointer

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Sparks, NV 89431
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ScanJet Plus

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Interface Kit

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Hewlett-Packard Customer Information
19310 Prune Ridge Ave.
Cupertino, CA 95014
(800) 752-0900

VPC 2100 Voice Recognition Board

\$1,800

Votan
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Additional Resources

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TEST LAB

AST PREMIUM EXEC 386SX/20

Have you ever loved something so much that you were willing to overlook its flaws? That's how I feel about the AST Premium Exec 386SX/20. Despite the problems with early production models, this is the best overall notebook computer I've seen.

For one thing, it speeds along at a full 20 MHz, which is fast enough to run most *Windows* programs at a comfortable clip. In addition, you can order the Premi-

While the 386SX comes with 2MB of RAM and the 286 comes with 1MB, you can expand the memory of either machine to a total of 8MB. Even though the Premium Exec is relatively new, you can already buy memory upgrades from discount mail-order houses at a substantial discount. (AST charges \$995 for 4MB, while one mail-order company charges \$388 for the same amount of memory. As for the notebook itself, you can buy the various models by mail order at a discount of about 20–25 percent.)

The Premium Exec's LCD screen is the sharpest I've seen, and its VGA controller, from Cir-

like some other notebook computers, this one doesn't make you press a special option key to access the Home, End, PageUp, and PageDown keys. My only criticism is that the right Shift and Backspace keys are too small.

As for the case itself, it's solidly built and looks great. The small battery is relatively lightweight and easy to remove. The screen feels firm when you move it into place and locks tight when you close it for travel.

Many notebook computers offer power-saving features to extend the life of the battery. The Premium Exec tops them all with three ways to save power: programmable timeouts that can shut down the hard drive and LCD screen when they're not being used, a suspend/resume mode that can shut down the entire system while preserving your data (unfortunately, this feature doesn't work with protected-mode programs, such as *Windows 3.0*), and a BIOS-level clock-speed control feature that can automatically slow down the processor when it isn't processing data or redrawing the screen. With the power-saving features switched on, you can expect over three hours of battery life with each charge. Until notebook computers are available with Intel's new power-saving 386SL chip, the Premium Exec is the state of the art in power management.

So what were the problems with the early production models? The screen flickered slightly when the Premium Exec was running on the battery, and *Windows* programs wouldn't recognize the modem. I also couldn't get one of the units to recognize the PS/2 port. All three problems were fixed with BIOS updates, so be sure to get a BIOS with a version number of 1.06.04 or higher.

Notebook technology moves so fast that a recommendation

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



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Street Price: \$2,337*

rus Logic, does a great job of translating colors into 32 shades of gray. For those times when you absolutely must have color, you can hook up a color VGA monitor through the external VGA port.

In addition to the VGA port and the usual parallel and serial ports, the Premium Exec includes a PS/2 port that lets you add an external keyboard, mouse, or numeric keypad. You can also add an internal 2400-baud data modem (\$249) or an internal 2400-baud fax modem (\$349). The fax modem is send-only (9600 baud) and uses the Sierra chip—so it works fine with *WinFax*. Even though you can hook up an external keyboard, you'll probably use the built-in keyboard most of the time. The AST's keyboard stands out as one of the best I've seen on a notebook computer. It has a good feel and a slight audio click when you press a key. Un-

um Exec with a 20MB, 40MB, or 60MB hard drive that's rated an impressive 23 milliseconds (20MB drive) or even faster 19 milliseconds (40MB and 60MB drives). I'm using the 60MB version, and it's a real joy to have so many of my favorite programs with me—no matter where I go.

AST Research has made upgradability a major feature of its desktop computers and has carried that philosophy to its new line of notebook computers. You can buy the 12-MHz 286 version of the Premium Exec notebook and upgrade the microprocessor later to a 20-MHz 386SX—for not much more than the price difference between the two machines (\$400 as opposed to \$499).

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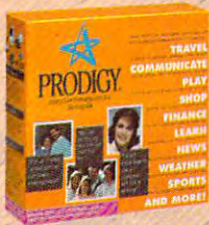
We all love the PRODIGY clubs where we exchange information about things we enjoy. The computer club is great because it keeps me up on the latest PC technology. My wife's favorite is the food club where she shares recipes and tips.

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TEST LAB

can be outdated by the time you read a review. With that disclaimer out of the way, I can safely say that the AST Premium Exec offers the best speed, expandability, and power-management features of any notebook computer. And all for a very attractive price.

DAVID ENGLISH

DELL 320N

Given a notebook computer's design constraints, Dell has done a superb job with the 320N. As with any laptop, this machine certainly makes compromises, but each one is well thought out and carefully engineered. In almost every area, Dell has done a little more and gone a little farther to make this machine smaller, faster, and easier to use than the competition.

If you look at the dimensions and weight of this computer, for example, you'll notice that it's just a bit smaller and a bit lighter than most of the other laptops reviewed here. And if you place the 320N beside almost any other notebook, this machine's sleek black body and carefully sculpted features will make the other machine look clunky. But the 320N is much more than just small size and high style.

The standard VGA screen (640 x 480) is exceptionally

bright. When you're looking at LCD VGA displays, one of the most important features to consider is the finesse with which the video controller maps colors to gray levels. In this respect the Dell is exceptional. In *Windows' Solitaire*, for example, you can tell the red cards from the black ones by their shading.

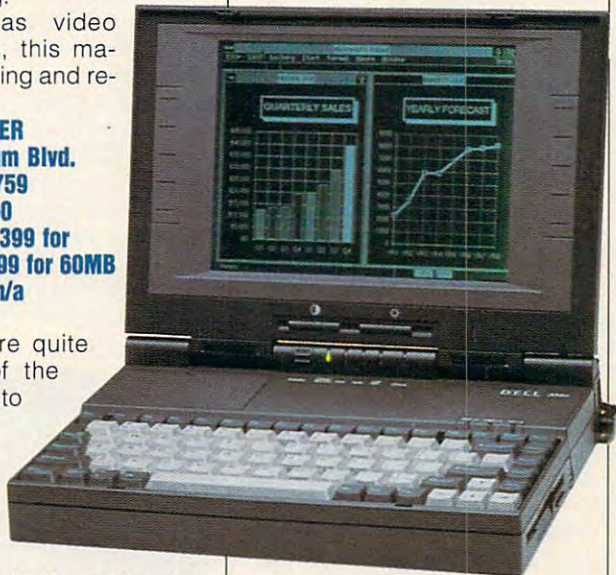
As far as video speed goes, this machine's scrolling and re-

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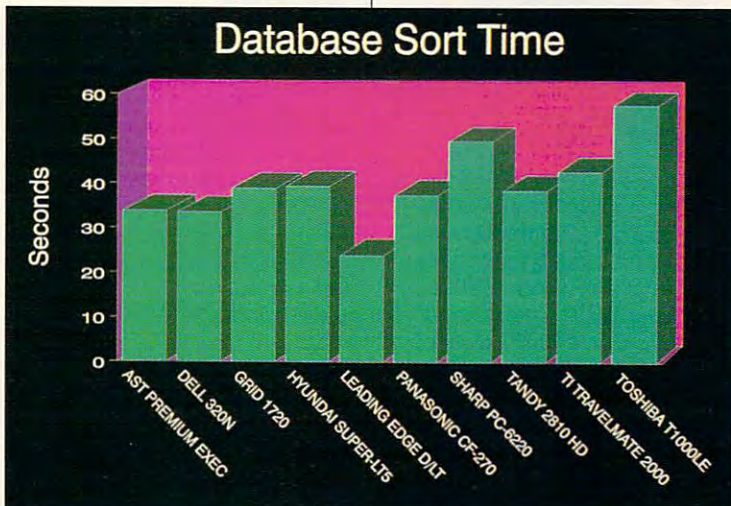
fresh rate are quite fast. One of the best ways to judge video speed is to use a mouse in graphics mode. Most LCD displays simply can't keep up with the mouse cursor, but the 320N does a very good job.

My only complaint with the screen is that it's compressed when DOS programs run. This happens because the video's vertical resolution in DOS is actually

400 pixels of vertical resolution instead of the VGA's possible 480, a common compromise in notebooks. *Laptop UltraVision* from Personics fixed this problem and allowed DOS to use the full 480 pixels for a *much* improved display, but I'd prefer that the machine's video controller do this itself.



The 320N's keyboard is certainly a compromise compared with most desktop keyboards, but its 85-key layout is very well thought out and offers a 3-mm key travel (most notebooks have a shorter 2-mm key travel). The cursor



COMPUTE APPLICATION INDEXES

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

The timings indicate how long it took a particular computer to sort a database, perform a search and replace in a word processor, and recalculate a spreadsheet.

—RICHARD C. LEINECKER

keys assume an inverted T formation and the Home, PgUp, PgDn, and End keys line up along the right side of the keyboard. None require you to press a special Fn key to access them.

There are also 12 function keys, which are smaller than the other keys. But you don't have to press the dreaded Fn key to use them.

The Dell sports a 20-MHz 386SX CPU that provided more than enough power for everything I wanted to do on the road, including running *Microsoft Windows* in 386-enhanced mode.

As for memory, the 320N comes with 1MB, expandable to 5MB. The unit I reviewed was maxed out with the full 5MB, which I certainly recommend, if you can afford it.

The machine comes with either a 30- or 60MB 19-ms IDE hard disk. The unit I reviewed was equipped with a 60, and it *sizzled*. I never felt I was waiting for the hard disk, even when using virtual memory (using the disk as if it were RAM) in *Windows*.

The 320N's ni-cad battery gave me a bit of a scare. It's supposed to last for three hours, but the low battery light came on after about ten minutes of use. The machine continued to chug along happily, however, for nearly three hours. The warning light kept me worried, however.

To help conserve the battery, you can employ several power-saving features built into the 320N. You can set timeout values for the hard disk, the display, and the system. In addition, there's a convenient standby button that places the machine in a special battery-saving mode.

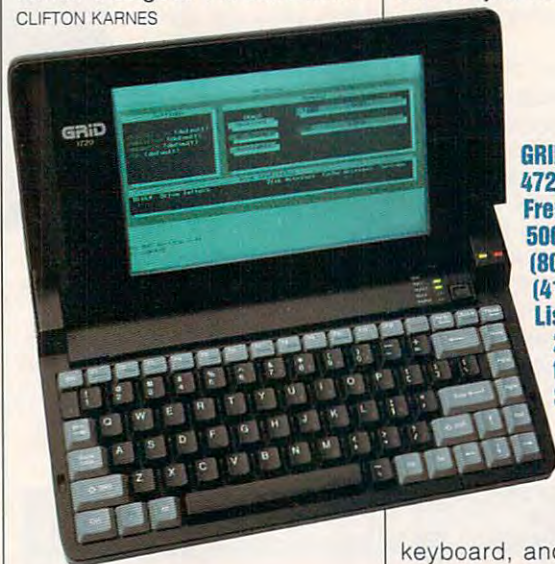
When it comes to talking to the outside world, the Dell 320N has a full complement of ports. There is one serial and one parallel port, an external VGA port, and PS/2 mouse and keyboard ports. An internal modem is available as an option.

You've probably gathered that I'm enthusiastic about this ma-

chine. It's beautifully designed and exceptionally fast and powerful. But is it worth the price? At \$3,399 for the standard configuration, it's not cheap, but if you look at similarly equipped competition, it's almost a bargain.

If you're thinking about buying a notebook, the next question to ask about the 320N is whether you need this much power. If you're primarily doing word processing, for example, then a notebook in the 320N's class is overkill. But you need a powerhouse like the 320N if it's your primary machine. And for running *Windows*, a computer in the 320N's league is a must. For state-of-the-art computing in a very small package, the 320N is a world-class performer that goes the extra mile.

CLIFTON KARNES



GRID 1720

Laptops are great, but it's rare that you would choose one over a comparably equipped desktop computer. That's exactly, however, what the Grid 1720 convinced me to do. Ever since I've had my review unit, I've only turned on my 386SX desktop to play *Lexi-Cross*. This sleek, black, 6.9-pound Grid packs enough power to run all but the most demanding applications. Its 80C286 microprocessor runs

at 16 MHz, and my review unit was packed with 3MB of memory. Only the 20MB hard disk left me feeling a bit cramped for space.

The two most important parts of any laptop, arguably, are the screen and the keyboard. These are the parts that you have to interact directly with, and the Grid has the best-feeling keyboard and the nicest screen I've ever used, laptop or desktop. Keyboard springs are used in the Grid to provide excellent tactile feedback without annoying clicking sounds. The keyboard spacing is the same as you'd find on a stand-alone PC keyboard, so your fingers aren't cramped as you type. The 12 function keys are arrayed across the top of the

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keyboard, and the cursor keys are in a standard inverted-T layout. You can reverse the positions of the Ctrl and CapsLock keys by simply switching the key caps and flipping a switch on the bottom of the computer. Only the lack of a separate numeric keypad would ever tempt you to take advantage of an external keyboard.

You owe it to your eyes to check out the Grid's LCD VGA screen. Easier to look at for long periods of time than even the sharpest Super VGA monitors, the Grid's screen produces

crisp, solid black characters on a gray background. Best of all, you won't notice any of the ghosting common to VGA-resolution LCD screens. (The monitor was noticeably sharper than that of Tandy's similar 2810 notebook PC.) I felt the desire to use an external VGA color monitor only when I played games.

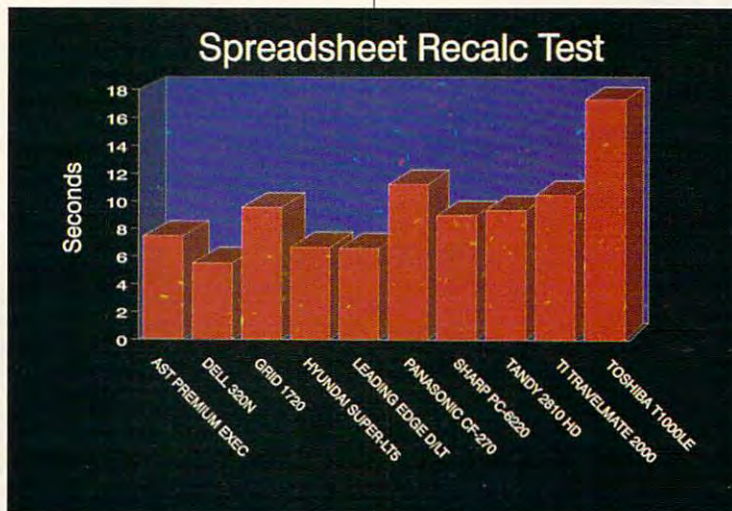
The Grid 1720 has most of the amenities you'd expect on a modern laptop. Along with VGA and keyboard ports, it comes with serial and parallel ports, a 1.44MB

drain and decreases battery life. With 3MB I was able to use the 1720 for about 3 hours. Removing the 2MB of expansion memory increased that duration to a little over 3½ hours. Unless you absolutely require 5MB of memory, the 3MB-configuration compromise between battery life and performance will serve you well. Adding memory or an 80287 math coprocessor won't cause you much trouble—just remove a panel from the bottom of the computer and plug in the SIMMs or

roduction to MS-DOS. While other computer packages may include larger, more detailed manuals, average users will probably find all the information that they need here. And this manual is small enough to slip into your laptop carry case.

The Grid 1720 is speedy, well-constructed, and an ergonomic marvel. And it's certainly one of the most attractive MS-DOS computers I've ever used, desktop or laptop. Now I understand why NASA has flown Grid laptops on the space shuttle.

DENNY ATKIN



floppy drive, and an internal Hayes-compatible modem. Grid chose a 20MB hard disk to save space and weight—it's one of the new 2½-inch models. Despite the limited capacity, it's quiet and uses very little power compared to larger drives.

Normally I find *Windows* too sluggish on a 286 system, but the extra zip provided by the Grid's 16-MHz clock speed makes all the difference. The 3MB of memory in the system I tested allowed me to set up a large disk cache, speeding operations even more. Add one of the new clip-on trackballs, and you've got a nice, portable, no-compromise *Windows* system for the road.

While the 1720 can handle up to 5MB of memory, each additional megabyte increases power

math chip.

The Grid has above-average power-management capabilities. The hard drive and screen will automatically power down after a user-selectable period. You can also selectively disable the speaker, serial port, LCD display, and hard drive in order to save power. For non-speed-sensitive software applications, such as word processing, toggling the system down to 8 MHz will extend battery life even further. A key combination will put the computer in stand-by mode, turning off the hard disk, LCD, backlight, and floppy disk controller. The program in memory resumes upon the first keypress.

The concise 97-page owner's manual covers all the computer's features and provides a brief in-

HYUNDAI SUPER-LT5

The Hyundai Super-LT5 makes the machines I once toted under my arm seem terribly limited—and wonderfully light. At 11-plus pounds, it's a load at the end of your arm or on your lap, with a bulky AC adapter when you're not running it on battery power—but then, that's true of any laptop in this class. The Super-LT5 is also a fast, efficient laptop with a roomy hard drive, a sharp screen, and a nice-size keyboard.

Weight aside, it's a well-made machine with the advantages of a desktop model compressed into a box smaller than a briefcase. With a built-in handle and a screen that folds down and locks readily into place, the Super-LT5 is its own case.

The keyboard, though understandably cramped, features full-size, fully responsive keys. It's laid out in a familiar manner, with the function keys arrayed horizontally along the top. The number keyboard overlaps some of the letters, meaning that it's separated from the familiar overlay with the cursor-movement keys. Given that the Hyundai Super-LT5 is a laptop, it's a perfectly suitable layout, although the NumLock key's proximity to the right Shift, Ctrl, and Alt keys caused me to activate it inadvertently more than once.



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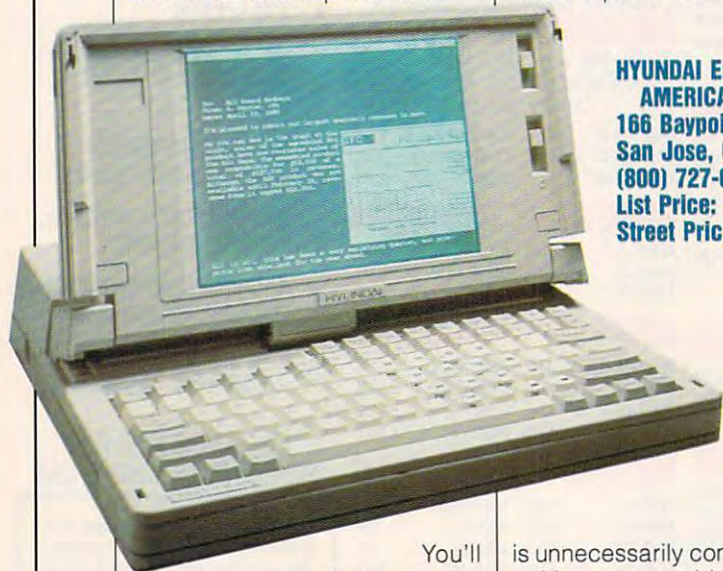
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The machine's floppy drive and expansion ports are readily accessible, as is the motherboard. I had no trouble hooking up my VGA monitor to get full color, though the Super-LT5's screen proved marvelously well lighted, well defined, and easy to adjust—just right for my writing. Brightness and contrast were adjustable via two smoothly sliding controls adjacent to the screen, a more convenient location than I'm accustomed to seeing even on full-size desktop monitors.



You'll find expansion jacks around the laptop's sides. Besides the port for the external monitor, there are ports for a keyboard, a 5¼-inch floppy disk drive to supplement the built-in 3½-inch drive, and a printer. I tried hooking up my desktop IBM-compatible's keyboard to the Hyundai Super-LT5, but its recessed external keyboard jack proved too deep for my angled plug. You can, however, plug in an internal modem.

The laptop operates very quietly, emitting just enough squawks to let you know when it's reading a disk. I found the internal speaker to be adequate, perhaps just a little too quiet.

The user's guide provides clear, basic guidance, with a particularly helpful chapter of trou-

bleshooting tips; however, it should have an index.

There are no cables to install and no screws to screw, and getting the machine up and running takes no more or less time or effort than with a comparable desktop model. Included with the Hyundai Super-LT5 are DOS disks and a reference disk that includes *Windows* and OS/2 drivers.

The Hyundai Super-LT5 has a built-in MS-DOS shell program, which is a nice feature. It's too bad this particular shell program

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is unnecessarily complicated, requiring unnatural key combinations when a simpler menu probably would've done the trick. Again, it's a nice feature to have; it just doesn't make getting around in DOS as easy as it could.

Though not astoundingly fast, the Hyundai Super-LT5 generally works quickly and efficiently. Installing software onto the hard drive takes relatively little time.

The battery for the Hyundai Super-LT5 takes four to six hours to charge and lasts for one to three hours. Given the machine's power, that seems reasonable, even though it would be nice if it could hold out longer on a charge. One problem I encountered using the laptop on both electrical and battery power was that after a while it got uncomfortably hot under-

neath, especially when I was using it while wearing shorts.

Fortunately, I never subjected the Hyundai Super-LT5 to the toughest test I ever gave a laptop during my days as a newspaper reporter: skidding it across a concrete parking lot after accidentally tripping in the dark during a late-night run for police news. Even so, it appears to be a solidly built, durable tool, capable of performing almost as well as a pricey desktop computer but without the usual constraints; it's powerful and portable.

EDDIE HUFFMAN

LEADING EDGE D/LT386SX PLUS

Nothing makes the time go by on a long plane ride like a good laptop, and whether you use yours for spreadsheets or *Star Control*, the Leading Edge D/LT386SX Plus certainly beats a talkative stranger when it comes to airborne companionship. Whatever your reason for carrying a laptop, you'll want to balance weight, display readability, and price against its usefulness. A close look at this laptop reveals a perplexing mix of fine and somewhat below-average features.

On the plus side, the D/LT does run a 16-MHz 386 processor, providing the necessary micro horsepower to make *Windows* run at a usable speed, and the 40MB hard drive provides more than ample storage space for on-the-road applications and their data files. The 3½-inch 1.44MB floppy drive port faces you, so you can keep an eye on disk activity. All the standard ports—serial, parallel, and PS/2 mouse—further enhance the D/LT's versatility. For you avid telecommunicators, the roomy modem bay looks as if it should easily accommodate the Leading Edge \$199 proprietary modem. Should you have the chance to plug the D/LT into a color monitor, you won't be disappointed by

the graphics; this laptop's crisp-VGA 640 × 480 pixel output does justice to your games as well as your chart generators.

A winner all around, the D/LT's keyboard doesn't complicate typing by shrinking its keys; they're the same size as those of larger, stay-at-home machines. While the keyboard won't detach from the D/LT entirely, it does have the surprising ability to sled forward away from the rest of the machine, putting just enough distance between you and the LCD

screen for a comfortable working relationship at your hotel room desk. Well, maybe not quite far enough for some; the glare from this laptop's 8 × 6 inch backlit display can quickly tire your eyes. Compared to many other laptop displays, this one's downright fatiguing. And despite a purported antiglare feature, text on the D/LT display, like text on many laptop displays I've looked at, is best read in indirect light. The brightness and contrast sliders do little to improve the situation.

Also problematic is the screen's tendency to fall forward at the slightest disturbance and to resist proper positioning. Setting the display in place often requires multiple attempts. Practice patience here; the manufacturer warns against bending the screen back too far, though it remains a constant temptation. A more effective locking and tilting mechanism is definitely in order.

Those traveling computer-philosophers who remember the heyday of the KayPro luggable won't

HOW THE POWER GOES

There's more to testing the life of a laptop battery than turning it on and letting the unit run until the power gives out. To truly test a manufacturer's claim of battery-powered operating time, you have to test the battery as if it were in normal use.

Almost all laptops use rechargeable ni-cad (nickel-cadmium) batteries, with a flat voltage discharge. That simply means that voltage discharges constantly until the battery runs dry. For example, a six-volt ni-cad battery will give a constant six-volt discharge up until the moment it dies, unlike, say, flashlight batteries that gradually lose power. Ni-cad batteries also operate well in low temperatures, unlike their acid-based automobile counterparts that tend to be sluggish on very cold mornings.

Our test lab charges the ni-cad battery according to the manufacturer's exact instructions. Once the battery is fully charged, the laptop is put to use, and its between-charge lifespan is tested using COMPUTE's battery-testing program. The program monitors the laptop constantly until it completely gives out, so the exact power-up and power-down times can be recorded.

But there's more to it than that. To realistically simulate lap-

top use, our testing program runs the laptop disk drive in a selected duty cycle. For instance, in a 40-percent duty cycle, the drive runs for four minutes of continuous disk access and then rests for six minutes. The cycle is repeated constantly until the battery dies. The test program's timer constantly saves to disk, so when the system is booted up again after recharging or plugging in, the time has been recorded for reference. A stopwatch serves as backup.

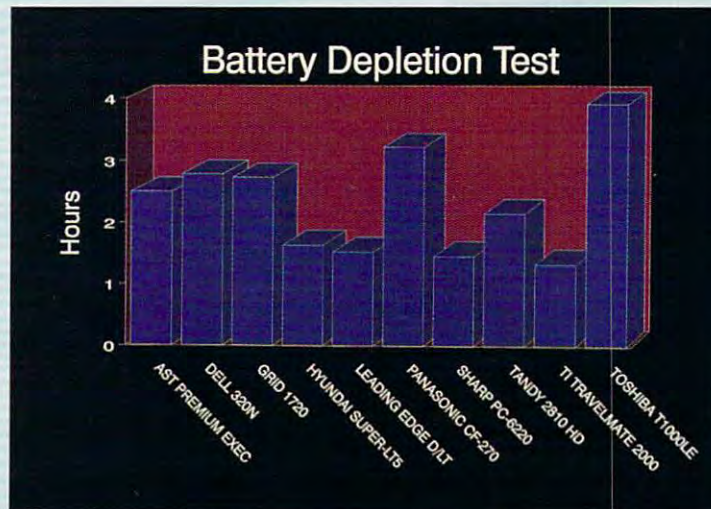
If a laptop has an automatic rest mode or screen blanker, someone physically monitors the computer, tapping it every

screen cycle to return the screen to normal mode.

Once the battery dies, the lab repeats the test two more times in its entirety, beginning with a battery recharge. After testing each laptop three times, the lab uses a spreadsheet to calculate mean times for each battery.

Most batteries are going to yield about the same amount of running time because they're essentially the same product—rechargeable ni-cad cells. The real difference is in how you use your laptop, what type of microchip runs it, and the machine's built-in power-saving features.

—JILL CHAMPION



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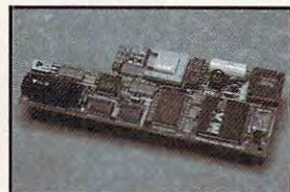


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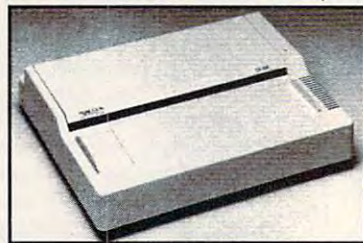


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ately. The D/LT comes bundled with DOS 4.01, *Windows 3.0*, and *Microsoft Works*.

You might think that a laptop with a VGA port makes the perfect go-between for home computing and computing in your hotel room, but think again. Most laptops just don't offer the expandability that full-size PCs do, and even the larger-than-average D/LT won't adequately serve as a substitute. With a 2MB RAM limit and no card slots, the D/LT won't replace your versatile desktop PC. And for true portability, you'll want to try the Leading Edge NB 300S notebook computer. The standard unit packs less RAM and hard drive space than the D/LT, but its reduced weight and increased operating time per battery charge probably bring it closer to your idea of what constitutes a laptop these days. At only about \$400 more than its larger cousin, the notebook warrants a frequent traveler's attention.

So, who needs the D/LT? Well, for shoppers who appreciate a bargain, the D/LT could turn out to be a surprise hit. To compete with other manufacturers in this market of increasingly smaller and lighter portable computers, Leading Edge lowered the suggested retail price of the D/LT laptop by about \$1,000. Any further price cuts could carve out quite a niche for this machine, especially with computer users who travel only from time to time but want to make sure they can work out of town if they need to.

DAVID SEARS

much mind carrying the hefty D/LT for short distances. After all, this computer's 13 pounds doesn't compare to the weight and bulk of most earlier portables. More contemporary users, though, might not want the burden of this much weight, especially in this age of 386 notebooks. The D/LT thankfully balances on its edge quite well. Even if the D/LT should fall over, I wouldn't worry much about damage—this machine's case could stop bullets.

This laptop doesn't spare you the cold reality of mysterious battery charges. You should expect about two hours of use per full recharge of the ni-cad battery. Expect less if you access your hard drive and floppy frequently. Leading Edge has built in some features to help you conserve power and keep track of the D/LT's battery life. Left unattended, the D/LT dims its screen to conserve power. A battery check light flashes when power's low, and if you don't soon save and shut down, you might damage your hard drive and will certainly lose your work.

Alarm software, such as *Battery Watch*, warns you when battery failure will occur, but you'll need to buy such software sepa-

PANASONIC CF-270 BUSINESS PARTNER

Can a seven-pound notebook computer measure up to the needs of someone accustomed to using a well-equipped desktop machine? Panasonic's CF-270 Business Partner comes mighty close and offers many of the important features that we've now come to expect in notebook computers.

At a mere seven pounds, the CF-270 is a lightweight whose approximate dimensions are 12 inches by 10 inches by 2 inches—small enough to fit into most attaché cases. The CF-270 compares well with other notebooks currently available, offering a 16-MHz 80C286 CPU, 20MB hard drive, 1.44MB 3½-inch floppy drive, 640 × 480 backlit black-and-white LCD display with 16-level gray-scale VGA, and 1MB standard memory (expandable to 5MB).

The CF-270 comes with two 3½-inch floppies, which include everything you would expect, including MS-DOS 4.01 and GW-BASIC. The floppies also include some programs that add important features: a setup program, a power-management program, FDISK to set up the hard drive, and a diagnostic program that tests each component of the system.

How long the battery holds a charge and how long it takes to recharge can often be the determining factors when you're deciding which notebook to purchase. The CF-270 comes equipped with a quick-charge battery that will fully recharge in about two hours when the computer is turned off and in four hours if you use the computer while charging. The battery charge lasts about two hours but will vary depending on how often the drives are accessed and which power-conservation options you've selected.

The CF-270 software (called *Power Management Setup Utility*) allows you to select power-reducing options including slowing or shutting off the CPU when the computer is not busy, turning off the hard drive motor when it's not in use, placing the floppy drive on standby, and automatically turning off the screen or the entire unit if there's no keyboard input after a certain time interval. Each of the power-saving features operates only when the CF-270 is running on battery power.

Using the *Power Management Setup Utility* is simple enough. The manual briefly explains each of the options, and the utility includes online help screens—a handy convenience, especially if you want to change an option at 31,000 feet and haven't brought the manual.

I set the system to maximum power savings and found that the system functioned satisfactorily. The only time I could detect a slowdown in performance was when I accessed the hard drive after the motor had shut off. Usually the delay was only a few seconds while the drive got up to speed again, a small price to pay to extend the life of a battery charge.

I especially liked the keyboard and its layout; a touch typist would have little trouble adjusting. If you're a heavy spreadsheet user, you'll enjoy being able to convert the keyboard to a numeric keypad. Although not as convenient as a separate keypad, this compromise proves quite workable.

The CF-270 comes with several external ports and jacks. With the serial and parallel ports, you can connect to your favorite printer, external modem, or serial mouse. And with its VGA port and keyboard jack, you can use your CF-270 as if it were a desktop computer.

The CF-270 comes with several manuals. Less than 100 pages long, the basic User's Guide covers all the basics clearly and concisely. Also included are a

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very short Getting Started Guide, a User's Reference Guide, an MS-DOS Shell User's Guide, and a Quick Reference Guide to MS-DOS and GW-BASIC. Anyone with any experience with MS-DOS computers should find this documentation satisfactory, albeit a bit skimpy. If you've never set up a new system before, you might find the process a bit intimidating, as you would with most computers. And if you have limited experience with DOS, you'll not learn much from these guides.

Panasonic has designed a respectable notebook computer that includes most of the features we've come to expect. If you're in the market for a small, lightweight

computer that will fit easily into your carry-on luggage and on an airplane's table tray, you would do well to consider the Panasonic CF-270 Business Partner.

STEPHEN LEVY

SHARP PC-6220

Sharp's PC-6220 is a compact and, on the whole, well-designed computer for its small size (11 x 8 x 1.5 inches). This 80C286 notebook computer runs at 12MHz and comes equipped with a full megabyte of memory. Its durable exterior and light weight (4.4 pounds without the optional floppy drive) should make this machine an attractive option in the world of portable computing.

THE POWER-SAVING SL CHIP

Intel has introduced a new 20-MHz SL chip, exclusively for laptops, that's supposed to add significant power-saving features. Zenith claims its MastersPort 386SL (currently the only laptop with an SL chip) will preserve an application for two weeks and then resume at the push of a button.

Since most of the recent laptops carry the SX chip—and will for some time to come—your best bet for extended laptop battery use is to buy a lap-

top with an array of power-saving features. An automatic screen timeout blanks the screen after a period of time passes without mouse or keyboard input, a sleep or rest mode will actually slow down the computer's processing time while the machine is still running but not in use, and standby mode is designed to conserve power while allowing instant access to what you were working on with the press of a key.

—JILL CHAMPION

TEST LAB

Frequent travelers will appreciate not having to carry around any more pounds than necessary. Once you've loaded your hard drive with the software you use, you don't really need to lug the optional 3½-inch plug-in floppy drive. If you don't care to invest in the external drive, a ROM version of Traveling Software's *LapLink* software and the supplied cables will let you make transfers between this notebook and your desktop computer. *LapLink* works fine, though, and in no time I was transferring my favorite word processor, graphics, entertainment, and other software to the 6220's hard drive.

The system's port covers must be detached and stand a good chance of getting lost (a storage hatch for these little guys would be a nice feature). And the screen/cover is stiff and difficult to place at just the right angle. It would've helped if a demonstration program or at least some modest utilities had been included either in ROM or on the 20MB hard drive. When you consider the power that has been packed into such a small package, however, a lot can be forgiven.

Though the 6220 is as powerful as a desktop AT, it shares with many other notebooks the limitations of a 20MB hard drive. There are limitations on the number of powerful applications you can use. For instance, *MicroSoft C 6.0* with all the associated utilities takes up at least 3MB of storage, as does *GeoWorks Ensemble*, while *WordPerfect 5.1* and *Windows 3.0* take at least 6MB each.

An informal test of processing speed, using a few of my own calculation-intensive routines and comparing completion time with the completion time on other AT-compatibles, showed that the 6220 compared remarkably well. If you add a coprocessor in the notebook's 80C287 socket, you can expect even better performance. You have the option of increasing the system memory,

which will also boost performance. Memory can be increased to two or three megabytes through the purchase of optional 1MB RAM cards.

You can set the liquid crystal display for CGA, EGA, and MDA emulation, as well as the default VGA. And a Hercules option exists for an external monitor. The 6220 does a pretty good job of displaying graphic images in 16 shades of gray. I tested several compatible images with the

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same resolution and found reasonable faithfulness. The next test involved running a few graphic-intensive games. Games, as programmers and gameplayers were early to discover, challenge computer abilities like no other software. In fact, the games I tried worked surprisingly well. The persistent problem with any LCD screen continues to be the slow liquid crystal response times—if the image on the screen is changing rapidly, there's a blurred, shadowy effect because liquid crystals, rather than being strictly on or off, show an obvious range of activation. An optional adapter for CRT output, to either a multisync or VGA monitor, makes the 6220 more convenient for desktop use. The same is true of the separately sold numeric keypad and expansion unit. The expansion box will provide power and peripheral connectivity while furnishing two expansion slots.

The nickel-cadmium battery

supplied with the 6220, after its initial two-hour charge and with only limited hard drive access, goes for about an hour and a half before a warning beeper informs you that there's only about ten minutes of power remaining. If you don't save what must be saved within that ten minutes, it will be lost. The AC adapter, included, either doesn't recharge the battery when the computer is being used or does so very slowly. Either way, if you need to get the 6220 back on the



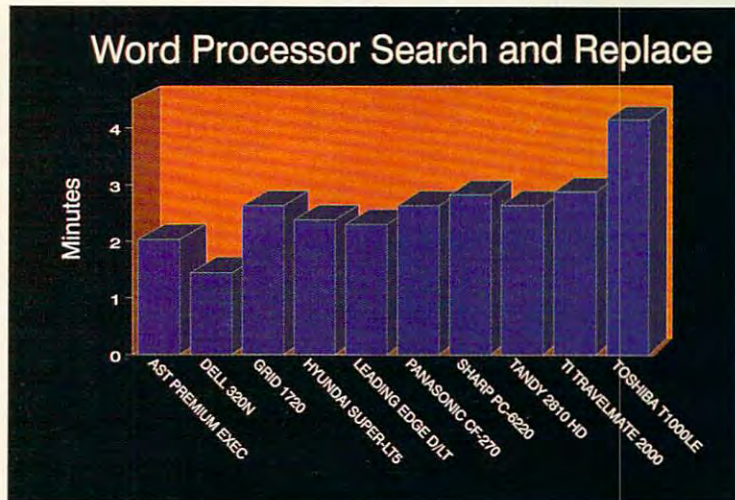
road again soon, you must switch it off and wait for the battery to recharge. An optional battery pack, which plugs into the back of the unit, is available, and according to the manufacturer, it will extend battery-usage time an additional three hours.

I also experienced difficulty installing the battery pack, a problem which I attribute to the machine's overall compact design—sometimes a little extra space is welcome. Because the battery slot is barely larger than the battery, the connector wires can easily get in the way during battery insertion. I worked and worked to

get the battery pack neatly seated without deforming the case or mashing the wires; every possible permutation was (gingerly) tried. At last I had the battery and the wires in place, but the battery cover remained misshapen on the underside of the unit throughout the review process.

Except for its hefty price tag, I would not hesitate to recommend Sharp's PC-6220 notebook computer. In two weeks of heavy use, it performed flawlessly. And what liberty when your AT is no more difficult to lug about than a common book!

BRUCE M. BOWDEN



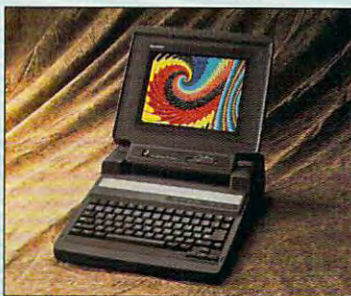
VGA COLOR FOR LAPTOPS

What's next for the laptop computer? Just a few years ago, color displays for portables seemed wishful thinking, but with the Sharp Colorstar, wishes can come true. No washed-out gray-scale images here; this machine delivers a stunning 256 vivid VGA colors, chosen from a palette of 262,144 possible hues. Combine brilliant color generation with the inherent sharpness that comes with smaller screens, and you have a remarkable picture, whatever you choose to display.

Using Sharp's innovative thin-film transistor (TFT) active-matrix LCD (Liquid Crystal Display) technology, the Colorstar stands head and shoulders above the competition in terms of visual impact. Each pixel has its own silicon thin-film transistor to allow precise color control. Not surprisingly, color LCDs aren't easy to produce; even a single pixel error stands out, so production standards call for perfection, not approximation. In part because of this difficulty, the Colorstar will initially sell for \$10,000 to \$15,000, but you can expect prices to fall as burgeoning consumer demand for color LCD microtelevvisions encourages the improve-

ment of factory methods.

The Colorstar comes with a 20-MHz 386DX processor, 2MB RAM (expandable to 10MB), a 1.44MB floppy drive, and a 100MB hard drive. Want expandability? The Colorstar has a half-size expansion slot (AT-bus, for networking, among other things), the standard parallel port, two RS-232C ports, a keypad port, and a CRT output. And best of all, the Colorstar



could have been a set piece for an episode of "The Jetsons." Sleek, ergonomic, and the very picture of high-tech, the Colorstar should turn heads on the basis of its style alone. And while this high-end machine may not wind up in your stocking this Christmas, move it up your wish list anyway.

—DAVID SEARS

TANDY 2810 HD

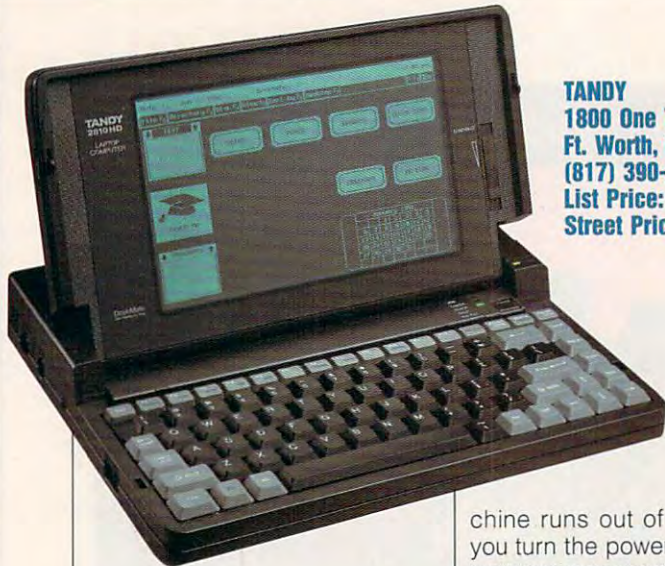
Versatile and packed with features, the Tandy 2810 HD laptop computer offers enough features to meet most of your computing needs, even if you're accustomed to working with a desktop. You get 1MB of RAM (expandable to 5MB), a 20MB hard drive, and a 3½-inch 1.44MB floppy drive. The computer operates at 16 MHz and has a socket for an optional math coprocessor.

The 2810's 84-key keyboard has full 101-key emulation and allows for some customization. If you don't like where the Ctrl and CapsLock keys are located, you have the option of physically reversing their positions. Smartly laid out, the keys have a good solid feel to them.

Other keys on the 2810 initiate battery power conservation. These place the computer in standby mode, toggle the speed between 16 MHz and 8 MHz, disable the speaker, switch from the internal screen to an external monitor, turn off the serial ports, and more.

In most working environments, I never noticed the small amount of noise generated by the 2810's disk drive. On the rare occasions I was able to use the laptop at home in my library-quiet den, I found the noise distracting. No

TEST LAB



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problem; press a key, and the drive shuts off until needed. You can also configure the computer to shut off the drive and/or display after a certain period of inactivity. This saves battery power, too.

The 2810 warns you when the batteries need recharging, giving you ample time to save any work in progress. If they should fail while you're working, however, the Resume feature remembers what's in memory when the ma-

chine runs out of power. When you turn the power on again, the program reappears, and you continue where you left off.

To add a printer and a mouse to the 2810, just plug the appropriate cables into the computer's parallel and serial ports. You can just as easily connect a VGA monitor and a full-size external keyboard via the built-in monitor and keyboard ports. This makes the 2810 a convenient backup for your desktop computer.

The 2810's VGA LCD screen with fluorescent backlighting has a three-position brightness switch and a sliding contrast control bar allowing for readability in a wide range of lighting conditions. A key combination lets you further vary the contrast of characters and background; you can even reverse the display entirely.

As with all Tandy computers, the 2810 comes equipped with the *DeskMate* graphics-oriented interface and application software. These applications include a word processor, drawing program, spreadsheet, calendar, address book, filer, and telecommunications program.

Other manuals should emulate Tandy's User's Guide. Written for the 2810, it isn't meant to cover 57 other models or configurations. The introduction guides you through the basics, explains the different keys and setup options, and explains many useful MS-DOS commands. A separate manual guides you through *DeskMate* and its applications.

Setting up a new computer is always challenging, but Tandy's manual removes much of the confusion that comes from working with a new system. The manual explains the different parameters and what they do; then it explains your options. For example, the time and date functions are fairly simple to understand, but do you know if you want to enable or disable the serial ports, FDC Standby, Standby Timeout, or VRAM Timeout? After a quick glance through the slim but thorough manual, you'll have no doubt about what these functions do and how you want them configured.

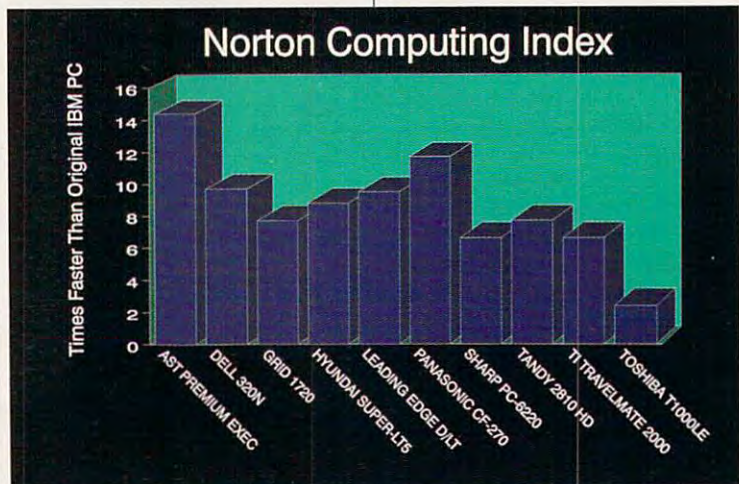
Adding extra memory cards and allocating memory are also

NORTON INDEXES

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

The CPU (Central Processing Unit) speed test rates the computer's microprocessor performance. The disk index rates the performance of a system's hard drive. The overall performance index factors in the CPU and disk indexes among other things.

—RICHARD C. LEINECKER



carefully explained. The 2810 has 1MB installed with 640K of conventional memory and 384K of extended or shadow RAM. Available slots leave room for an additional 4MB of RAM. Depending on the requirements of the operating system and the software you run, you can configure addi-

2000 notebook just may be your ticket.

It's an amazingly small 286 notebook computer, measuring only 11 inches wide x 8.5 inches deep x 1.4 inches thick and weighing in at a meager 4.4 pounds. It comes standard with 1MB of RAM, a 20MB hard disk,

them around when you don't need them. The drive plugs directly into an expansion port located on the back of the computer. To install it, simply pop off the rear cover and plug in the drive. Two thumbscrews hold the drive in place, so you don't have to fuss with cables. It's pretty slick.

The modem/fax card plugs into a small compartment located just above the keyboard. The card is held in place by a single screw and the plug. I assumed that this screw would be a thumbscrew like those on the disk drive, but it's not. However, if you have a small screwdriver, you can swap cards in a matter of minutes.

I was impressed with the software that came with the system: *BatteryPro* and *LapLink*, a file transfer program that serves as your gateway to the outside world if you don't purchase the optional 3½-inch disk drive. Connected by the *LapLink* cable and running the *LapLink* software, two computers have complete access to each other's disk files. *BatteryPro* is perhaps the more valuable piece of software. It's a utility package that functions as a power-conservation system for the computer. The *BatteryWatch* feature of the package monitors battery consumption, and *BatteryPro* provides only the power necessary

tional memory either as expanded or extended. Some configurations require minimum allocations for shadow RAM and a software driver installed in a CONFIG.SYS file. Once again, you'll find this information clearly spelled out in the manual.

A solid performer, the Tandy 2810 HD will keep pace with advanced users but, thanks to clear documentation, won't overwhelm a beginner. With 1MB of RAM, a high-density disk drive, a 20MB hard drive, a VGA display, bundled software, and solid workmanship in an attractive package, this laptop is ready to go to work for you in a big way.

TOM NETSEL

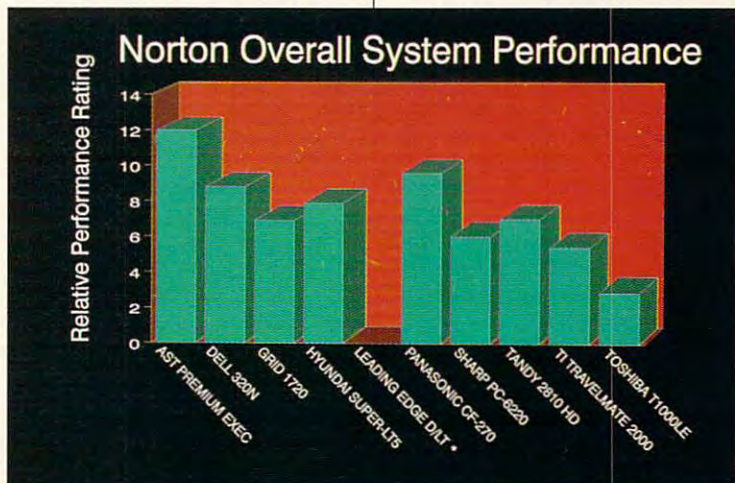
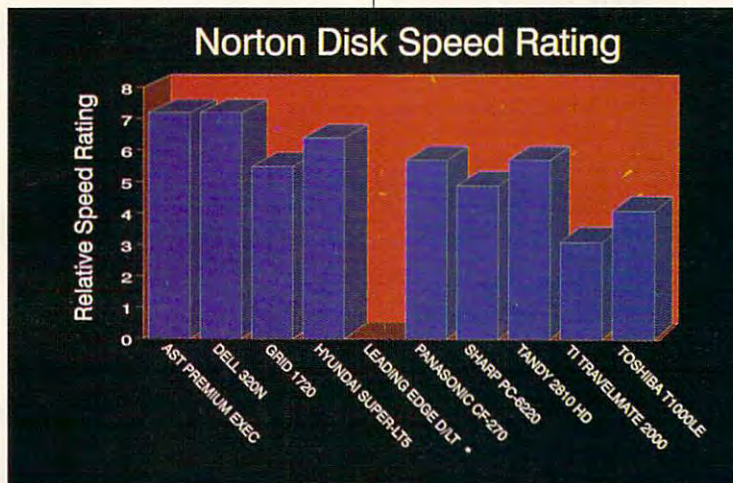
TEXAS INSTRUMENTS TRAVELMATE 2000

If you're ready to take your computing on the road, then the Texas Instruments (TI) TravelMate

and a backlit LCD VGA display. The TravelMate has an attractively styled case and a comfortable, solid-feeling keyboard.

The unit I reviewed came with the optional external 3½-inch disk drive and 2400-baud modem/fax card. All of the optional accessories can be quickly installed or detached, which means you don't have to lug

*Unable to run test.



TEST LAB

to do your work. This combination saves valuable battery power that's usually wasted by other portables.

The battery test results for the TravelMate were acceptable. With the *BatteryPro* utilities installed, it's possible to get about an hour and a half of use from each charge, with moderate disk activity. The battery pack con-

capabilities. Both are extremely easy to use; in fact, I successfully used both without reading a single page from the manuals. I'd never sent a fax before doing this review, but *BitFax* walked me right through the whole process of sending files to a fax machine here in the office.

I thoroughly enjoyed using the TravelMate 2000. I thought the computer was well designed and attractive. In addition, it seems to be very sturdy



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sists of a candy bar-shaped nicad battery that's about 11½ inches long. It fits into a very tight compartment on the back of the computer. The process of removing and replacing this piece of hardware is, at best, difficult. However, that's an extremely small price to pay when you consider the small, lightweight design of the TravelMate.

Included with the modem is a well-rounded set of communications programs, *BitCom* and *BitFax*. *BitCom* is a full-featured terminal program, and *BitFax* takes advantage of the card's fax ca-

and solid, which is a big plus in a portable computer.

The only thing I didn't like about the computer was the small plastic covers that protect the external ports. They just didn't want to stay in place for me. I simply removed them and placed them in the box for safe-keeping. (Most portables don't even have protective covers, so it's not really a problem.)

If you're thinking about purchasing a high-quality notebook computer, then you owe it to yourself to check out the TravelMate 2000. It's a very powerful tool that comes with good software, has room for expansion, and offers you a wide range of optional equipment.

TROY TUCKER

COPROCESSOR SPEED

COMPUTE's benchmark statistics allow you to compare how our Test Lab computers handle *COMPUTE's* proprietary benchmark tests. But there's another kind of comparison you should consider—the speed of a computer with a math coprocessor versus the speed of a computer without one.

When one of our review computers arrived at the lab with a coprocessor, we decided to run our benchmarks first with the coprocessor and then without it. The differences in performance were quite dramatic in some tests.

In the computer-aided design (CAD) tests, for example, the coprocessor enabled the computer to load a drawing in just under 14 seconds rather than the minute and 8 seconds the computer required without the coprocessor. Rescaling a drawing required a minute and 12 seconds without the coprocessor, 16 seconds with it. In the floating point math calculation comparisons, the differences are similarly dramatic. With the coprocessor, floating-point addition required 35 microseconds, 306 microseconds without it.

However, when our lab ran speed comparisons in applications—including a database sort, a database reindex, a text search and replace, and a spreadsheet recalculation—the differences were decidedly less significant.

Any kind of application that requires the plotting of curves or other geometric shapes or any type of vector-based graphic will benefit significantly from a math coprocessor. Anything, in other words, that's math intensive will benefit.

—MIKE HUDNALL

TOSHIBA T1000LE

At first glance you might pass over this laptop for other more powerful models. But that could be a big mistake. I ran this 8086-based machine under some of the most demanding conditions for months, and it performed with flying colors.

Let's start with the important stuff. It's lightweight and rugged, and it has a good battery life. You can't love one of these babies after lugging it to three trade shows in two weeks unless it's really light—and this one is. Using a canvas case to carry it, I traversed several airports, a hotel lobby, and several sidewalks without any hint of soreness in my tender shoulder. On our semiofficial scale here at COMPUTE, it weighed in at seven pounds. With the carrying case, the power supply, and an assortment of backup floppies, the total is around eight pounds. Not bad, considering everything I needed to do my work was in the package.

And none of that banging around broke anything. Sure, I'm careful. But when fighting jet lag, I, like most other people, get a bit careless. You won't find any flimsy breakaway doors on this unit. Just good, honest, substantial covers that stand up to almost anything you can dish out.

If you've ever flown from one side of the continental U.S. to the other, you know it's a long trip. Not being one for the in-flight movie, I counted on having something to work on for the entire 5½ hours. No, I didn't get that far. But I did work for almost 4 hours with heavy disk access. For most people that's plenty.

What about performance? As an 8086-based machine, it was good, though not as fast as a 286 or a 386. When you're on the road, though, how often do you reindex your database files or recalculate your spreadsheet? Most of us run a simple database program, contact manager, or

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word processor, and for those applications, my Toshiba filled the bill. When I did compile a program with my *Microsoft C* compiler and stepped through the program with the *Codeview* debugger, I was pleasantly surprised at how well it performed. These two programs separate the men from the boys real fast. They both squeeze every available ounce of performance out of a system. And on this computer the performance was adequate.

I'm not fond of laptop keyboards, but this was one of the best I've experienced. Positive key movement with definite contact points let me know that I was working on something solid. There isn't a separate numeric keypad, but the most important functions, such as PageUp and PageDown, have their own separate keys.

Reading the display is easy if you've adjusted it properly. The controls are right there on the side—no fumbling around to get the right setting. In a wide variety of situations, this Toshiba's display was crisp and clear. One nice addition that helps adjust for different uses is the ability to change system fonts with a hot key. If you're having trouble reading what's on the screen, you can toggle between the fonts and decide which is best. I found myself changing fonts several times each day as I went from setting to setting.



I had an internal modem that was a lifesaver when I had to send files to the office. It's one convenience I wouldn't want to be without. With the phone cord that arrived in the box, I was able to connect in all of my hotel rooms.

There's an indispensable feature built in that's as close as a hot key away. It's a pop-up display showing you how much power is left in your batteries and letting you set various switches so that the computer is tuned for maximum performance. You can turn the speaker and modem on or off, set the display to reverse, and toggle the auto power off features of the hard drive and display.

A single internal floppy drive was all I needed: Once all of my files were copied to the 20MB hard drive, I rarely needed it. Disk access for both drives was good—on par with any desktop model with an 8086 processor running at 9.5 MHz.

If you have to be the first on your block with the latest computer technology at any price, you'll probably look elsewhere. But if you're interested in a great value on a workhorse unit, this laptop is for you. It's not fancy or overwhelmingly fast, but dollar for dollar, you'll get your money's worth.

RICHARD C. LEINECKER

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FURTHER INFORMATION

AST PREMIUM EXEC 386SX/20

CPU: 80386SX, CPU Speed: 20 MHz

Conventional Memory: 640K, Extended Memory: 1MB, up to 8MB

Ports: serial, parallel, VGA, 6-pin PS/2-style mini-DIN (for mouse, keypad, or keyboard)

Drives: 3½-inch 1.44MB floppy, 20MB, 40MB, or 60MB hard

Video Modes: VGA paper white with 32 shades of gray

Screen Type: backlit CCFT supertwist film LCD

Standard Accessories: MS-DOS 3.3, LapLink 3, serial interface cable, BatteryWatch, tilt stand/battery pack, 110/220-volt autosensing AC adapter, carrying case with handle, AST utilities, complete documentation

Optional Accessories: 2400-baud modem—\$249, 9600-baud fax/send—\$349, numeric keypad—\$119, leather accessory case—\$299, nylon accessory case—\$129, car adapter/battery charger with built-in quick charger—\$129, lightweight small trickle battery charger—\$29, secondary battery pack—\$99, 4MB memory expansion (SIMMs)—\$999, external charger for use with AC and auto adapters to charge secondary battery pack—\$119

Warranty: one year (extended warranty available)

Service Plan: through dealer or third-party maintenance company

Circle Reader Service Number 301

DELL 320N

CPU: 80386, CPU Speed: 20 MHz

Conventional Memory: 640K, Extended Memory: 1MB, expandable to 5MB

Ports: serial, parallel/external drive, VGA, keyboard/keypad, mouse

Drives: 3½-inch 1.44MB floppy, 40MB or 60MB hard

Video Modes: VGA

Screen Type: triple supertwist LCD

Standard Accessories: battery pack, nylon case, AC power adapter

Optional Accessories: 1MB memory—\$149.00, 2MB memory—\$249.00, 4MB memory—\$498.00, monochrome VGA monitor—\$149.00, color VGA monitor—\$399.00, Super VGA color monitor—\$499.00, 2400-bps data/fax modem (price unavailable), extra battery—\$79.95, DOS 3.3—\$99.95, DOS 4.01 or 5.0—\$119.00, pocket network adapter cards—\$279.00—\$659.00, 9600-bps fax—\$399.00, 8387 SX coprocessor—\$349.00, external 5¼-inch 1.2MB drive—\$349.00, 40/120MB external tape backup unit—\$449.00, numeric keypad—\$149.00, automobile adapter—\$129.00, additional AC adapter—\$69.95, pseudoleather case—\$99.95, replacement slip case—\$17.95

Warranty: one year parts and labor, 30-day satisfaction guarantee

Service Plan: automatic one-year contract with next-day on-site replacement, can be extended for additional fee; offered by Dell, performed by Xerox

Circle Reader Service Number 302

GRID 1720

CPU: 80C286, CPU Speed: 16 MHz

Conventional Memory: 640K, Extended Memory: 1MB, up to 5MB

Ports: serial, parallel, VGA, external PS/2-compatible keyboard, modular phone jack

Drives: 3½-inch 1.44MB floppy, 20MB or 60MB hard

Video Modes: CGA, EGA, VGA

Screen Type: backlit triple twist LCD

Standard Accessories: internal rechargeable/removable battery pack, DOS 4.01, AC power supply, 2400-baud modem, real-

time clock

Optional Accessories: leather carrying case, corduroy carrying case, enhanced battery, Xircom token ring adapter, ethernet adapters (prices unavailable)

Warranty: one year

Service Plan: information available by calling Grid

Circle Reader Service Number 303

HYUNDAI SUPER-LTS

CPU: 80386SX, CPU Speed: 8/16 MHz switchable

Conventional Memory: 640K, Extended Memory: 2MB, expandable to 6MB

Ports: serial, parallel, VGA, external floppy drive, external keyboard

Drives: 3½-inch 1.44MB floppy, 40MB hard

Video Modes: VGA

Screen Type: backlit supertwist LCD

Standard Accessories: AC adapter, ni-cad battery, MS-DOS 4.01, GW-BASIC

Optional Accessories: 2400-bps modem—\$395, soft black carrying case with shoulder strap—\$95, extra battery pack—\$145

Warranty: 18 months

Service Plan: through dealer

Circle Reader Service Number 304

LEADING EDGE D/LT386SX PLUS

CPU: 80386, CPU Speed: 16 MHz

Conventional Memory: 640K, Extended Memory: 2MB

Ports: serial, parallel, VGA, mouse

Drives: 3½-inch 1.44MB floppy, 40MB or 100MB hard

Video Modes: VGA

Screen Type: backlit supertwist LCD

Standard Accessories: battery, MS-DOS, GW-BASIC, and Windows 3.0

Optional Accessories: modem—\$199, extra battery pack—\$70, cigarette-lighter adapter—\$6, carrying case—\$70

Warranty: 12 months on all equipment

Service Plan: no on-site for laptops; carry-in to dealers; number listed above

Circle Reader Service Number 305

PANASONIC CF-270 BUSINESS PARTNER

CPU: 80C286, CPU Speed: 16 MHz
Conventional Memory: 640K, Extended Memory: 1MB, expandable to 5MB
Ports: serial, parallel, VGA, external keyboard
Drives: 3½-inch 1.44MB floppy, 20MB hard
Video Modes: VGA
Screen Type: backlit supertwist LCD
Standard Accessories: MS-DOS, GW-BASIC, diagnostic utilities, AC adapter
Optional Accessories: 1MB RAM card—\$369, rechargeable ni-cad battery—\$99, internal 2400-baud modem—\$199
Warranty: one year parts and labor
Service Plan: through Panasonic
Circle Reader Service Number 306

SHARP PC-6220

CPU: 80286, CPU Speed: 12 MHz
Conventional Memory: 640K, Extended Memory: 1MB, expandable to 3MB
Ports: serial, parallel, numeric keypad, bus for expansion unit
Drives: 20MB hard
Video Modes: CGA, EGA, VGA, MDA
Screen Type: backlit triple supertwist LCD
Standard Accessories: AC adapter, MS-DOS, *LapLink*
Optional Accessories: CRT cord—\$149, 1MB memory—\$499, add-on battery—\$249, 3½-inch 1.44MB floppy drive—\$299, fax/modem—\$499, numeric keypad—\$99, expansion unit—\$699
Warranty: one year for service and parts
Service Plan: through Sharp Electronics
Circle Reader Service Number 307

TANDY 2810 HD

CPU: 80286, CPU Speed: 16 MHz
Conventional Memory: 640K, Extended Memory: 384K, expandable to 5MB
Ports: serial, parallel, VGA, external keyboard, external disk drive
Drives: 3½-inch 1.44MB floppy, 20MB hard
Video Modes: VGA
Screen Type: backlit triple supertwist LCD
Standard Accessories: MS-DOS 4.01, battery, *DeskMate 3*, LIM 4.0, AC adapter, charger
Optional Accessories: 2400-baud internal modem—\$199.95, replacement battery—\$99.95, 1MB memory—\$399.95, carrying cases—\$39.95—\$49.95
Warranty: one year
Service Plan: optional extended plan with Radio Shack
Circle Reader Service Number 308

TEXAS INSTRUMENTS TRAVELMATE 2000

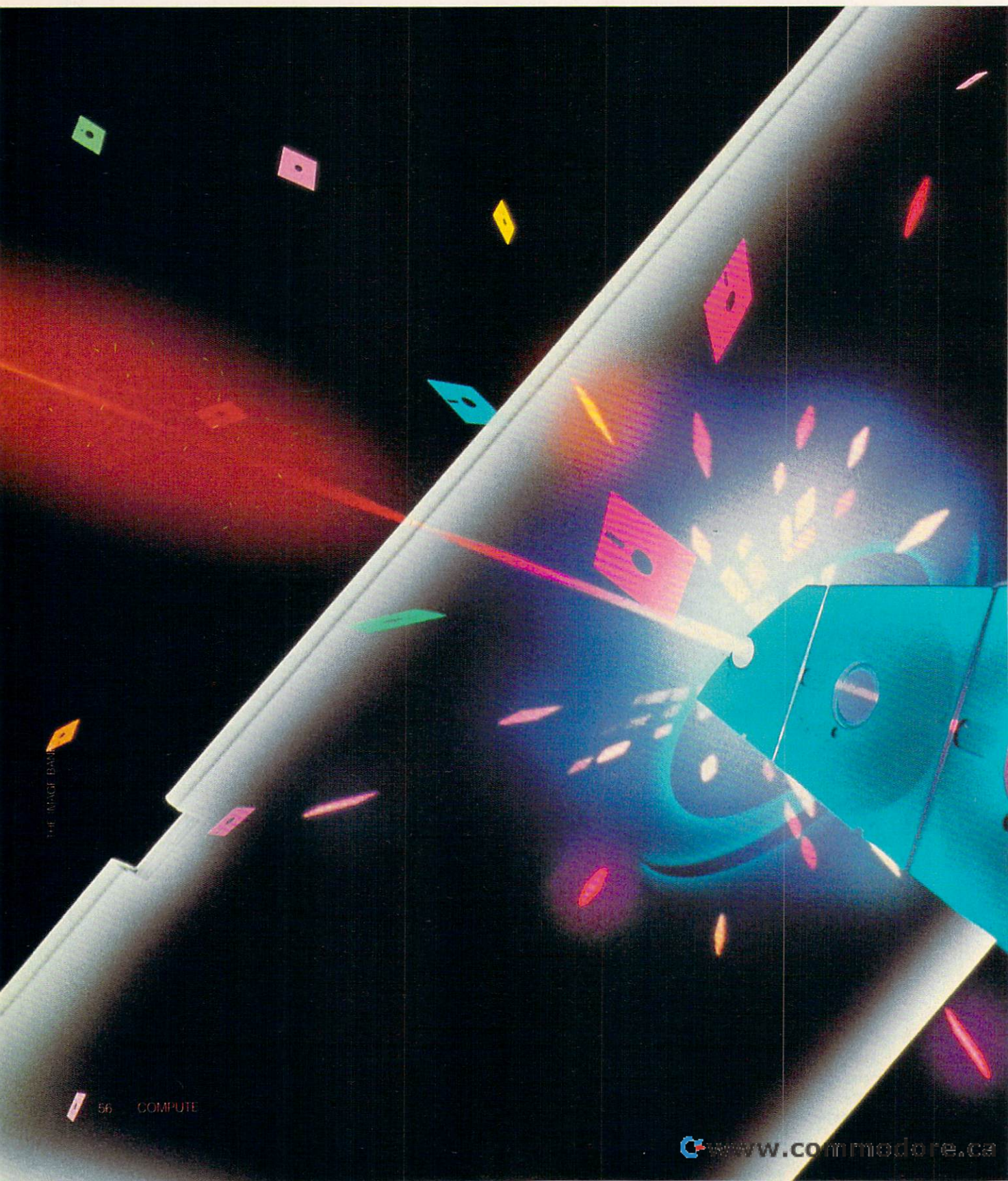
CPU: 80286, CPU Speed: 12 MHz
Conventional Memory: 640K, Extended Memory: 1MB, expandable to 3MB
Ports: serial, parallel, numeric keypad, expansion station
Drives: 20MB hard (standard), 40MB hard (optional)
Video Modes: VGA
Screen Type: sidelit triple supertwist LCD
Standard Accessories: DOS 4.01, *BatteryWatch*, *Laptop and File Manager*, *LapLink*
Optional Accessories: modem—\$299, extra RAM module—\$399, optional floppy drive—\$219, math coprocessor—\$589, CRT interface—\$109, extra battery pack—\$89, external battery pack—\$179, numeric keypad—\$69, deluxe carrying case—\$69, leather portfolio—\$49, expansion station—\$799
Warranty: one year
Service Plan: optional, varies by location
Circle Reader Service Number 309

TOSHIBA T1000LE

CPU: 8086, CPU Speed: 9.54 MHz
Conventional Memory: 640K, Extended Memory: 1MB, expandable to 9MB
Ports: serial, parallel
Drives: 3½-inch 1.44MB floppy, 20MB hard
Video Modes: CGA
Screen Type: sidelit supertwist LCD
Standard Accessories: DOS 3.3, Reference Guide, Portable Companion, MS-DOS Manual, FirstTime Guide
Optional Accessories: 1MB memory—\$269, 2MB memory—\$479, 4MB memory—\$889, 8MB memory—\$1,779, universal AC adapter—\$75, battery pack recharger—\$279, battery pack 2200 milliamps—\$105, battery pack 1700 milliamps—\$65, modem-slot battery pack—\$65, fabric carrying case—\$79, leather carrying case—\$105, automobile adapter—\$59, 2400-bps Hayes-compatible modem for dedicated slot—\$279, 2400-bps Hayes-compatible modem (cellular modem)—\$359, external 5¼-inch 360K floppy—\$399, Toshiba BASIC 3.0—\$99, MS-DOS 4.01—\$99, *Desk Station II*—\$1,199
Warranty: one year parts and labor
Service Plan: Exceptional Care (Toshiba), first year free
Circle Reader Service Number 310

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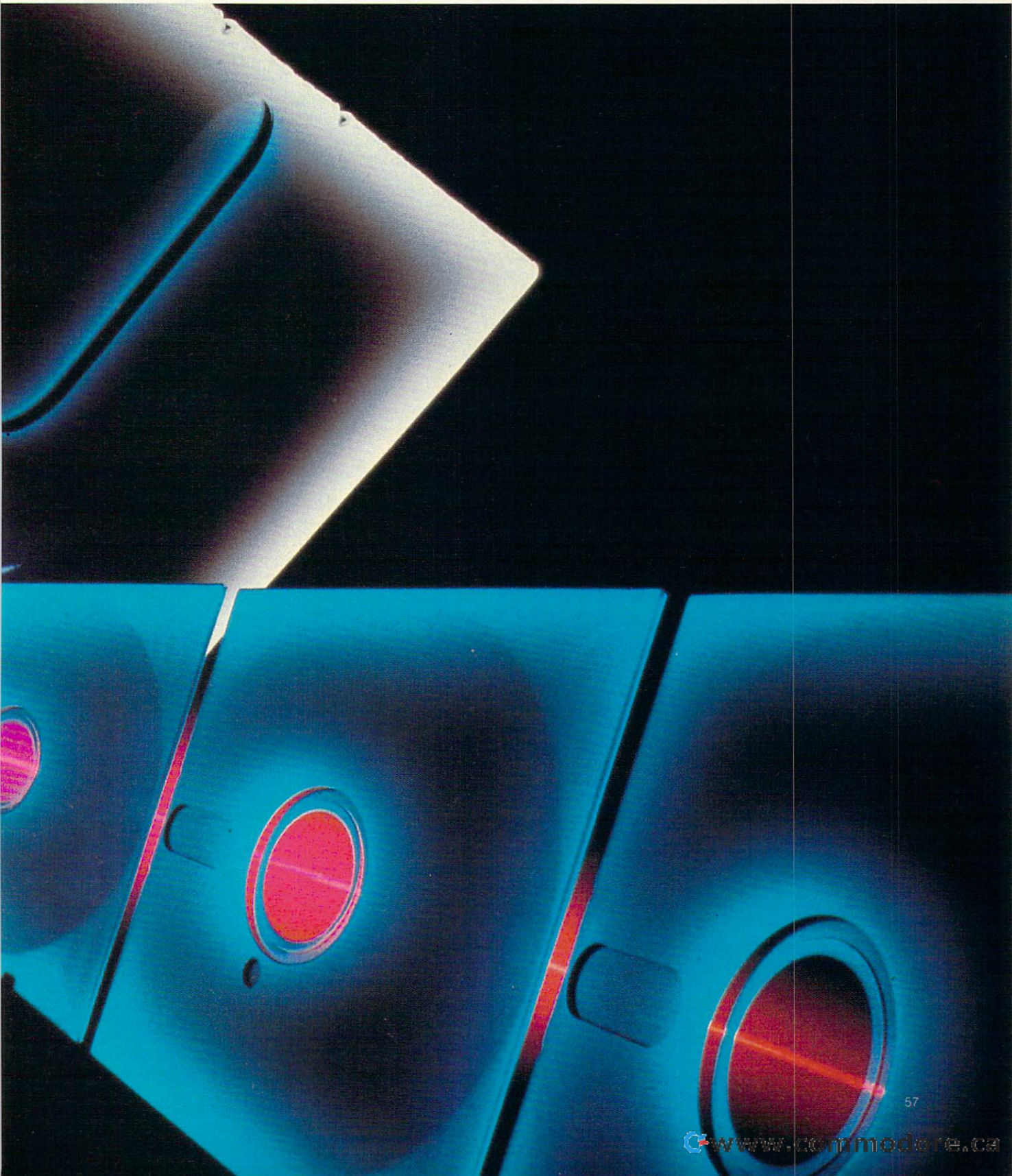
DOS 5.0 A PERFECT 10



THE IMAGE BANK

THE
SOFTWARE BARGAIN
OF
THE YEAR

BY MARK MINASI



Since its introduction ten years ago, DOS has seen a lot of changes, not all for the better. People with long PC experience and good memories know that new versions of DOS are often mixed blessings, so the news that there's a new version may not bring a smile to everyone's face.

But this version is different, and it *ought* to make you smile. With version 5.0, DOS has emerged from its stormy adolescence and developed into a mature, well-rounded operating system.

What's so special about this DOS? Well, it uses less memory than previous versions and includes commands that allow you to unerase files and, more amazing, unformat disks.

It comes with a shell that lets you run multiple programs at the same time, and it remembers your last 20 or so commands, allowing you to recall, edit, and reissue them, saving countless keystrokes.

With the new DIR command, you can sort files by name, size, date, or extension; show hidden files; *only* show hidden files or files that haven't been backed up; and a multitude of other possibilities.

If I sound breathless, I am. I've worked with enough so-called new-and-improved software products to know what to expect of a new operating system. I figured that 5.0 either wouldn't work with my Novell network, would clash with my *OnTrack Disk Manager*, or wouldn't run with *Windows*, and on and on.

Imagine my surprise when I saw that 5.0 ships with a Novell driver, a 5.0-compatible version of the *OnTrack* software, and new and cleaner versions of EMM386.EXE and HIMEM.SYS, the critical memory-organizing device drivers used by *Windows 3.0*!

Microsoft has really put some thought into this system, and I'm sure it's going to pay off. I wouldn't be surprised if virtually everyone in the PC world hasn't switched to DOS 5.0 within a year.

More Memory

At a recent press conference, a Microsoft PR person asked, "What is Microsoft best known for?" A member of the audience shouted, "The 640K limitation!"

That wasn't the answer the flack was looking for, but it addressed perhaps the best-known and most annoying limitation of MS-DOS. The operating system is restricted to using the lowest part of your computer's memory potential, called *conventional memory*.

Some vendors have responded to this problem with clever programs called *memory managers*. The best-

selling of these are *QEMM*, from Quarterdeck Systems, and *386MAX*, from Qualitas. These programs allow you to make some use of the extended memory that often goes unused on a 386, 386SX, or 486 system. These 386-type systems can theoretically have more than 4000 megabytes of extended memory, so any program that lets you use some extended memory is obviously valuable.

These memory managers perform two main functions. First, they allow you to load device drivers and memory-

You'll need to focus on the HIMEM.SYS and EMM386.EXE device drivers, the new DOS=HIGH,UMB command, the DEVICEHIGH CONFIG.SYS command, and the LOADHIGH AUTOEXEC.BAT command.

You'll have to noodle around with these a bit to make them work well, but it's worth the time. One final caution: In order to load DOS above the 640K addresses, you need an 80286 or better computer; to load device drivers and TSRs above 640K, you need an 80386 or better.

DOS 5.0'S TOP TEN FEATURES

- New memory manager that loads DOS, device drivers, and TSRs into high memory (DOS, HIMEM.SYS, and EMM386.EXE)
- New unerase, unformat, and file-system tracking commands (UNERASE, UNFORMAT, and MIRROR)
- New text editor with full mouse support and pull-down menus (EDIT)
- New QuickBASIC interpreter (QBASIC)
- New command-history retriever (DOSKEY)
- Improved SYS command (SYS)
- Improved shell with built-in task switcher (DOSSHLL)
- Improved directory command (DIR)
- Improved disk checking (CHKDSK)
- Improved memory viewing (MEM)

resident TSR programs above the 640K of conventional memory, freeing up conventional memory that was once used by these helpers.

Second, they temporarily translate some of that otherwise-unused extended memory into a third kind of memory called *expanded memory*, memory used by programs like 1-2-3 version 2 or *WordPerfect* version 5.1.

Both of these functions are valuable, and that's why both Qualitas and Quarterdeck sales are doing well at the moment.

But now, they have competition from DOS itself. The new HIMEM.SYS included with 5.0 does more than simply serve *Windows*; it provides the real magic behind one of 5.0's most eye-catching features.

Is There Really 614K Free?

I just ran CHKDSK, and it told me that, despite having loaded a pile of memory-hungry device drivers and TSRs, I have 614K of my 640K free. Under DOS 3.3, that number would've been somewhere around 520K; under 4.01, it would be about 508K.

HIMEM, in concert with a new CONFIG.SYS command DOS=HIGH, actually loads as much as 64K of DOS into your computer's extended memory! Another 5.0 program, EMM386.EXE, allows you to load device drivers and TSRs above 640K, just like *QEMM* and *386MAX*, and again, it works without a hitch with *Windows*.

Once you get a copy of 5.0, don't miss out on these memory benefits.

A Kinder, Gentler File System

You've done it. I've done it. Everyone's done it at some point or another: accidentally erased a file. If you're like millions of PC users, you've gone out and purchased *The Norton Utilities*, *PC Tools*, or *The Mace Utilities*. But 5.0 now includes the utilities UNDELETE, UNFORMAT, and MIRROR from Central Point Software's *PC Tools Deluxe*. UNDELETE reverses a file erasure—within limits. If you wait too long between when you've erased the file and when you try to undelete it, it may no longer be recoverable.

How does UNDELETE work this minor miracle? Simple. When DOS erases a file, it doesn't go to the actual trouble of overwriting the area on disk where the file resides. Instead, it just marks that area as usable for creating new files.

As long as you don't create any new files, there's no demand to actually utilize this available area. Create a new file, however, and there's the chance that your "erased" file will actually be irrevocably overwritten. UNDELETE sniffs out the waiting-to-be-overwritten file and reconstructs its old directory entry.

You can make life easier for UNDELETE, however, with another of the Central Point tools now in 5.0: MIRROR. MIRROR makes a copy of your system's table of contents—two areas you may have heard of, called the *File Allocation Table (FAT)* and the *root directory*.

Both UNDELETE and UNFORMAT



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USING DOS 5.0'S MEMORY MANAGER

To get the most from 5.0's new memory management skills, you need to follow a few simple rules.

The first two lines in your CONFIG.SYS file should install HIMEM.SYS and EMM386.EXE in that order. If you're running EMM386 just to load device drivers and TSRs high and aren't using its ability to emulate expanded memory, you'll need to add the parameter NOEMS. Also, if your system includes hardware that uses addresses between 640K and 1024K, you'll need to add the exclude switch (X) to tell EMM386 not to use those addresses. Here's an example of those first two lines:

```
DEVICE=C:\DOS\HIMEM.SYS
DEVICE=C:\DOS\EMM386.EXE NOEMS
X=CC00-D000
```

Make sure you use DOS 5.0's HIMEM and EMM386 commands. You may have several copies of these on your hard disk. Find the old ones and delete them.

Now you're ready to load device drivers and TSRs high.

To load a device driver high, instead of using DEVICE=, you use DEVICEHIGH=. For example, to load ANSI.SYS high, you'd use the command DEVICEHIGH=ANSI.SYS. It's important to note that you can't use DEVICEHIGH with HIMEM.SYS and EMM386.EXE.

As a rule, it's best to load programs in order by size, starting with larger programs.

To load DOS itself high, you'll want to add the command DOS=HIGH,UMB.

Here's a sample CONFIG.SYS for DOS 5.0:

```
DEVICE=C:\DOS\HIMEM.SYS
DEVICE=C:\DOS\EMM386.EXE NOEMS
DEVICEHIGH=C:\DOS\SMARTDRV.SYS
2048 1024
DEVICEHIGH=C:\DOS\SETVER.EXE
```

```
DEVICEHIGH=C:\DOS\ANSI.SYS
DEVICEHIGH=C:\MOUSE.SYS /S50
SHELL=C:\DOS\COMMAND.COM C:\
DOS\E:512 /P
BUFFERS=10
FILES=40
STACKS=0,0
DOS=HIGH,UMB
```

To load TSRs high, you simply precede the command in your AUTOEXEC.BAT with LOADHIGH. For example, to load DOS's new DOSKEY command-history retriever into conventional memory, you'd put the command DOSKEY in your AUTOEXEC.BAT file. To load this program into high memory, you use the line LOADHIGH DOSKEY.

Here's a sample AUTOEXEC.BAT:

```
@ECHO OFF
VERIFY OFF
PATH C:\DOS;C:\WINDOWS;C:\WINDOWS\
UT;C:\BA;C\UT;C\UT\NU;C\UT\XY
C:\DOS\MIRROR C: /I
SET DIRCMD=W/P/PON
PROMPT $S $PSG
LOADHIGH C:\DOS\DOSKEY /INSERT
CD \WINDOWS
WIN
```

There's one more command that's essential for memory management—MEM. MEM's been around since DOS 4.0, but it has a new feature that displays how much memory your device drivers and TSRs are using and where in conventional or upper memory they're loading.

To get the big picture, type MEM/C IMORE at the DOS prompt. If some of the programs you tried to load into high memory actually loaded into conventional memory, change the order in which they load. You'll probably need to experiment a little to get the most from 5.0's excellent new memory management features.

—CLIFTON KARNES

your hard disk. More than once, I gave up trying to get SYS to play ball and just reformatted the disk to get the new DOS on the hard disk.

SYS is now much more accommodating. So much so, in fact, that it seems amenable to making any disk bootable, so long as there's about 85K of free space on the disk for the system files.

The UNDELETE and UNFORMAT programs, and others like them, have certainly been available through third parties for years. But it's nice to finally see them included with DOS. These tools are too good for just power users to know about. And the fact that SYS is finally useful (after a mere ten years) is quite welcome.

The Old Shell Game

More and more PC users prefer a program-launching, file-managing shell program to the arid charms of the C prompt, so word of DOS 4.01's shell program was greeted enthusiastically in the user community—at least until the community actually saw the shell.

You could say that the DOS 4.01 shell was to shells what EDLIN is to editors. DOS 5.0's DOSSHELL improves on the previous shell to a point where it's actually not bad, as shells go. Even veteran command line jocks may find a use for the shell's newest feature—task switching.

With task switching, any computer, even an XT, can load multiple programs and switch among them. Now, be sure to read that correctly. This isn't full-fledged multitasking. Load 1-2-3 and WordPerfect, and only one of them is actually running at any time—the program that you're working with.

But when you want to switch from 1-2-3 to WordPerfect, you don't need to exit 1-2-3 and start WordPerfect. Rather, you just type Alt-Esc, a key combination familiar to Windows users.

The main benefit is quick switches from one program to another, which could be quite a welcome benefit for a user with an older 8088-based system or someone who doesn't want to have to fool with Windows just to load multiple programs.

Each DOS session, by the way, gets 582K of RAM (on my system, at least)—not bad for a task switcher that comes free with the operating system.

Other than task switching, the shell has the usual shell features—mouse support for selecting files for copying and deleting, a visual representation of your disk's tree structure, and point-and-click program launching.

There are a couple of little extras, too: a 50-line screen mode and the an-

use this copy as a starting point when reconstructing files after damage or erasure. The MIRROR backup isn't essential, but it greatly increases your chances of data recovery. And running it regularly is painless—just include it in your AUTOEXEC.BAT.

The third command of this group is the most amazing: UNFORMAT. Accidentally format a floppy disk or a hard disk, and in a twinkling you can undo the damage. This seems to violate the laws of physics, but again, there's no real magic involved. It's already been said that erasure operations don't actually overwrite files. Instead they tell DOS to forget that the files exist and treat the areas in which they reside as available. As it turns out, the FORMAT command just does the same thing on a grand scale.

UNFORMAT reconstructs the FAT and root directory, effectively nullifying the accidental FORMAT operation—again, this only works if you run UNFORMAT before you create any new files.

Along the lines of data recovery, there are two minor revisions of old DOS programs that are worth mentioning. FORMAT itself is smarter and can now format a disk in just 16 seconds, provided that the disk has already been formatted at some time in the past.

And SYS, the DOS utility that makes disks or hard drives bootable, used to be very picky about which disks it would work with. Its criteria for bootability were so stringent that it was nearly useless.

SYS's limitations really showed when trying to upgrade the DOS on

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swer to an old DOS question, How do I rename a directory? The customary way to rename a directory has been to create a new one with the desired name, copy the files to the new directory, and erase the old one. But with the DOS shell, you just click on the directory and select Rename under the File menu.

Teaching an Old DOS New Tricks

Finally, there's a group of items for which 5.0's designers can be justly proud. DOS 5.0 eradicates bugs (some ancient, some arising as recently as DOS 4.01), and it adds many long-awaited features.

Perhaps the most significant of these is much smoother support for large drives. DOS 4.01 supported drives larger than 32 MB—that was almost its sole saving grace—but it had a catch. In addition to the extra 10K of RAM that DOS 4.01 needed, you also had to load SHARE, a memory-resident program that burned up a few more K all by itself.

Setting up drives is a bit easier with the new FDISK. FDISK, for those who've avoided it, is one of the programs that you (or someone) must run when setting up a new hard disk.

Part of the setup process divides a hard drive into sections used by differ-

ent operating systems—some for DOS and some for UNIX, for example. Most of us give 100 percent of the disk to DOS, but whoever sets up the disk must still make the explicit step of allocating the entire disk to DOS. DOS is not the primary partition by default.

Under previous versions of DOS, a setup person occasionally ran into a blockade. If there's already a partition from an operating system other than DOS (such as UNIX), FDISK couldn't delete it. This put installers in a difficult position if they didn't have the FDISK for the originating operating system. Only the UNIX FDISK could delete a UNIX-created partition. With 5.0's FDISK, however, you can now delete any kind of partition.

Since DOS 2.0, CHKDSK has done an odd thing when it encounters a disk problem called *lost clusters*. It tells you that you've got lost clusters—a relatively minor problem indicating some confusion in DOS's disk house-keeping—and offers to fix them. You give it the go-ahead, but it doesn't actually fix the problem.

Then you look more closely at the screen. Before it told you about the lost clusters, it warned you that the /F option wasn't activated, so changes would not be written to disk. What it was trying to tell you was that some-

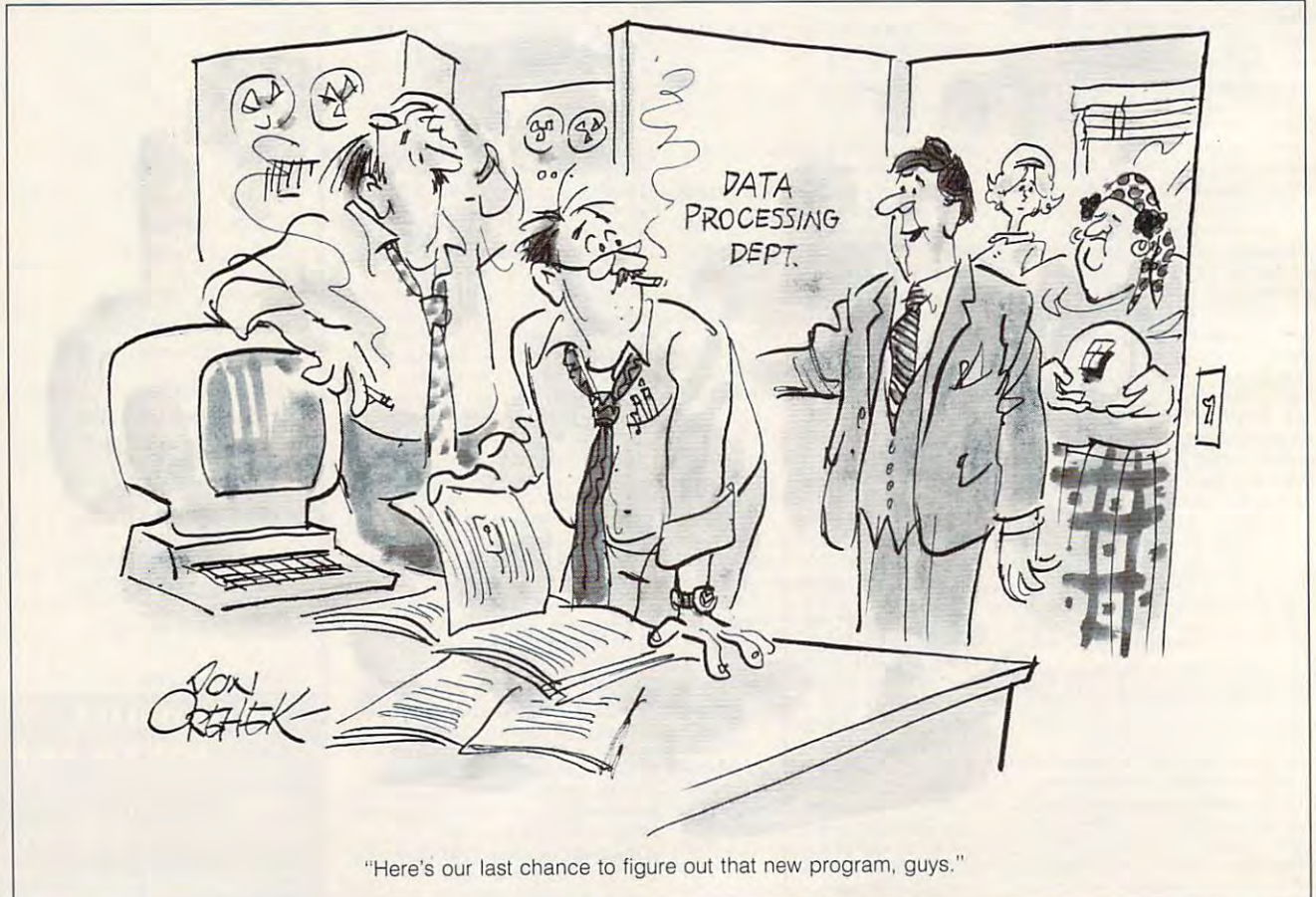
thing was wrong, but that CHKDSK wasn't started with the /F option and that CHKDSK isn't allowed to make any changes to the disk, even much-needed fixes, without the /F option.

That doesn't keep CHKDSK, however, from leading you to believe that it is going to do something useful with the next few lines. It has confused more than one user, but no longer. Now CHKDSK is much more direct, telling you that you have a problem and that you must rerun CHKDSK with the /F option in order for it to fix the problem.

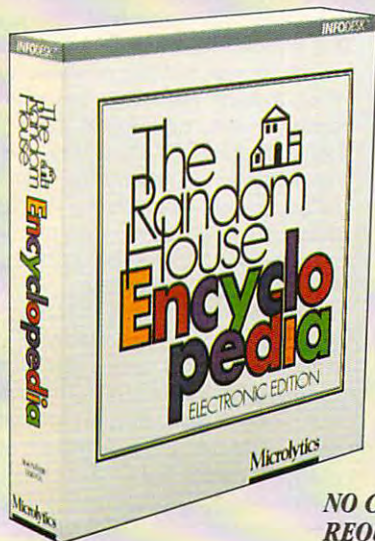
EDIT, DIR, and More

A few paragraphs back, I did a little left-handed EDLIN bashing. EDLIN's still around—for the purists—but now there's EDIT, a fairly complete full-screen text editor. It supports the mouse and has search and block operations, word-wrap, and printing—all supported by a pull-down menu system. It's easy to use, it boasts good help, and it's fast.

Ever wanted to sort the output from a DIR command? The new DIR command can sort files by size, extension, name, or date of creation. When cleaning out a directory to make space, you can sort the files by size (DIR /OS) so that you can figure out which files will yield the most space once deleted.



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DOS has had an almost human life cycle. At birth, ten years ago, it was a promising new baby of an operating system. It couldn't support hard disks or serial printers, but it could do basic things fairly well, certainly as well as other operating systems on microcomputers at the time.

PC-DOS 1.0 included the COPY, ERASE, and TYPE commands; it even included a version of CHKDSK. DOS 1.1 followed a bit later, offering a few bug fixes as well as support for the then-new 360K double-sided drives. (Remember that for years, the driving force for new versions of DOS was support for new IBM hardware.)

Meanwhile, Microsoft began a tradition of offering roughly parallel, slightly tardier, but more stable versions of DOS called MS-DOS. In truth, it never really mattered all that much whether you used MS- or PC-DOS, since they both ran on almost all machines. The first release of MS-DOS was version 1.25.

DOS left toddlerhood with 2.0, which saw the beginning of hard disk support, device drivers, and a few notions stolen from an older operating system typically seen then on minicomputers—UNIX. DOS 2.0's quantum leap from 1.1 was the kind of development that would make any parent proud.

Somewhere after version 2, however,

THE CHANGING FACE OF DOS

DOS entered a stormy adolescence. PC-DOS 2.1 (MS-DOS 2.11) was just a slightly more memory-hungry version of 2.0 that IBM released mainly to support the substandard floppy drives it put on the late and unlamented PCjr and the now-forgotten PC Portable.

DOS 3.0 was an example of more growing pains. IBM released it to support the new 1.2MB drives shipped with the AT, but inside it was very different. The file system was cleaned up a bit, and the entire operating system's source code was converted from assembly language to C.

None of these changes were apparent to users, but people certainly noticed the conversion's unpleasant side effect: DOS 3.0 took up 50 percent more memory than 2.1.

DOS 3.1 was written to support an IBM LAN product, 3.2 added support for the 720K floppies on the IBM Convertible and added a few commands (XCOPY is the most prominent), but it was really 3.3 that convinced people to upgrade to version 3.

DOS 3.3 was a bit more stable (although it wouldn't run with some compatibles' hard disk controllers) and provided a way to support hard drives larger than 32MB through logical drives. Instead of telling DOS that you had a hard drive of the unpalatable size of, say, 60MB,

you'd tell it that you had two hard drives—one the maximum size of 32MB, the other 28MB.

DOS 4.0 tried to present a better face to the world in the form of the original DOS shell, but that face suffered from near-terminal acne. The quickly patched 4.01 tamed the obvious bugs, but 4.0 is still far outsold by its older brother, version 3.3.

Now, with DOS 5.0, it seems that DOS has gone to college, lost a little weight, learned a few manners, and gotten a bit of polish. It even gets along better with its relatives, OS/2 and Windows.

Memory Munching

To get an idea of how DOS's appetite for memory has changed over the years, here's a comparison of DOS versions with the memory requirements for each.

Version	Memory Requirement (K)
1.0	11
1.1	12
2.0	24
2.1	26
3.0	37
3.1	38
3.2	53
3.3	54
4.01	65
5.0	61 (without memory manager)
5.0	29 (with memory manager)



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You can finally display hidden files (DIR /AH), or for that matter, you can display only those files that have their archive bits set (DIR /AA)—that is, files that haven't been backed up yet. And now there's a feature wherein DIR will search more than just the current directory. Can't remember where you put RESUME? It's easy to find; DIR \RESUME /S/B does the trick.

And once you've decided on the DIR switches you'd like to use, instead of typing them each time you issue the

DIR command, you can set an environment variable. For example, to always sort on filename, you'd put SET DIRCMD=/ON in your AUTOEXEC.BAT.

Now DIR not only shows you how much free space is on the disk but also computes the total amount of space taken by the files whose names it has just shown you. For example, type DIR *.BAT and it will, as always, show you all the files with the BAT extension, but it will also tell you how

much space is taken up in total by those files.

And once you've found all of those BAT files, perhaps you'd like to erase some, but not all, of them. Just type ERASE *.BAT /P. The /P means pause and verify for each file. One by one, it examines all of the files, asking if that file should be erased.

Of course, having all these new options means you may miskey now and then, which makes yet another new command, DOSKEY, all the more useful. DOSKEY remembers your last 20 or so commands. Using the up- and down-arrow keys, you can recall a previous command, edit it, and reissue it, saving tons of keystrokes.

You can even write macros and assign them to keys, the way you do with 1-2-3 and other applications. There have been public domain versions of this utility around for years, but it's nice to see it's finally part of DOS.

If you've cursed DOS's BASIC interpreter, either BASICA or GW-BASIC depending on your DOS version, DOS 5.0 has a surprise for you. The new DOS comes with a reduced-function version of Microsoft's QuickBASIC compiler. It even ships with a few sample programs that are a bit more interesting than the old mortgage calculator.

Space is running out, so let's see what's left. The ATTRIB command can now modify hidden and system attributes, in addition to the archive and read-only bits, which it could modify before.

MODE CO80,50 shows a 50-line screen on VGA; there's a 43-line mode for EGA. MODE will also speed up your keyboard.

And all these neat new features cried out for another new feature: built-in help. Can't remember the new syntax for DIR? No problem. Just type DIR /?, and you'll get a complete listing of the options and syntax for the command.

So there you have it. Not only is MS-DOS 5.0 a stable replacement for its older brother 4.01, but it reduces the need for file recovery tools like *The Norton Utilities* (around \$100), task switchers like *Software Carousel* (around \$80), 386 memory managers (around \$100), hobby-level BASIC compilers (around \$70), and full-screen text editors (\$50 to \$400). Not a bad deal. I'd say DOS 5.0 is the software bargain of the year.

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Denny Atkin

A NEW MEANING FOR ONLINE HELP

It's 9:45 on Friday night, and you can't get your new *Windows* spreadsheet to print sideways on your ink-jet printer. The software company's offices won't open again until Monday morning, so you can't call the technical support line. What will you do?

You could try calling local bulletin board systems and posting a plea for help there, but the odds are pretty slim that someone else in Hattiesburg, Mississippi, is using the same hardware and software combination that's troubling you now. You'd better call a national service, where you're more likely to find someone familiar with your problem.

The first place to check is in the technical support chapter of your program's manual. If the company has an online support round table, chances are good you'll find it listed there. If not, log on to your favorite network, open your terminal program's capture buffer, and get a list of all of the special interest groups (SIGs) on the network. Log off and peruse the list offline, looking for SIGs that cover topics related to your problem. Since you won't feel the "time is money" pressure checking the list offline, you might find more areas appropriate to your problem.

Once you find a SIG that might help with your problem, all you can do is upload your problem and hope that someone answers you in time, right? Wrong! Why wait for an answer that might already be there?

Many online services will let you search message categories for occurrences of a specific word or phrase. If your service of choice has such a feature, use it to search for an appropriate word—in this

case, perhaps *sideways* or *printing*. If not, then open your capture buffer and invoke a nonstop read command of the messages in that particular category. Close the buffer, log off, and load the capture file into a text editor.

You can now use your text editor's search command to hunt quickly through the file for words that might flag a message that relates to your problem. With any luck, one of these methods will find a message relating to your problem and how to solve it.

If not, though, don't despair. Chances are you can leave a message online and still get some helpful advice before your deadline.

Check for a support area for the publisher of your spreadsheet program. If that turns up nothing online, check for a *Windows* support area. If you're on BIX, you'll find IBM.WINDOWS. On CompuServe, there's the MS Windows Advanced Forum (WINADV), the Windows New Users Forum (WINNEW), and three *Windows* third-party forums (WINAPA, WINAPB, WINAPC).

If you don't have any luck there, find the general forum for your computer platform, in this case an IBM compatible. On BIX, check IBM.PC; on GENIE, go to the IBMPC Roundtable at page 615; on CompuServe, check the IBM Applications forum (IBMAPP); and on People/Link, GO IBM. You might also want to see if there's a SIG run by your printer manufacturer, since you're having a printing problem.

Hooray! You've found a topic discussing your spreadsheet program. The next thing to do is to compose a message describing your problem and asking for help. It's smart to leave messages in more than one area, in the hope that more people will see your message and you'll be likely to

get an answer faster.

When you type your message, make sure you provide all the necessary details. Include your hardware configuration, DOS version, software versions, and any TSRs or other applications you may be running at the time. Explain exactly what's happening when the problem occurs. The more detail you provide, the more likely someone will come up with a solution for your problem.

If you post your message in more than one SIG, though, don't leave the same long, detailed message in each one. That would be costly to you and to the people who have to read your message over and over again. In the other areas, post something along these lines: "I'm having problems printing to my Howitzer BJ-220 printer using the *Aileron for Windows* spreadsheet. If you think you can help, please see message 42 in the Windows/Spreadsheets conference."

You could ask that any helpful hints be sent via electronic mail, which would be easier to check the next day, but then you'd be depriving others of information that could potentially help them later.

Next, you log off and go to bed. The following morning you log on, and someone has referred you to a new printer driver that you can download on that service. You grab the driver and install it, and your spreadsheet prints beautifully. Even if somebody didn't leave a solution to your problem, chances are good that you'll find some hints that will help you isolate the problem.

The next time your work comes to a grinding halt due to a technical problem at a weird hour, don't get ticked off; log on instead.

Send comments and suggestions to DENNYA on BIX and GENIE, DENNY on Plink, or 75500,3602 on CIS. □

No matter when problems arise, the help you need can be found online.

Really Wild Cards

Sometimes you want to be able to use wildcard specifications on programs or DOS commands that don't support them. It might be convenient to enter the command `TYPE *.TXT` to read a directory full of text files. But it doesn't work that way.

However, `STAR.BAT` does that—and one better. It allows you to use *lists* of file specifications! For example, enter the command `STAR TYPE *.TXT *.BAS TEST.C` to run the `TYPE` command on all text files, all BASIC files, and the C program `TEST`. The `STAR` program does its magic with the sorely neglected `FOR` command in batch:

```
ECHO OFF
CLS
REM Check for at least 2 parameters.
IF "%1" == "" GOTO Syntax
IF "%2" == "" GOTO Syntax
REM %%1 is the command or REM program. Everything else REM is matched by the file REM specification.
FOR %%r IN (%2 %3 %4 %5 %6 %7 %8 %9) DO %1 %%r
GOTO Bottom
:Syntax
ECHO Need a program or command name and one or more file specifications.
ECHO For example:
ECHO STAR TYPE *.DOC
ECHO STAR QB S.BAS
TIMER.BAS
:Bottom
```

The heart of the program is its `FOR` loop. `%1` is the name of the program or command. `%2` through `%9` are the command line parameters. Note that the program will quit if it doesn't find at least a pair of parameters: the program or command name, and at least one file specification. The `%%r` gets replaced by each file matching each file specification; in the `TYPE` example

above, all files ending in `TXT` are matched and copied into `%%r` file by file in directory order.

You could improve this program even further by using a `SHIFT`. That would give you even more than the eight file specifications offered by this version of `STAR`, although I've never used more than three or four.

TOM CAMPBELL
IRVINE, CA

Always On

When I teach PC troubleshooting seminars, the most controversial advice in the whole three-day class is to leave the PC on all the time. Why? Here are a few short reasons:

- Turning electronic devices on and off subjects them to a power-on or ballistic surge. Light bulbs burn out mainly when you turn them on, right? The same principle is involved with your computer.
- The small motors on hard disks have a hard time starting up in the morning. Granted, leaving them on all the time will shorten their lives due to the greater demands on the motor bearings, but generally the bearings aren't the things that die. What kills hard drives is that one day they can't get started. Leave them on and avoid the start-up problem.
- Think of all the things that you use every day whose circuits are active all the time: electronic clocks, thermostats, TVs with the instant-on feature. These are all fairly reliable, right?

There *is* a catch to leaving your PC on all the time: You have to make sure that you've got good surge protection and a good fan. With a good fan, your PC can operate in the desert at 105 degrees

and be perfectly happy.

MARK MINASI
ARLINGTON, VA

Reet Delete

Sometimes it's nice to have DOS ask whether I'm sure I want to delete all the files in a subdirectory, but most of the time I know what I'm doing, and I'd just as soon not have to answer any questions from the operating system.

Use DOS redirection to solve this problem. Create a file called `YES.TXT` with a text editor or with `COPY CON`. In this file put the letter `Y` followed by a carriage return. Save it as an ASCII file.

Next, enter the following line in a batch file and save it as `EMPTY.BAT`.

```
ERASE *.* < YES.TXT
```

Now, when you give the command `EMPTY`, the batch file runs and gets its input from the file `YES.TXT`. The `Y` answers the *Are you sure?* prompt for you. You can put the `YES.TXT` file anywhere on your system (I keep mine in the `BATCH` subdirectory) as long as you include its full path when you use it in batch files.

The following command deletes everything in a subdirectory, but this method lets you see what's going on while the files are being deleted:

```
FOR %%F IN (*.*) DO ERASE %%F
```

This deletes every file in the directory, but it does so by executing the `ERASE` command for each file, giving you a chance to double-check the files as they are being eliminated. If you have second thoughts about tossing a certain file, use an `UNERASE` utility to bring it back.

TONY ROBERTS
GREENSBORO, NC

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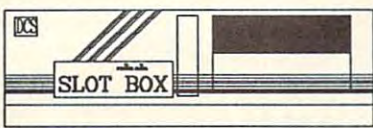
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Graphics Batching

You might assume that, like most utilities, batch files won't work in graphics mode. Not true—they work just fine. Showing remarkable foresight, the designers of the PC wrote the BIOS so that all text services work equally well in either mode, and DOS displays text with the help of BIOS services. So batch files will work. To try it out, create a file called TEST.BAT:

```
REM TEST.BAT
PAUSE Note that text displays just
fine in graphics mode.
```

Then fire up BASIC or GW-BASIC and run this short program:

```
100 REM Go to graphics mode.
110 SCREEN 2
120 REM Drop to DOS and run the
130 REM TEST.BAT program.
140 SHELL "TEST"
150 REM Wait for the user to
160 REM press Enter.
170 INPUT
```

TOM CAMPBELL
IRVINE, CA

Blank Echo

Here is yet another look at echoing a blank line in a batch file. You can't just type ECHO all by itself on a line, because you'll get a message like *ECHO is off*.

ECHO is a three-part command:

- With no arguments, it reports status: ECHO is on, or ECHO is off.
- With arguments ON or OFF, it enables or disables command echoing.
- With any other argument, it just repeats back what you tell it: ECHO Hello will just make the PC say *Hello* on the screen.

How, then, to create a blank line on the screen?

There are three approaches. The first is to use the ANSI.SYS escape codes to move the cursor around, creating blank lines by skipping lines. It's too much work. And if ANSI.SYS wasn't loaded by the user's CONFIG.SYS file, this approach won't work.

An easier way is just to use the ECHO command with a period (.) after it. Try it out:

```
@ECHO OFF
ECHO The following is a blank
line:
ECHO.
ECHO See?
```

(Editor's note: This technique won't work consistently in all versions of DOS.)

The third way is to hold down the Alt key and type 255 on the numeric keypad after the ECHO command. This enters a blank character after the ECHO command, which will print to the screen.

MARK MINASI
ARLINGTON, VA

The Straight and Narrow

Sometimes you need to employ DOS utilities in a batch file, but you can't ensure that they are available on the target machine. For example, this handy line displays a sorted directory:

DIR | SORT

However, it requires that SORT.EXE appear someplace on the path. IF EXIST won't do it, because in order to use it, you must know the full pathname of the file.

FOR comes to the rescue, thanks to the fact that DOS treats the semicolon as a separator. Try this program twice. The first time, use the name of a program you know is on the path; for example, SORT.EXE. Next, try a name you know doesn't exist; for example, LUNKHEAD.TMP. In both cas-

es you should remember the extension; SORT won't work, but SORT.EXE will.

```
ECHO OFF
CLS
IF "%1" == "" GOTO END
SET TMP=N
FOR %%f IN (%PATH%) DO IF
EXIST %%f \%%1 SET TMP=Y
IF %TMP% == Y ECHO %1 is
on the path.
IF %TMP% == N ECHO %1 is not
on the path.
SET TMP=
:END
```

The SET TMP=N line means *Make the value of the environment variable TMP the letter N*. This is short for *No*, because we assume the file doesn't exist. (If you are already using TMP as an environment variable, use some other variable name in place of TMP in the example.) The next line is the heart of the program. The FOR loop searches the path directory by directory doing an IF EXIST search in each one. If the file is found, the value in TMP changes to Y. You can now query this value anytime you want in the program. The program then displays the results of the search and removes the TMP environment variable, since it's no longer needed by your environment.

TOM CAMPBELL
IRVINE, CA

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PROGRAMMING POWER

Tom Campbell

GLOBAL WARNINGS

If you're a regular reader of this column, you're familiar with my diatribes against global variables: They make code harder to maintain and reuse, they can be dangerous, and so on. But globals offer an important feature that local variables don't: They retain their values between subroutine calls.

Of course, this can be a trap. You may find yourself dealing with an unexpected bug (then again, how many of them are expected?) in which the value of a global is supposed to change but doesn't. It can be a long time before you discover that you've created a local variable in one of your routines with the same name as the global.

Another example: In some multitasking environments, where several copies of the same program can be running at the same time, the global variable space, like the code, is a shared resource. So if you've written a word processor and user A adjusts the tab settings while user B is painstakingly editing a complex table, user B's work might suddenly take a nasty turn for the worse the next time the display is reformatted, because you've put the tab settings in a global variable.

Closer to home is *Microsoft C*, which relied on globals to such an extent that a huge number of its library routines, including common ones like `scanf()`, didn't work under *Windows* or *OS/2* because they multitask. The list of verboten routines dwindles with each release of the compiler, but the lesson remains—not even the biggest developers are immune to questionable programming practices.

Disregarding for the mo-

ment that you probably program on a PC and don't have to worry about multiple users, there's a third kind of variable called *static* that gives you the best of both worlds. It has the same scope as a local variable, yet it saves the value of that variable between subroutine calls. Statics may be initialized when declared, but the initialization is performed only once—not each time the routine is called. The name *static* is a C term; *Turbo Pascal* gives these variables the confusing moniker *typed constants*. They're declared in the `CONST` section, yet, unlike normal constants, their values may be altered.

How can statics coexist with the apparently exclusive global and local types? By trickery in the compiler.

Local variables are kept on the stack, which on many machines (80x86 machines among them) can be just about anywhere in memory. Even between invocations of the same routine, that routine's stack can be in a different place, and it's tracked by a variable on the CPU called the *stack pointer*. Since the same local variable could be stored in a hundred different places inside of a second, you can't rely on its value.

Globals, on the other hand, sit placidly in the same place all the time. The compiler itself is therefore written to "remember" the name of a global variable during the entire compilation. It remembers a local variable only while it's generating code for the routine in which that variable was declared (as well as any nested routines, in the case of Pascal) and lets the stack pointer track its physical location in memory at runtime. As you've probably guessed, a static is stored in the same area of memory as global data, but its name is only meaningful to the compiler

while the routine it was declared in is being compiled.

This month's program is `ONPATH.EXE`, which lets you find all files on the path that meet the file specification you give it. To use it, enter `ONPATH file-spec` at the command line. Here are some examples:

```
ONPATH TLINK
ONPATH COMMAND.COM
ONPATH README.TXT > LPT1:
```

Don't give it a leading directory name, as in `ONPATH C:\DOS\LINK.*`. It won't work right, and if you want to restrict your search to a directory, you might as well use `DIR`.

The first example finds all files starting with `TLINK` and ending with any extension. For example, my path is `PATH=E:\BAT;E:\BIN;C:\DOS;E:\WORD5;C:\WINDOWS;E:\BORLANDC\BIN;E:\GEO` and the search for `TLINK` on my machine turned up this disquieting result:

```
E:\BIN\TLINK.EXE
53414 05-07-90 02:00a
E:\BORLANDC\BIN\TLINK.EXE
72585 02-13-91 02:00a
E:\BORLANDC\BIN\TLINK.CFG
19 03-24-91 01:52a
```

3 File(s) found.

When dozens of strange errors popped up in a program after I installed a new compiler, I discovered I needed `ONPATH`. The same program had compiled just fine before. You can't see the culprit above. Two different versions of the linker. Since `E:\BIN` came before `E:\BORLANDC\BIN` on the path, the older linker was being run first.

The second example, using the filespec `COMMAND.COM`, will find all copies of `COMMAND.COM` on your path. I found three versions of `COMMAND`, from

Global variables are tempting, but like spicy food, they can come back to haunt you.

DOS versions 2.0, 3.2, and 3, on the path of one machine (not mine!). Note that, like DIR, ONPATH appends "." as the extension if you don't provide one. ONPATH's output is redirectable, as you can see in the third example.

A static variable is used in the routine NextDirOnPath, which is passed a string to which it writes the name of the next directory on the path. If you have the very short path C:\DOS;E:\BIN, the first call will write C:\DOS to its Result parameter.

Note that NextDirOnPath thoughtfully removes trailing semicolons and backslashes. The second call writes E:\BIN to Result, and the last call returns an empty string. NextDirOnPath must obviously save the ever-shrinking path somewhere, yet ONPATH.PAS sports no global variables.

NextDirOnPath works its magic by storing the path in a typed constant, Turbo Pascal's confusing name for static variables. The first time NextDirOnPath is called, the input variable Result is empty, so Turbo's GetEnv function is used to extract the PATH variable from your DOS environment, whereupon it's written to the static variable (or typed constant) SavedPath.

On later calls to NextDirOnPath, Result will be a nonempty value, so GetEnv is only called the first time. A search now commences for the first semicolon. When it's found, the path up to that point is copied into Result, it's amputated from the beginning of SavedPath, and the surviving path is automatically available for the next call to NextDirOnPath. You could have a global named SavedPath and variables named SavedPath in every routine, yet the static variable SavedPath would retain its value and be visible to this routine and this one only. □

```

USES CRT, DOS; { ONPATH shows files matching #1 on the path.
PROCEDURE Pause; { Pause on any key except Esc, which quits to DOS. }
VAR
  ch : CHAR;
BEGIN
  IF KeyPressed THEN { If a key was pressed, pull it }
  BEGIN { off the keyboard buffer. Then }
    ch := ReadKey; { check to see if it's Esc. }
    IF ch = #27 THEN { If it is, quit to DOS, setting }
      halt(1); { ERRORLEVEL to 1. }
    REPEAT { If it's not Esc, wait around }
      UNTIL KeyPressed; { for another keypress; then }
    ch := ReadKey; { toss that one into the bit }
  END; { bucket as well. }
END; { PROCEDURE Pause }

PROCEDURE NextDirOnPath(VAR Result : STRING); { Writes the name of }
VAR { the next dir on the path to }
  SemiColon : INTEGER; { Result, saving the remaining }
CONST { path in a local static variable }
  SavedPath : STRING = ''; { (which Turbo Pascal calls }
  BEGIN { "typed" constant. }
  IF Result = '' THEN { If the input is empty, it's the }
    SavedPath := GetEnv('PATH'); { first time. Save PATH= here. }
  SemiColon := Pos(';', SavedPath); { Trim off any semicolon, if need }
  Result := Copy(SavedPath, 1, Pos(';', SavedPath)); { be. }
  IF SemiColon > 0 THEN { Delete trailing semicolons. }
    Delete(Result, SemiColon, 1) { Delete trailing backslashes. }
  ELSE { BEGIN Result := SavedPath; SavedPath := ''; END; }
  BEGIN Result := SavedPath; SavedPath := ''; END;
  IF Pos('\', Result) = Length(Result) THEN
    Delete(Result, Length(Result), 1);
  Delete(SavedPath, 1, SemiColon); { Remove this dir name from the }
END; { PROCEDURE NextDir }

FUNCTION LeadingZero(Value : INTEGER) : STRING;
VAR
  tmp : STRING;
BEGIN
  Str(Value:0,tmp); { Stolen straight out of the TP }
  IF Length(tmp) = 1 THEN { online help, this formats Value }
    tmp := '0' + tmp; { in a way similar to DIR's -with }
  LeadingZero := tmp; { a leading 0 if the number is }
  END; { only one digit wide. }

PROCEDURE WriteFilename(InsertPath : STRING; DirInfo : SearchRec);
VAR
  Display : STRING; { This routine displays a }
  Index, Len : INTEGER; { filename in a manner similar }
  ParsedTime : DateTime; { to that of DIR, except that it }
  BEGIN { precedes it with the path. That }
  Display := InsertPath + DirInfo.Name; { makes it easier to see matches. }
  Len := Length(Display); { Create a 40-character }
  IF Len > 40 THEN Len := 40; { width pathname. Truncate }
  Write(Display); { if it's over 40. }
  FOR Index := Len TO 40 DO Write(' '); { Display the filename; }
  Write(DirInfo.Size:8); { then pad with spaces }
  Write(' '); { Right-justify the size. }
  UnpackTime(DirInfo.Time, ParsedTime); { Parse the time into three }
  WITH ParsedTime DO { fields, then display it }
  BEGIN { with leading 0s. }
    Year := Year - 1900;
    Write(LeadingZero(Month), '-', LeadingZero(Day), '-', Year, ' ');
    IF Hour = 12 THEN Hour := 24; { Tricky handling for noon }
    IF Hour = 0 THEN Hour := 12; { and midnight. }
    IF hour < 13 THEN
      WriteLn(LeadingZero(hour), ':', LeadingZero(min), 'a')
    ELSE
      WriteLn(LeadingZero(hour-12), ':', LeadingZero(min), 'p');
  END;
END; { PROCEDURE WriteFilename }

VAR
  DirInfo : SearchRec;
  FilesFound, Index : INTEGER;
  FileSpec, NextDir, NextName : STRING;
BEGIN
  Assign(Output, ''); Rewrite(Output); { Make output redirectable. }
  FilesFound := 0;
  FileSpec := '';
  NextDir := '';
  IF ParamCount > 0 THEN FileSpec := ParamStr(1)
  ELSE
    BEGIN
      Write('File or file specification to search for? Enter to quit. ');
      ReadLn(FileSpec);
      IF FileSpec = '' THEN
        Halt(1);
      END;
    IF Pos('.', FileSpec) = 0 THEN { Add an implied '.', the way }
      FileSpec := FileSpec + '*.*'; { DIR does, if no extension. }
    NextDirOnPath(NextDir); { Get next dir name from path. }
    WHILE NextDir <> '' DO { For each directory on the path: }
      BEGIN
        NextName := NextDir + '\' + FileSpec; { Get full file spec. }
        FindFirst(NextName, Archive, DirInfo); { Find first match. }
        IF DosError = 0 THEN { If match is found, display it. }
          BEGIN
            WriteFilename(NextDir + '\', DirInfo);
            INC(FilesFound); { Track number of files found. }
          END;
        WHILE DosError = 0 DO { As long as matching files can }
          BEGIN { be found in this directory, }
            Pause; { allow user to press Esc to quit }
            FindNext(DirInfo); { or space to pause. Then print }
            IF DosError = 0 THEN { the filename in question with }
              BEGIN { its location on the path. }
                WriteFilename(NextDir + '\', DirInfo);
                INC(FilesFound);
              END;
            END;
          NextDirOnPath(NextDir); { Repeat this process for each }
        END; { directory on the path. }
      WriteLn(' ', FilesFound, ' File(s) found. ');
    END.

```

POINT & CLICK

Clifton Karnes

COLD HARD CACHE FOR YOUR GUI

Whether you're running *Windows*, *GeoWorks Ensemble*, or a more exotic graphical user interface, one thing's for sure: You need a disk cache. Why? Because all GUIs are disk-intensive. They simply can't keep everything they offer in the computer's memory, so they routinely swap program code and data from disk to memory and back. Every time your computer reads from the disk, your system slows down. Just how much depends on how fast your hard disk is.

By far, the most cost-effective way to speed up your hard disk is to use a disk cache. This is such an important tool that *Windows* actually includes a cache as standard equipment, and it automatically installs it for you.

GEOS doesn't come bundled with a cache, probably because its programs run so fast without one. You pay the price for speed, however, when you run a DOS program or shell to DOS. Here *GEOS* is a tortoise; a cache will dramatically improve its speed.

So, you need a cache. But which one? *Windows* users get the latest version of *SMARTDrive* free (it comes with most versions of MS-DOS, too), but there are other programs that claim to be better. This month I looked at two: *HyperDisk* (HyperWare, Route Box 91, Pall Mall, Tennessee 38577; 615-864-6868; \$69.00) and *Power Cache Plus* (Intelligent Devices, 112 Harvard Avenue, Suite 295, Claremont, California 91711; 714-920-9551; \$99.95). Both high-performance programs work with *Windows*, *GEOS*, and DOS, and both claim to be faster than *SMARTDrive*.

HyperDisk comes with spe-

cial versions for conventional memory, 286 systems, and 386 systems. As with most modern caches, it can cache in conventional, expanded, or extended memory, but if you're running *Windows*, you'll almost certainly want to use extended memory.

Power Cache Plus comes in two versions: *PCPFAST* offers faster performance, and *PCPSMALL* is slower but optimized to use less memory. As with *HyperDisk*, it can cache in conventional, expanded, or extended memory.

Power Cache Plus has one incompatibility with *Windows*: It can't coexist with a permanent swap file. If you run *Windows* in 386-enhanced mode and use a permanent swap file, you'll take a performance hit by switching to a temporary swap file, as we'll see.

To test these caches, I ran a series of benchmarks in *Windows*, DOS, and *GEOS* and found some surprising results.

For the *Windows* test, I created a macro using *PubTech's BatchWorks* that opens four applications along with typical documents. I loaded *Word for Windows* with a 34K document, *Microsoft Excel* with a 15K spreadsheet, *Q+E* with a 190K database, and *Crosstalk*. After each was loaded, its window was resized (with *BatchWorks*), and then each was closed.

I ran the tests on a Gateway 25-MHz 386 with 4MB of RAM and a 17-ms 110MB hard drive. I set each cache for 1024K using extended memory. In 386-enhanced mode, the suite of *Windows* programs produced the following times:

No cache	2.08 minutes
<i>HyperDisk</i>	1.03 minutes
<i>Power Cache Plus</i>	1.68 minutes
<i>SMARTDrive</i>	1.13 minutes

Both *HyperDisk* and

SMARTDrive were able to work with a permanent swap file with which *Power Cache Plus* is incompatible. Because of this, its time suffered. When I tested *HyperDisk* and *SMARTDrive* without a permanent swap file, their times were closer to that of *Power Cache Plus*. Next I tested all three caches in DOS, using the database cache test supplied with *Power Cache Plus*. Here, the results were amazing. *Power Cache Plus* averaged more than twice as fast as *HyperDisk*, and in reading and writing random records, it was more than three times as fast. *SMARTDrive* and *HyperDisk* were neck and neck. Average times were:

No cache	6.79 minutes
<i>HyperDisk</i>	4.61 minutes
<i>Power Cache Plus</i>	2.14 minutes
<i>SMARTDrive</i>	4.69 minutes

For *GEOS*, I tested each cache with a variety of operations: loading *GEOS* from DOS, running *GeoDraw* and *GeoWrite*, and shelling to DOS—one of *GEOS's* slowest operations. Since *GEOS* is less disk-intensive than *Windows*, neither cache significantly improved the performance of *GEOS* applications. But the time it took to shell to DOS and return was more than doubled with both caches. Cache times for these operations were almost identical for *HyperDisk*, *SMARTDrive*, and *Power Cache Plus*.

What does all this mean? If you're using lots of DOS applications and you don't mind not being able to use a permanent swap file in *Windows*, then *Power Cache Plus* is the choice. If you're not into DOS apps in a big way, then *HyperDisk* is the winner by a hair. For most of us, *SMARTDrive* will do just fine, especially if you can afford to give it 1024K of memory. □

Where your GUI is a tortoise, a cache will bring it up to speed.



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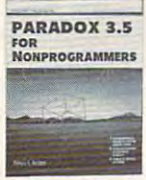
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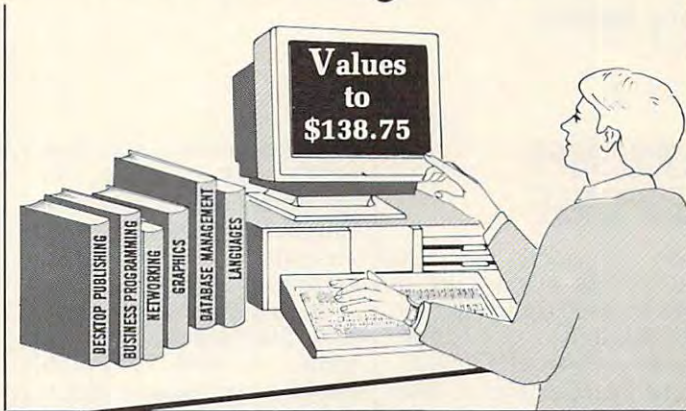


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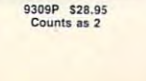
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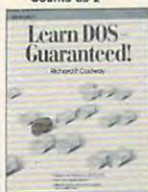
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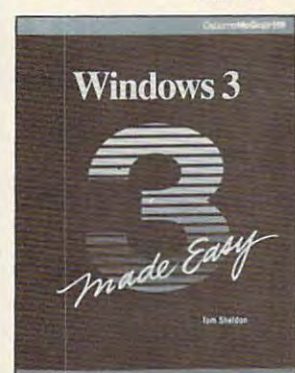
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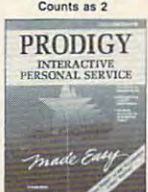
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INTRODOS

Tony Roberts

A PROMPT RESPONSE

Over the years, the DOS prompt has taken a lot of heat. It's been called cold, unfriendly, and a lot of other names—many unprintable. It's not hard, though, to take the edge off the infamous prompt. In fact, fooling with the DOS prompt has provided many an evening of recreation for computer users.

DOS provides the PROMPT command so you can customize the prompt to your liking. In many cases, this command is either ignored or placed in the AUTOEXEC.BAT file and forgotten. A common example is the command PROMPT \$P\$G, which is found on most hard disk systems.

Although it doesn't look like much, the above command instructs the computer to print the current directory path followed by a greater than sign. It might come out looking something like C:\DOS\UTILITIES>.

But how did the cryptic command PROMPT \$P\$G turn into something helpful and useful? The answer is metastrings. Metastrings are groups of characters (strings) that the program changes into something else. In the case of the PROMPT command, the dollar sign is a signal that tells the program to apply a special interpretation to whatever character follows.

The metastring \$P is transformed into the current path, and \$G is transformed into the greater than character. Your DOS manual includes a table that lists the PROMPT metastrings. Among them are codes to display the current time or date, as well as characters to move the cursor to the next line or to erase the previous character.

If you use a program such as a word processor or spread-

sheet that allows you to shell to DOS, you've probably had the experience of forgetting that your application program was running, and you've tried to run it again.

To remedy this problem, start the application via a batch file that uses the PROMPT command to remind you that you should exit back to your application. Here's how I do it for Borland's *Quattro Pro*:

```
@echo off
PROMPT Spreadsheet program ac-
tive. Type EXIT to return.$_P$G
cd \QPRO
q
cd\
PROMPT $P$G
```

The metastring \$_ is translated into a carriage return-line-feed, so this prompt ends up being displayed on two lines. At the end of the batch file, the prompt is restored to its normal state.

Some users like to create elaborate prompts using some of the graphics characters that are available in the upper half of the ASCII set. To use these characters, first look them up in an ASCII chart so you'll know the ASCII number of each character you want to use.

Then, to include the character in your prompt command, hold down the Alt key and punch in the ASCII code on the numeric keypad. When you release the Alt key, the character will appear on-screen.

If creating the perfect prompt has caught your fancy, you'll want to take the next step and include some ANSI escape sequences in your prompt, allowing you to add color to your creation.

To do this, you'll need to have the ANSI.SYS device driver or an equivalent (NANSI.SYS, GANSI.SYS, or TANSI.SYS) installed on your sys-

tem. If it's not installed, you can add the line DEVICE=ANSI.SYS to your CONFIG.SYS file. If the ANSI.SYS file is in a directory other than the root directory, be sure to include the complete path to it in the DEVICE statement.

With ANSI.SYS installed, you can make your prompts include boldface, flashing, or reverse type, and you can select foreground and background colors as well.

ANSI commands involve the use of another set of metastrings called escape sequences. These sequences combine an escape character (ASCII 27), a left bracket ([), an optional parameter, and a one-letter command code.

This gets pretty involved, and there isn't room here to list all the codes and parameters for colors and video modes, so I'll provide an example to get you started.

Let's take the usual \$P\$G prompt and spice it up by displaying the prompt itself in reverse video.

PROMPT \$E[7M\$P\$G\$E[0M

Notice the metastring \$E in the command above. This is the PROMPT command's way of sending the escape character. When ANSI.SYS detects the escape character followed by a left bracket character, it knows that it should interpret the characters that follow. The code 7M is the ANSI code for reverse mode. ANSI.SYS switches the display to reverse mode, and then the PROMPT metastrings \$P\$G are expanded and printed. Finally, another escape sequence changes the video back to normal mode.

As I said, you can have a lot of fun playing with prompts. Send me your best creation in care of COMPUTE, and I'll print a selection in a future column. □

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HARDWARE CLINIC

Mark Minasi

DON'T CATCH THE WRONG BUS

In the past four years, there's been plenty of smoke (and mirrors) about computer buses. If you're like most people, you've heard of IBM's Micro Channel, and you may know of the clone-meisters' response, EISA. They're supposed to be better somehow—aren't they?

Here's the straight and skinny on what these new buses offer and why you should care. In the process, I'll explain a whole bunch of things, including the horrifying DMA Speed Scandal.

First things first: What's a bus? Basically, a bus is the set of connectors—the slots—on your motherboard. It's the point from which your system can be expanded.

Fortunately, the buses in the PC are well documented. That means that anyone can design and sell an add-in circuit card, and that's got a lot to do with why the PC is so popular in the first place. The entirely open nature of the PC—its bus slots, its third-party operating system (you had a choice of buying DOS, CP/M, or the p-System from IBM in 1981)—and its fully documented BIOS are the reasons why the PC is the market leader.

Ticket to Ride

The original PC had the bus that's still found on XT clones. If you count all the metal fingers in a PC bus slot, you'll find 62—and each of the 62 wires has a specific job. Some transmit data, while some communicate address information. Some warn the CPU of upcoming activity or ask the CPU to yield control of the PC, as when one circuit board talks directly to another (that's called *DMA* or *bus mastering*, and I'll discuss it soon).

On the original PC, 8 of the 62 wires transferred data. That's why the PC bus is called an *8-bit bus*. The advent of the AT in 1984 saw a modification of the PC bus to double the width of the data path, leading to the so-called *AT bus*. This bus has a 16-bit data path, allowing it to transfer 16 bits in the time that the PC bus would take to transmit 8 bits. Data paths on computer buses are like lanes on highways; the more lanes you have, the more that can be transported (bits on buses, cars on highways). The AT bus became the standard for most clones and has been redubbed the *Industry Standard Architecture*, or *ISA* (pronounced *ice-ah*).

ISA has served us well to date, but it's limited in several ways. First, the 16-bit data path was nice in 1984, but it's less than optimal for 386DX and 486 computers. Both of those chips have the potential to do 32-bit data transfers, so a 32-bit bus would create a market for add-in boards that could more fully exploit the full power of those chips. Virtually all ISA machines run the bus slots at a mere 8 MHz, so even the fastest ISA machines must slow down to 8 MHz whenever communicating with an expansion board. Second, ISA uses edge-triggered interrupts. The alternative would be level-triggered interrupts. Edge-triggered interrupts are more noise-prone and so restrict how fast a PC's CPU can communicate with its expansion boards.

The DMA Scandal

IBM decided to scrap ISA altogether with its post-1987 PS/2 line of computers. The PS/2s use an entirely new bus called *Micro Channel Architecture* (MCA).

Working from a clean slate, IBM was free to add

some nifty features to MCA. First, there's a 32-bit version of MCA as well as a 16-bit version, allowing greater speed in 386DX and 486 PS/2s than would be possible if they were ISA machines. Unfortunately, it's not much faster—the maximum clock rate for MCA slots is only 10 MHz. It also uses the cleaner level-triggered interrupts.

But it doesn't stop there. DMA is faster under MCA than under ISA, and MCA offers bus mastering. *DMA* is short for *Direct Memory Access*, an interface method that allows peripheral devices (such as disk controllers or LAN boards) to transfer data to and from memory without having to first pass the data through the CPU.

Why's that good? Consider what happens when you ask your floppy disk to read a file. The CPU tells a board called the *floppy disk controller* to read a block of data from the floppy; that block is 512 bytes long. Once the data has been read by the floppy controller, that 512 bytes must be moved into memory so that the floppy controller can get ready to read (or write) more data to (or from) the floppy. How does it get moved? The basic way is for the CPU to take each byte from the controller (one at a time), figure out where in memory to put that byte, and go on to the next byte. The buzzword for this kind of transfer is *PIO*, or *Programmed Input/Output*. PIO's fine, except for the fact that it's slow.

Enter DMA. With DMA, we eliminate the middleman. The floppy disk controller is temporarily empowered to talk directly to the CPU's memory—hence the name *Direct Memory Access*. DMA is solely intended for speed.

Which brings us to what I call the *DMA Scandal*. For pur-

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poses of total backward compatibility, IBM ran the DMA on its 8-MHz AT at 4.77 MHz—the speed of the PC! Following IBM's lead, the makers of virtually all ISA machines to this day run their DMAs at 4.77 MHz. That means that when your 33-MHz ISA 386 is doing DMA, it slows down to the speed of the original IBM PC. A few no-name cloners run DMA at 10 MHz, but they're few and far between. Incredible, ain't it?

Micro Channel improves on ISA by running DMA at half the processor speed, so a 10-MHz PS/2 runs DMA at 5 MHz—basically the same as an ISA machine, but a 20-MHz PS/2 runs DMA at a more acceptable 10 MHz.

Switch Flipping

Perhaps the nicest feature of MCA is Programmable Option Select (POS). Anyone who's ever had to flip switches and move jumpers on an expansion board will appreciate this feature. When installing an expansion board, you often have to configure the board. For example, when installing an internal modem, you must set it as either COM1 or COM2. You set it by moving a jumper or flipping a DIP switch. That's annoying because it means that every time you want to reconfigure a board, you've got to pop the top on your computer, remove the circuit board, make the change, and replace it. MCA (and EISA, for that matter) allow all of these choices to be made with software—a real timesaver.

Even better, an expansion board whose configuration is software adjustable means automatic configuration. Rather than your setting the modem to COM2 because you have a mouse on COM1, why not just let the MCA configuration software sense the conflict

and resolve it automatically? That's just what the PS/2 Reference Disk does (or tries to do, but that's for another column). EISA, again, shares this capability.

The Empire Strikes Back

Nice as these MCA features are, they come at a terrible price: ISA-compatible boards don't work in MCA machines, and MCA boards don't work in ISA machines. Further, IBM wrapped up MCA in enough legal red tape that it became quite unattractive for third-party PC vendors to clone the new bus. To legally offer an MCA clone, vendors must pay IBM a royalty equal to 5 percent of their gross sales on the machines. Five percent is usually the total profit for most makers of compatibles—as Big Blue well knows.

So Compaq and a number of other vendors (Wyse, AST, Tandy, Hewlett-Packard, Zenith, Olivetti, NEC, and Epson—the initials spell *watchzone* when you include Compaq) designed an alternative bus with features similar to MCA's: software-setup bus mastering, faster DMA, and 32-bit width. They call it *EISA* (pronounced *ease-ah*), for *Extended Industry Standard Architecture*.

Then they went IBM a hair better. They designed EISA to be backward compatible with ISA. Every EISA slot has a double-decker connector. The top part is the ISA circuitry, and the bottom part has the EISA lines. Only EISA boards have connectors that can extend down to the EISA part. (I wonder if that's where the *Extended* in *Extended Industry Standard Architecture* came from.)

EISA has a few other leads on MCA. An EISA machine can have up to 16 slots; MCA, 8. EISA can allow an ex-

isting ISA board to run its DMA at twice normal speed with no hardware changes to the ISA board (there must be some new software, however). The speed of EISA itself is, unfortunately, stuck at 8 MHz.

The EISA specification allows boards to be physically larger and draw more power than MCA. That's important because it means that EISA boards are cheaper and easier to design, and so presumably will cost less.

All Aboard

So what's the right bus for you? Well, the vast majority of the boards out there are ISA compatible, despite the fact that the PS/2 has been around for four years. EISA boards are as scarce as hen's teeth, so even if you did buy an EISA machine, you'd have to wait for boards that exploit EISA's capabilities.

Further, 90 percent of the expansion boards wouldn't benefit from the improved throughput of MCA or EISA—talking to my printer or 9600-bps modem at 8 MHz is hardly what I'd call useful. The boards that really would benefit from better throughput are VGA boards, hard disk controllers, and LAN cards. EISA and MCA versions of these are appearing, but slowly.

So buying an ISA machine today still isn't a bad idea, particularly when you consider the cost.

On the other hand, an EISA machine has ISA compatibility. And when the EISA boards do appear, you'll be ready. And just to make things complicated, one vendor even sells a reasonably priced EISA machine—the ALR Business VEISA. It won't be the only low-price EISA seller for long.

Heck, maybe it is time to upgrade . . . □

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DISK UPDATE

Richard C. Leinecker

END MACROS THE RIGHT WAY

We've streamlined *COMPUTE's Menu Operating System* to make it simpler to use. In the past, we've offered the option of running some of the programs directly from the menu. The menu program decompresses the files (or loads them straight off the disk if it's a 3½-inch disk) and then executes the code. MS-DOS has some inherent problems, however, that make this impractical in most cases, so we've decided to eliminate this feature—at least for now.

If you try to run memory-resident programs, such as *SCROLOCK* from the April 1991 disk, your computer will crash after quitting the menu program. That's because the system can't keep track of where everything is in memory after the menu program is terminated.

Some programs may look for a configuration file or other files they need to run. That's the case with *ASIC* from the February disk. It attempts to run but aborts because it can't find its support files.

There's one last problem related to running programs from the menu program. We used to use a file called *LAUNCH.EXE* to help us run programs from the menu. If you typed *LAUNCH* from the command line, though, it tried to execute code that didn't exist. You won't find it on disk from this point on, but if you see it on old disks, don't run it. If you do, your computer will probably lock up, and you'll have to reboot.

Ending Macros Gracefully

SuperMAC (April 1991) loads a macro file that you create with your text editor or word processor. When the program runs, it loads the file and con-

verts it to a format that its internal routines understand. The conversion routines are designed to alert you to any problems in the macro file. If problems are found, the program quits with an error message. We've gotten calls from several people who've received these error messages, and we have some suggestions for avoiding them.

The most common problem is leaving off the carriage return at the end of the last macro. Your text editor will place a carriage return at the end if you press Enter. You can even add extra blank lines at the end of the file to make sure that at least one is there.

A second problem can occur when your editor places non-ASCII characters in the file. You have to make sure that your word processor saves the file as straight ASCII text. Make sure, too, that your editor saves the file with hard carriage returns and not just linefeeds.

If you're still having trouble, you might have to resort to more thorough measures. Make sure that the DOS program called *DEBUG* is in your path or in the current directory. At the DOS prompt, type *DEBUG filename.MAC* and press Enter. You'll see a prompt that looks like a dash. Press D and then Enter. *DEBUG* will show you the first several lines of the text file as hex data. Disregard the numbers in the left column; what you're looking for is to the right.

When your editor inserts a carriage return, it's actually inserting two characters—a 13 and then a 10. You'll see these in the *DEBUG* dump as a consecutive 0D 0A pair. If you don't see several of these pairs, your editor isn't saving in the proper format. If you don't see one of these

pairs after the last macro, you haven't ended with a carriage return.

There's one more thing you can look for in the hex dump. Any character that's less than 20 hex or greater than 7F hex doesn't belong in there. If you see characters in these ranges, then your editor has inserted its own special formatting characters, and *SuperMAC* is reporting an error when it runs into these.

Getting the Best Support

If you call *COMPUTE's* office for technical support, you'll want to be prepared so you can get the best possible response. Here are some suggestions that will help our technical staff solve your problems.

Be ready to list your computer's equipment. Many programs require certain equipment configurations to operate properly. These programs may also need you to configure the program for the equipment on which it's running.

It's especially important to know your graphics configuration for programs that run in graphics modes and your disk drive types for programs that are disk utilities or that access the drives often. Being able to accurately identify your system and its components will help give the technical support person the information needed to identify your problem.

Know the version of DOS under which your computer runs. You can get this by typing *VER* at the DOS prompt.

Although not always possible, the most important factor is to be right at your computer when you call so the technical representative can talk you through any problems while you're on the telephone. That may save you from having to call again because something wasn't clear. □

If you've had problems with *SuperMAC*, you may not be formatting your files correctly. Here's help.

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STACKER

Face it: Your hard disk is too small. If you have a 40MB drive, you need a 60. If you're spinning a 60, you'd be better off with an 80. And on and on, ad infinitum.

As a case in point, I recently acquired a new computer with a 60MB drive, but before a month was out, I was spending every free moment trying to decide what to kick off the disk to make room for something else. This is no way to live, I told myself.

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. How is this possible? In a word, *compression*.

Stacker is a device driver with an optional coprocessor board that stores data on your hard disk in a compressed form. 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.

Compression may sound complicated and dangerous, but *Stacker* works flawlessly and nearly transparently. In fact, if you're using an RLL controller (and almost everyone with a 40MB or larger drive is), your data is being compressed at the bit level already. Mainframes have been using RLL compression technology for years with no ill effects. So compression is OK as long as it is 100-percent reliable, and *Stacker* is.

Installing *Stacker* isn't diffi-

cult, but the more you know about your PC, the easier it will be. As I mentioned earlier, *Stacker* comes in two versions. One version uses a software driver coupled with a coprocessor board. The other version uses a software driver alone. The coprocessor board offers faster performance and much better compression, so it's the choice if you have a machine with an open slot. The coprocessor version also uses less conventional memory—21K RAM as opposed to 30K for the software-only *Stacker*.

To install the coprocessor version, you place the board in any available slot and run *Install*. For the software version, you simply run *Install*. The installation program creates a *Stacker* volume on your current hard disk that will hold your compressed files. For example, if you have one hard disk labeled drive C, *Stacker* will create a drive D to store its compressed files. Your system will see drive D as another hard disk, but in reality, drive D is a single large file on your C drive.

Getting back to the installation, the first thing the setup program asks you for is a base address in upper memory to use

for your coprocessor card.

The program supplies a default (CC00), which should work in most cases. Next, the program asks you for a size to use for *Stacker*'s disk cache. If you want to use your own cache, you can specify a size of 0. Next, *Stacker* asks how much space you want to dedicate to your new *Stacker* volume. After that, you can exercise the option to have the program transfer all the files on your current disk to the *Stacker* disk, compressing them in the process. By default, *Stacker* leaves 1MB of disk space on the non-*Stacker* volume. You can specify more if you choose.

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.

If you're running *Microsoft Windows*, *Stacker* will work without a hitch, but you do need to go through a few extra steps to install it correctly. First, if you're using a permanent swap file, you'll need to



delete it before you run the installation program. Then, when you're asked how much space to leave on your non-*Stacker* volume, leave enough room to re-create your swap file later. If you normally use a 4MB swap file, for example, you'll want to leave 4MB plus an extra megabyte on the drive: 5MB in all. After the *Stacker* installation is finished, you can rebuild your swap file on the non-*Stacker* volume. The only other thing you need to do is tell *Windows* about your *Stacker* coprocessor. You do this by adding the line `emmexclude=cc00-cfff` in the 386Enh section of your `SYS-TEM.INI` file.

One thing that may worry you a little about this whole business is the fact that you're depending on this coprocessor board to access all your data. What happens if it goes bad? Here, there's nothing to worry about. If for any reason the board stops working, the program defaults to the software-only version, which handles everything itself. I tested this by removing the coprocessor card and found that my system worked fine, though a little more slowly.

You can use all your usual disk utilities on the *Stacker* volume. If you accidentally delete a file, your undelete program should work fine. If you use *Spinrite* or another low-level disk diagnostic program, *Stacker* won't give it a moment's pause. And programs like *The Norton Disk Doctor* will examine your *Stacker* volume and treat it just like any other hard disk.

The only exception is that you can't run a defragmenting program on a *Stacker* volume. Because of the way *Stacker* organizes files, you could actu-

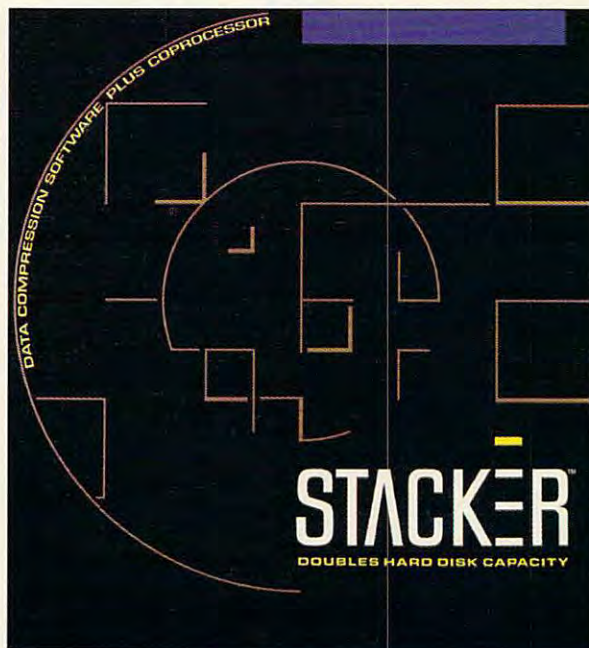
ally increase the volume's fragmentation. This means there's no way to defragment your *Stacker* volume, except by backing everything up and restoring it. *Stacker* realizes that this is a weakness with the system, and it is planning to include its own defragmenting program with future versions.

Now we're at the bottom line, and the two bottom-line questions are, How much compression will I get? and How much will my system slow down? On my 60MB hard disk, I received an overall compression ratio of 2:1 using the coprocessor version. This means I doubled the capacity of my hard disk, from 60MB to 120MB.

As far as performance goes, 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. As I mentioned, this all averages out.

I also tested *Stacker* and non-*Stacker* volumes without the coprocessor card, and here, the non-*Stacker* volume was about 18-percent faster than the software-only version of *Stacker*.

With *Stacker* and its coprocessor board, my system feels the same as it did before I installed *Stacker*. Even with *Windows*, which is probably the most disk-intensive program on the planet, I



haven't noticed any performance degradation.

If you're thinking about buying *Stacker*, there isn't much to decide. The system is so fast and transparent, you'll immediately reap the reward of a much larger hard disk and soon forget you're using it. You do need to take into account, however, the size of your current hard disk and how much you'll gain by installing *Stacker*.

The larger your current hard disk, the more you'll get from *Stacker*. If you have a 20MB disk, *Stacker* can turn it into a 40, but for what *Stacker* costs, you could buy a new 40MB hard drive. With a 40MB disk, however, *Stacker* will pay for itself, and with anything larger than 40MB, *Stacker* will give you the most cost-effective increase in disk capacity you'll find anywhere. To increase your hard drive's capacity, you just can't go wrong with *Stacker*. □

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WORKPLACE

Daniel Janal

HOW DO I THANK THEE? WITH A NOTE, OF COURSE.

When I was growing up, sending thank-you notes for gifts was considered a sign of good taste. But like most adolescents, for me, writing them took a back seat to watching ball games. Maybe *that's* why relatives stopped sending me birthday and holiday presents. Maybe if I'd thanked them, the presents would still be coming.

Hmm, what a concept. Maybe it works for businesses as well. You send business prospects thank-you notes, and they send more business your way. After all, a proper thank-you note serves many functions.

For one, you can keep your name in front of prospects and clients by honestly thanking them for their time, effort, and interest. Your note will stand out while a direct-mail piece might not even register.

One editor has a tremendously positive view of me sim-

ply because I sent him a thank-you note early in our business relationship. Even though our paths rarely cross, he still tells people I'm a gentleman—all because I took the time to thank him.

Why don't people bother with thank-you notes anymore? Let me count the excuses: sloppy penmanship, spelling, and grammar; lost addresses; too lazy.

Fortunately, your computer can solve these problems and more. You can use a word processor to write the letter, check the spelling, and correct the grammar. If you have horrible handwriting, you can use a font that mimics handwriting like Script or Architect. (Check with large font libraries from Adobe or with shareware sources.) If you're truly lazy, you can scan your signature into the computer and paste it onto thank-you notes.

Your note should contain certain key components: It should thank the recipient and refer to a specific incident the two of you shared. That way you avoid the look and feel of a form letter, while prompting the recipient to remember you. You then have permission to conduct business, addressing the person's requests and questions. Finally, you should end with a specific promise to follow up.

How do you remember enough about all the people you meet to follow up without getting them confused? When I meet people at trade shows and seminars, I ask for business cards and then make a note of the person's interests, my promises, and what we talked about. You don't have to write *The Great American Novel*.

How does all this save time if you have to write 50 different notes to people you met at the Gargantuan Con-

vention? Not to worry. You'll find that 90 percent of your letters fall into three categories: I'll call you to follow up, I'm sending you the product now, and I'll be sending you the product in the future. If you create three separate notes (or letters, if you have a lot to say) with such sentiments on your word processor, you'll have covered the majority of your thank-you-note recipients. Then, you can use the time you've saved to correspond even more personally with the other 10 percent.

Sort your business cards into three piles to correspond with the three note categories so you can "batch-process" the letters and virtually automate the system. Write the three basic notes, call up the first one, and either type the person's name and personal references or use the mail-merge feature of your word processor.

By storing the information in a file, you can retrieve it for reference and reprinting whenever you want. If you find mail merge confusing, you can make a copy of the master letter and manually type the information onto the copy, print it immediately, and save it for the future. Laser printing will allow you to send nicely printed letters and notes—even on fancy letterhead and odd paper sizes, such as note cards. Try printing a few sample sheets before investing in a load of paper, though. You also should print a few practice sheets until you get the margin spacing just right.

Taking the time to send thank-you notes to your clients and prospects is smart business. You'll be remembered for remembering them. By the way, thank you for reading this far. I wish I could send a note to thank each of you individually. □

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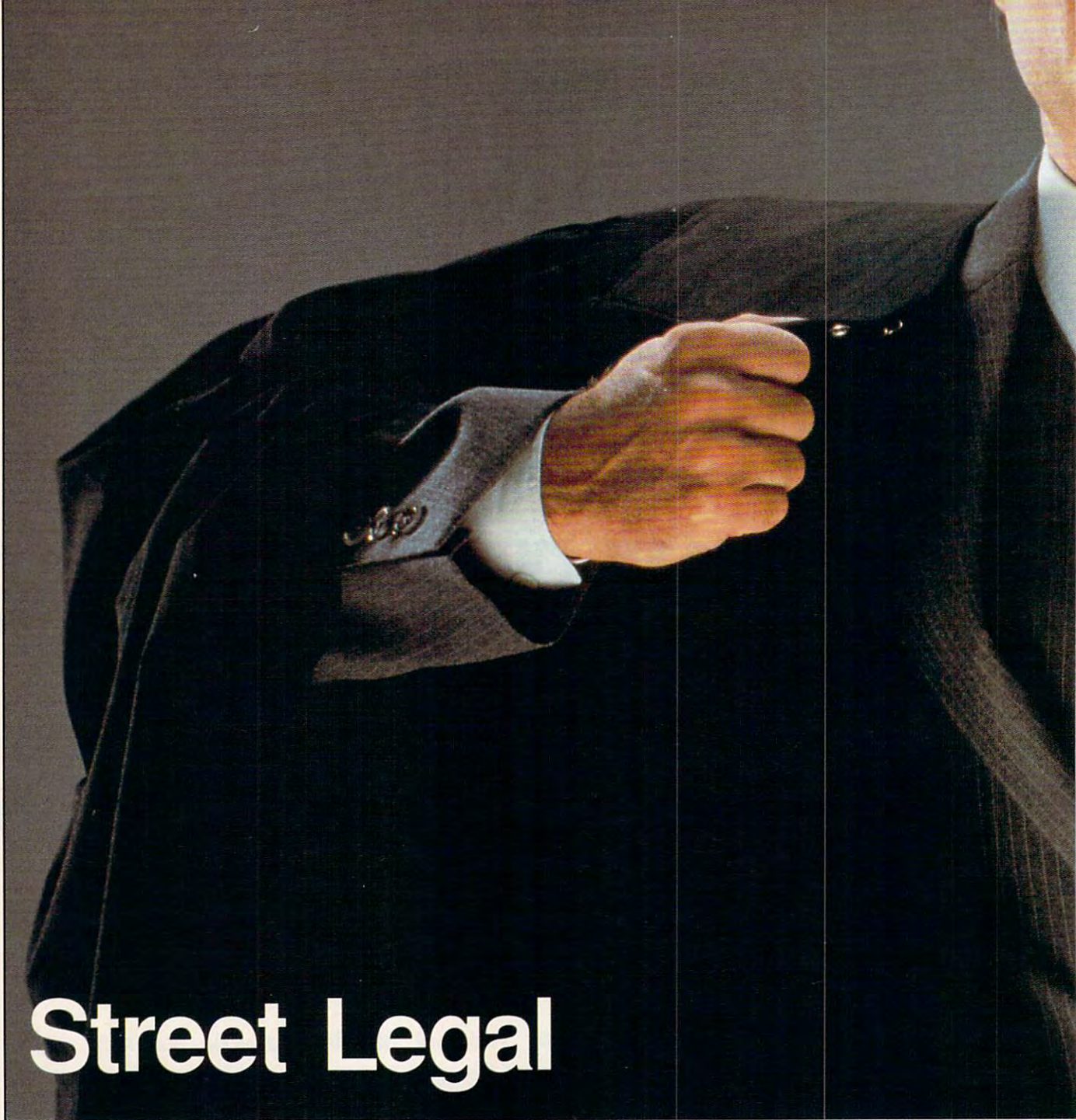
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Street Legal

Keep
your home office
running
on the straight and
narrow.

By Rosalind Resnick
and Susie Archer

People who run home offices typically spend half their time worrying about getting business in the door—and the other half worrying that they've taken on too much. With all the attention paid to sales and marketing, the legal aspects of setting up and maintaining a home office are often overlooked. And yet there are many legal questions that ought to give you pause: What if you need a contract drawn up? Which legal software gives you the biggest bang for the buck? And, most basic of all, does your community even *permit* you to work from home?

Legal questions often defy easy answers, but that doesn't mean that you should rush out and hire a lawyer. Your PC, a modem, and a couple of self-help law books may be what you need to cut through all but the thorniest of legal problems. Here's a beginner's guide to Home Office Law 101.

Zoning

The first legal issue many home office users must confront is whether they can legally open a home office at all. Some cities and states are very strict while others take a more tolerant view



of people running businesses in residential areas. Many communities don't allow businesses to operate from a home but make exceptions for professionals such as doctors, lawyers, writers, and artists. Illegally operating a home office can result in a court order to cease all business activity, fines, and even jail. The reality, however, is that in most places home business bans are unenforced. (That doesn't mean you should break the law.)

The best way to avoid zoning hassles is to maintain good relationships with your neighbors, find out what

kinds of businesses you can and can't run from home, and obtain all necessary permits and variances. To find out which home businesses are permitted, simply go to city hall and leaf through the local zoning ordinances or ask a city or county zoning official for help.

If it turns out that your business is not allowed, you can always petition the local zoning or planning board for a variance. You should try to show that what you are doing is similar to a permitted occupation, that enforcing the ordinance would strip you of your livelihood, and that your business

would not disrupt the neighborhood. It's not a bad idea to take a few neighbors with you—as long as they're on your side. Getting a building permit may require another trip to city hall.

Permits

Thinking about turning your spare bedroom, garage, or toolshed into a cozy home office? If you're planning to do more than slap on a fresh coat of paint, you may need a building permit. You may also need to obtain an occupational license, register your business, gain permission to collect sales

tax, get an employer's tax ID number from the Internal Revenue Service, and file articles of incorporation.

Insurance

Many people who work at home don't realize that their homeowner's policy may not fully insure computer equipment used for business.

Depending on the replacement value of your home office equipment, you may want to buy an additional policy from a specialty insurer such as Safeware, the Insurance Agency via CompuServe (type GO MALL) or by calling (800) 848-3469.

Incorporation

If you're like most home business owners and your company consists of you alone or you and your spouse, you probably don't need to incorporate. As a sole proprietor, you and the business are one and the same. What the business earns is yours to keep; what the business borrows is money you owe.

As your business grows, you may want to consider a more formal company structure. But beware: A partnership can burden you with somebody else's debts. Incorporating your business may lend it an air of permanence but can also saddle you with unwanted paperwork and legal bills.

Taxes

It's tempting to write off home office expenses on your 1040, but unless you want to risk an audit, you've got to know the rules. The IRS uses this two-part test: Is your home office used ex-

clusively and regularly for business? And if it is, is your home office either your principal place of work or a place where you meet with customers or clients in the normal course of business?

If the answer to both questions is Yes, your tax savings may be substantial. But remember that you can only deduct the portion of your expenses directly attributable to your home office.

Lawyers

It's wise to comparison-shop when looking for legal assistance. Depending on the lawyer's expertise, reputation, and the size and location of his or her law firm, rates can range from \$50 to over \$200 per hour. Savvy legal consumers typically shop around—visiting, or at least calling, three or four lawyers and interviewing them about fees, strategy, and past experience in handling their particular type of case. Once you've decided which lawyer to hire, be sure to get a written contract. Run, don't walk, from any lawyer who promises to win your case or tries to bowl you over with legal mumbo jumbo.

Prepaid Legal Plans

One way to keep your legal bills low is to join a prepaid legal plan that offers discounts on lawyers' hourly rates plus unlimited consultations by phone or letter. LawPhone Advisory Communication Systems, a 50-state network of private attorneys, charges \$60 for a three-month membership plus a \$15-a-month continuation fee or \$180 for an entire year. Members get free telephone consultations with a plan attor-

ney; letters written on their behalf; reviews of contracts, leases, and other legal documents; and a 25-percent break on legal fees.

Legal Software

For those home office professionals who want to brave the legal jungle alone, there's plenty of software available. Only a handful of programs are capable of generating documents other than wills. *It's Legal* (Parsons Technology), *Personal Lawyer* (BLOC Publishing), and *Hyatt Legal Services Home Lawyer* (MECA Ventures) are general-purpose legal programs that spit out commonly used legal documents.

Online Advice

A lot of law-related information can be gleaned online at minimal cost. America Online and PC-Link offer information in their Small Business Resource area on topics such as "Obtaining Good Legal Advice and Controlling Legal Costs" and "Keeping Your Business Out of Legal Hot Water." CompuServe offers law-related information in its Legal (LAWSIG) and Work at Home (WORK) forums. Forum members who log on to LAWSIG can browse through such libraries as Computer Law and Software and Lawyer-to-Lawyer, an information exchange for attorneys.

How-To Books

Since online searches can be expensive, it's a good idea to invest in a few self-help legal guides. Three we recommend are listed in the List of Products and Services box. □

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Everybody's Guide to the Law,
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Hyatt Legal Services Home
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ARTS & LETTERS

Robert Bixby

SHOWDOWN AT THE OK COREL

It's little wonder that *CorelDRAW!* so dominates its market, claiming over two-thirds of high-end illustrator sales, while its nearest competitor has less than a tenth.

Four major factors account for this dominance: It's easier to learn and use; it uses wire-frame representation, vastly speeding the screen-refresh process; it features associated tools for converting raster graphics to vector and for importing, exporting, and editing fonts; and it subscribes to the popular Pantone color-matching system, making it very attractive to professionals.

A fifth item is special effects. *CorelDRAW!* can now create blends as quickly and easily as *Arts & Letters*, which it surpassed by bringing out envelope distortion first. Text and graphics can also be extrud-

ed (extended into the third dimension) with the option of adding perspective. Speaking of which, you can now use an automatic routine to make your drawn objects appear to be on a plane oblique to the screen.

CorelDRAW!'s documentation has always been good. Its onscreen tool box adds to the speed of learning, and nearly all of its processes are completely logical. The only ones that might throw a newcomer off are determining how to edit existing text and how to draw with Bezier curves. Both are fully covered in the documentation.

CorelDRAW! gives you the option of viewing a wire-frame representation or a wire frame and a preview side by side. This almost completely eliminates the waiting encountered while *Arts & Letters* or *Micrografx Designer* recomposes the screen.

MOSAIC, *CorelTRACE*, and *WFNBOSS* are programs shipped with *CorelDRAW!*. *MOSAIC* changes the way you load graphics and clip art via disk. It changes the Open

Drawing dialog box to a picture gallery containing thumbnail bitmaps of the *CorelDRAW!* drawings. Instead of depending on hastily conceived names to identify files, you can locate the file in the *MOSAIC* gallery and double-click on it, and it's loaded.

CorelTRACE is an autotracing utility that traces black-and-white, color, or gray-scale images into an EPS format *CorelDRAW!* can import. It's not as fast or sensitive as *Micrografx Designer's*, and you have to leave the drawing program to use it. Still, it's better than many, and it's free with *CorelDRAW!*. *WFNBOSS* can convert various font types

for use in your *CorelDRAW!* renderings, and it allows you to export *Corel's* fine stable of fonts for use as downloadable fonts.

The Adobe Type 1 fonts exported by *WFNBOSS* don't work with *Adobe Type Manager* programs shipped through late spring 1991, but a phone call to Corel Systems yielded assurances that registered users should have received an updated version as early as last June, fixing this problem.

As I mentioned, *CorelDRAW!* subscribes to the Pantone color-matching system. You can specify a spot color by number, and your printer will be able to come up with the exact color ink to match. You can also freely mix process colors using several different mixing schemes and save your palette.

With the latest version of *CorelDRAW!*, you can now create bitmap and vector fills of your own or import any TIF or PCX file as a new pattern.

Envelope distortion is a new topic that may seem strange to first-time users. Essentially, it creates an enveloping rectangle around a selected object. This rectangle can then be distorted by dragging its handles. There are three set forms of distortion and a free-hand tool. The feature makes your drawing flexible—as though it were on a piece of Silly Putty. By stretching and bending, you can distort it almost infinitely.

CorelDRAW! is a treasure chest of powerful tools. It's so powerful, in fact, a printer manufacturer told me it makes PostScript printers look bad because artists can easily overwhelm the PostScript interpreters in so many printers.

Next month I'll talk about more powerful add-ons and tools for making graphic arts and desktop publishing pursuits even more fun. □

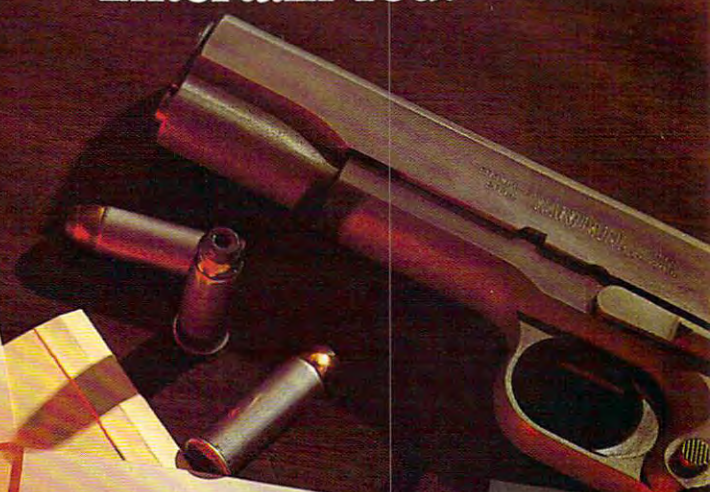
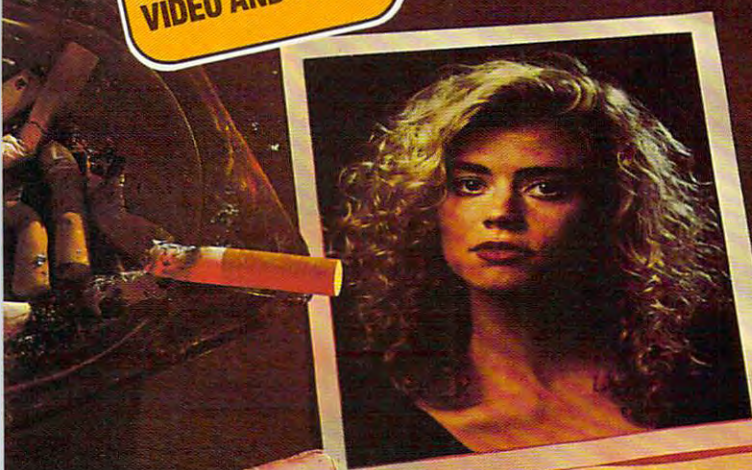
Horse, created by Steve Lyons of Fairfax, California, winner of the Grand Prize World in the CorelDRAW! International Design Contest, demonstrates the versatility of CorelDRAW!.



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TRANSPARENT LANGUAGE

To paraphrase Mark Twain, everyone wants to know a foreign language, but nobody wants to learn one. When you consider how languages are usually taught, it's no wonder. Most of us encounter a second language in a high school class with lots of tedious rote memorization but few rewards. And all that many of us can do with that language in our postacademic days is to tell someone where the pen of our aunt is, as long as it's on the table. Years later, we may toy with the idea of going back and refreshing our knowledge of the language, but we've forgotten too much. Besides, with our schedules, it would be years before we'd ever be able to read anything worthwhile: Balzac, Cervantes, Virgil, Maupassant, Flaubert, Ovid—all closed books to us until we can do significantly more than successfully locate our aunt's Bic.

Transparent Language creator Michael Quinlan had a similar problem: How could he relearn the German he had lost years ago—and relearn it well enough to read what he wanted? And then, while he and his wife, Lynn, were teaching their four-year-old son to read, he had the chance to watch how a mind first learns a language. He concluded that perhaps the best way to acquire language skills is to accommodate the way the brain naturally works—not by memorizing an abstract grammatical system first, but by actually using the language in an environment that provides the support of specific knowledge whenever needed. Quinlan re-

alized that the computer was uniquely empowered to be that environment. He began to design *Transparent Language*.

The philosophy of *Transparent Language* is that you can learn to read a language by actually reading something in that language—preferably, something enjoyable. One thing that makes learning to read a foreign language so difficult is that, for a long while, you probably won't be dealing with anything worth reading. The common instructional approach begins with a simple core vocabulary and grammar upon which you gradually build. The textbook reading samples reflect this, remaining at a cautious, low-vocabulary (and high-tedium) level. Few people can long bear reading denatured stories about where Marie or Gaius or Esteban place their writing implements. Worse, a graded reading sample can limit your progress by making no demands upon you. The normal linguistic environment of a child is rich and challenging; the child is aware that there's a lot

of interesting stuff going on over his or her head and is motivated to learn the language in order to get the goodies. Quinlan's idea was, simply, to provide some goodies worth getting by immersing the reader in an interesting work as soon as possible and making reading it practicable.

On the surface, the *Transparent Language* program seems quite simple; the top half of the screen displays the text of an actual literary work in German, French, Latin, or Spanish, supported by five ancillary windows at the bottom. As you scroll through the text, moving the highlight from word to word (or, in the case of idiomatic constructions, phrase to phrase), the windows provide a literal equivalent for the highlighted item, a translation of each sentence or clause into idiomatic English, and additional commentary (such as tracing words to their roots or commenting up-



on their grammatical or syntactic functions). If you prefer to read the text without these helps, you can opaque the help windows; but if, while reading, you don't recognize a word, you can glance at the definition window. If a phrase or an entire sentence is incomprehensible, check the idiomatic translation—and then go on reading. Just as you'll improve your tennis game only if you keep playing tennis, no matter how badly at first, your reading comprehension will advance only if you stick to reading. The odds are that you'll remember the words the next time you encounter them because you're learning them in the context of natural language usage.

If this process somehow seems familiar, perhaps it's because this is how you learned to read in the first place. You got the information you needed as you needed it, from an experienced reader, without necessarily understanding its place in a comprehensive grammatical scheme. And while such a knowledge of grammar is, of course, useful, it's not essential. As any language instructor could tell you, a good writer or reader may have trouble dealing with grammar exercises, while a student who breezes through grammar drills may have no intuitive feel for the language—and in language, the feel is the important thing. Language use is a right-brain activity; unfortunately, most language instruction comes in a left-brain format that, though easily memorized, cannot be as easily applied in concrete language-use situations. Quinlan intends *Transparent Language* to operate more on the right-brain model, supplying conno-

tation (or felt meaning) as well as denotation (or dictionary meaning) for the words you read—and therefore making it more likely that you will incorporate the words into a living vocabulary.

This is *Transparent Language's* advantage over some other forms of computer-assisted language acquisition. While there are already a number of programs that purport to help you improve your foreign language skills, most of these, as Quinlan observes, "are still mired in the textbook model." They provide drills, such as multiple-choice or true-false exercises, or operate as foreign-language phrase books. While these certainly have their legitimate uses—fine-tuning your language skills or serving as stopgaps until you can actually learn the language, for example—they are of little help in developing a fluent linguistic ability. They also fail to take full advantage of the computer's power to consolidate and present a lot of information instantaneously, a weakness that *Transparent Language* seems to have overcome.

The *Transparent Language* starter set includes the master program and four sample stories in German, Spanish, Latin, and French, along with an audio cassette of the stories and an easy-to-read User's Guide. The accompanying catalog of other titles currently available from the Transparent Language company includes such worthies as short stories by Guy de Maupassant, "The Windmill Adventure" from Cervantes' *Don Quixote*, a portion of Hoffmann's *The Nutcracker and the Mouse King* (the source for Tchaikovsky's popular ballet), excerpts from

Ovid's *Metamorphoses*, and a number of other works you probably never imagined yourself reading in their original languages. The works are available in both 5¼- and 3½-inch disks, as well as audio cassette versions to help you with hearing and pronouncing the language.

As a complement to the classroom, *Transparent Language* has a lot to offer in extending the student's reading skills and building his or her self-confidence. For self-motivated former foreign language students, *Transparent Language* is the best available alternative to digging out the grammar books and dictionaries. Don't fret over the locations of relatives' fountain pens; read a work of literature in a foreign tongue instead. □

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PATHWAYS

Steven Anzovin

WHO NEEDS A KEYBOARD WITH THESE GADGETS AROUND?

Carpal tunnel syndrome. Typist's neck. Weak back and abdominal muscles. Ailments of the computer age. And there in front of you sits the main culprit: your keyboard.

Mice aren't much better. They're often clumsy, and mouse fatigue is increasingly common. So I gave my keyboard and mouse to my 18-month-old daughter, who loves to type, and then checked out some alternatives.

The Wacom SD-510c graphics tablet for PCs and Macs (Wacom, Park 80 West, Plaza 2, Saddle Brook, New Jersey 07662; 201-265-4226; \$695) is receiving a lot of press as a breakthrough tool for graphic artists. What's new about the Wacom is that the pen is cordless and pressure sensitive.

With the right paint soft-

ware, such as *Oasis* from TimeArts (1425 Corporate Center Parkway, Santa Rosa, California 95407; 707-576-7722; \$795; Macs only), you can get the look and feel of traditional media like acrylics, pastels, and watercolors. For example, you can emulate a watercolor brush stroke, with the color lightening and brush width thinning as you reduce pen pressure.

The PC version of the tablet works with any software that accepts a mouse, making it an excellent alternative for people more comfortable with a pen. It's small enough for your lap, and the pen only weighs a few grams.

As a drawing tool, the Wacom tablet has no peer, but pressure-sensitive input devices have real potential for use in a *Windows*-style GUI. For example, little gadgets at the corners of windows could let you page through a document faster or slower by varying the pen pressure or let you send a window to the back, bring it to the front, or even park it in the middle.

And why not adapt the Wacom pressure-sensitive technology for foot control of a computer? I'd like to see a "gas pedal" to increase my computer's speed when I'm in a hurry and a "brake" to keep the machine from outrunning my thoughts.

The Mac world offers more alternative input devices PC users should ask for. One gee-whiz tool is the Voice Navigator II from Articulate Systems (600 West Cummings Park, Suite 4500, Woburn, Massachusetts 01801; 617-876-5236; \$795). Once you've trained it, you can speak any command or menu option into its microphone, and your Mac will obey instantly. The Voice Navigator has real potential as a mouse replacement, especially for people who need free hands.

With this in mind, can verbal text entry be far behind?

If your Mac isn't powerful enough, you can really "play with power" with Transfinite System's Gold Brick (P.O. Box N, MIT Branch Post Office, Cambridge, Massachusetts 02139-0903; 617-969-9570; \$169-\$245). This tiny interface lets you connect any Nintendo controller to a Mac through the ADB port. It works just like a mouse and even emulates some keyboard actions.

Hooking up a Nintendo to your Mac may sound odd, but keep in mind that toys like the Power Glove, Brøderbund's UFORCE, and Nintendo's Power Pad are inexpensive and built like tanks, perfect for applications where ruggedness and replaceability are important.

The Gold Brick already has some unusual applications. At the Speech-Language Pathology Lab at Northeastern University, experimenters Linda Farrier and Harriet Fell are using a Mac, a Gold Brick, and a Power Pad to develop a system called the Baby Babble Blanket, which allows speech-disabled babies to make meaningful sounds and initiate verbal interactions. The Mac issues digitized sounds—babbling or any other noise, including words—according to how and where the baby moves around on the Power Pad. Farrier says the system could also be used as a biofeedback device for adults in physical therapy.

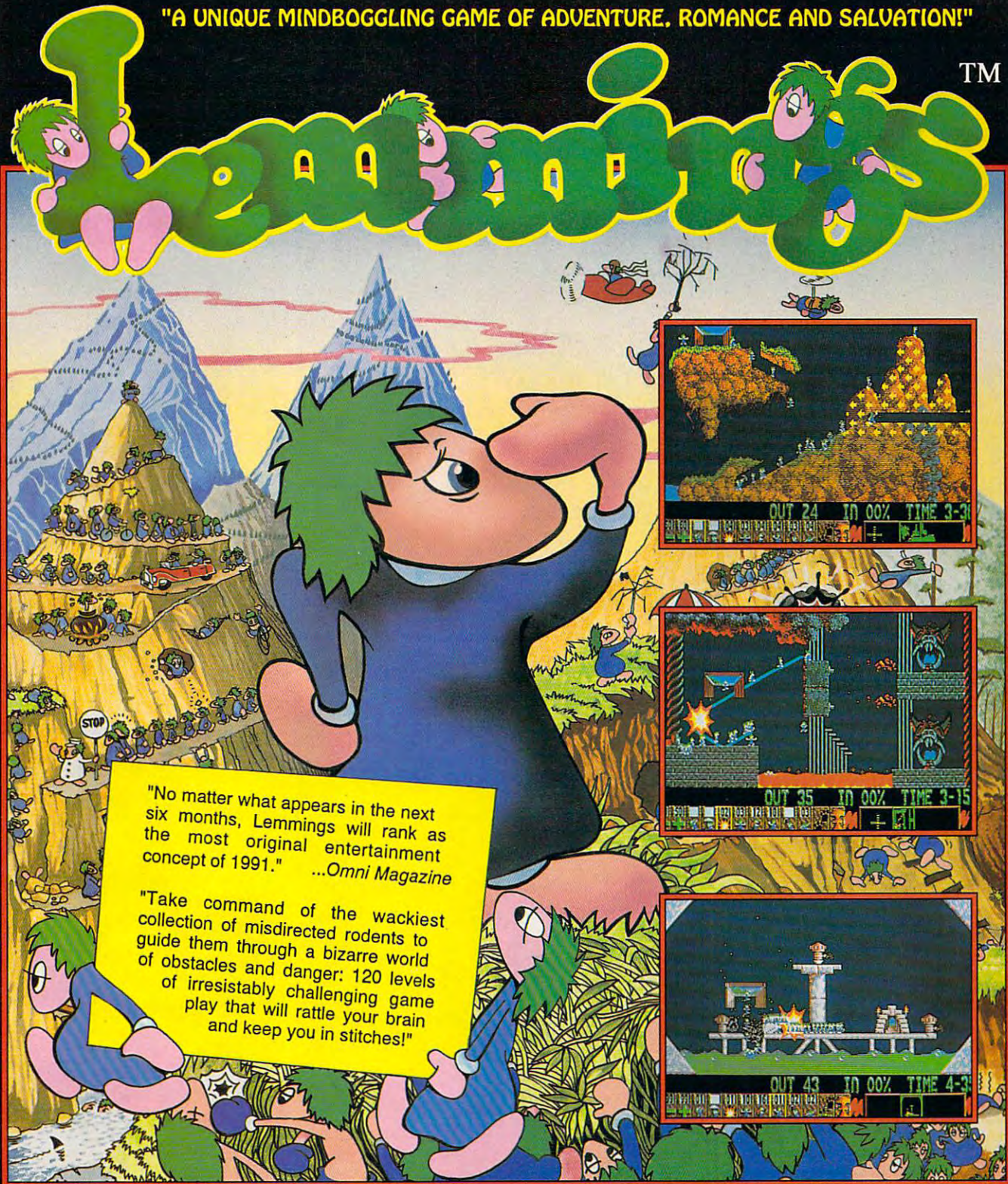
Wacom pen in left hand, Power Glove on right, and barking commands into the Voice Navigator, I tried to write this column but found that none of these gadgets could do the job sufficiently. I managed to rescue my keyboard and mouse from my daughter, but I'll never feel quite the same about them again. □

The Wacom graphics tablet. Will this device make the mouse obsolete?



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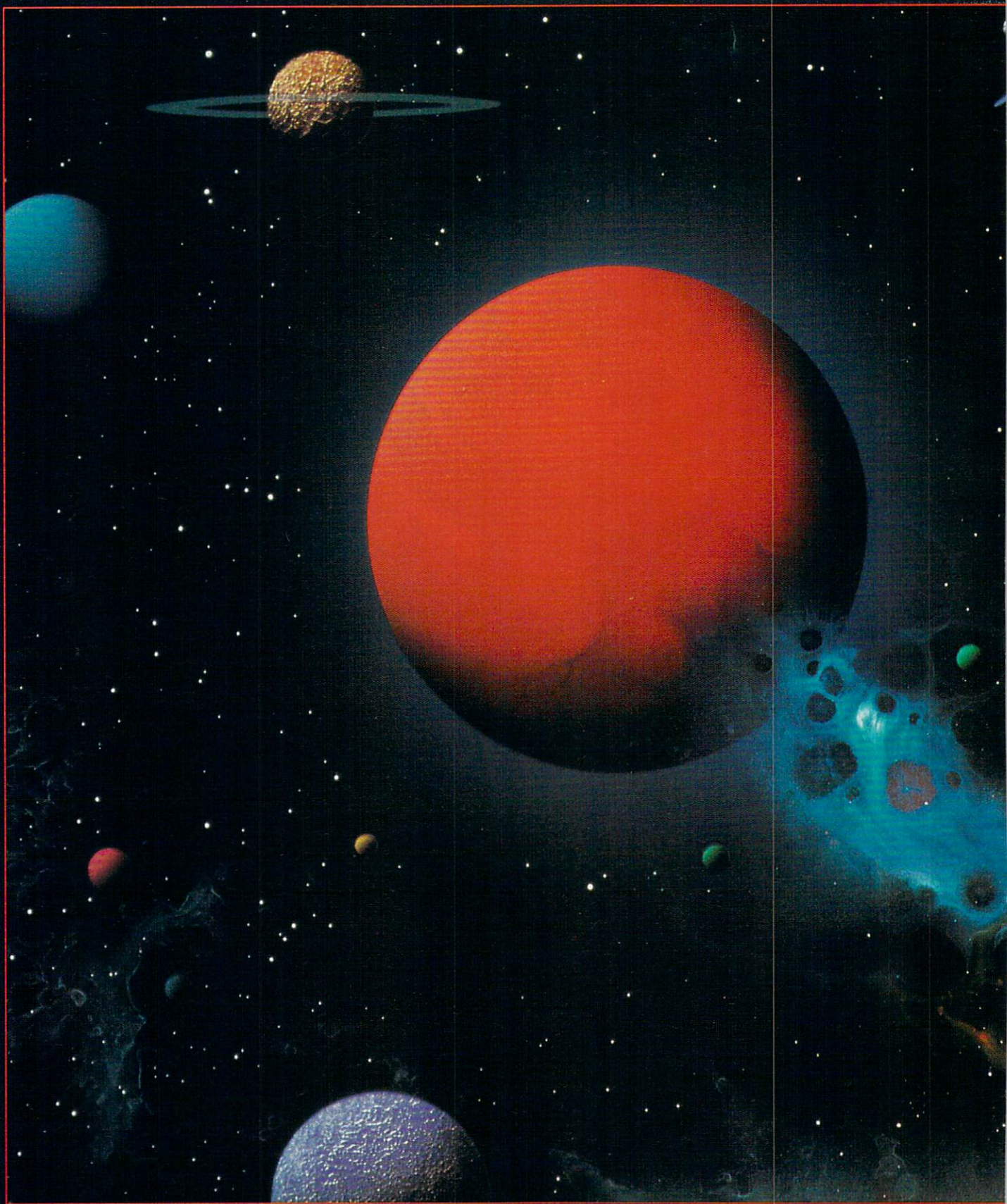
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Great Heavens Above

BY LAMONT WOOD

Galileo probably would have been the first person to suggest a software program for tracking the heavenly bodies had he only been born a few centuries later. As Galileo, Copernicus, and the rest of the stargazing pioneers knew, you can easily get lost in the night sky. The random spread of stars can defeat any attempt to learn the ever-shifting planetary positions and dozens of star patterns that at first glance look nothing like the constellations they're supposed to form.

In the old days, the undaunted could venture into the night with star-chart wheels showing the stars' nightly positions, usually for the wrong latitude and with confusing orientations. And then there were clouds, mosquitoes, jiggling telescopes, and eventually, an urban sky glow to drown out all but the brightest stars.

Now there's a better way—astronomy software that literally lets you explore the sky during the day—even indoors. You can learn the sky and solar system as if they were your own neighborhood, which in a way, they are.

Here we'll take a look at several leading astronomy packages for the PC. Each package was examined on a 16-MHz 386 machine with a VGA monitor. No coprocessor was used. First let's

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go over some basic terminology.

Positions and sizes in the sky are measured in degrees, where a degree is about the width (not length) of your index finger at arm's length. Brightness is measured on a magnitude scale, where 1 is about as bright as any star gets and 6 is about as faint a star as

sky), has a clumsier menu-driven interface, and provides no screen shots of celestial objects. According to Zephyr, it runs slower because things are calculated with more precision. The basic version comes with stars to magnitude 6.5, and there's an expanded version, for about \$30 more and 8MB more of

the positions of the four Galilean moons, a favorite of many backyard astronomers. (Io, Ganymede, Castillo, and Europa, lined up with Jupiter's equator and changing positions nightly, can be seen with a small telescope.) There's even an overhead view so you can identify each moon



Dance of the Planets allows you to view the solar system from outer space, as in this view of Saturn, January 1991.



EZCosmos lets you search the constellations as if you were on your back with your feet facing north.



The_Sky is meant to be used outdoors. The retrograde motion of Mars is shown with the program's time-skip feature.

you can see on a very dark night without a telescope. The programs ask for your location in longitude and latitude, not only to figure rising and setting times, but also to calculate the appearance of solar and lunar eclipses. You're also urged to use a coprocessor to speed up orbital calculations.

For the beginner, *EZCosmos* from Future Trends seems like the best bet at \$69.95. The screen shows the sky as it would look if you were on your back with your feet to the north. Placing the cursor on an object and pressing Enter will bring up identifying information about the object. Additionally, there are screen graphics (in the CompuServe GIF format) of 41 objects, including the planets and prominent galaxies and nebula you can call up. (Alas, for the beginner who might be misled, these are time-lapse photos taken through a big telescope—more colorful and detailed than what you would see through a backyard telescope.)

EZCosmos finds and displays named objects and allows you to speed up the pace of time and watch the planets move against the stars. (At intervals, Mars actually stops and moves backward.) Also, you can focus on the sun and watch for eclipses.

While this program does make it easy to take a grand tour of the universe, it isn't for the serious backyard astronomer. It doesn't offer stars dimmer than sixth magnitude, and it can't zoom in to a field narrower than one degree—a field twice the diameter of the full moon.

LodeStar Plus II from Zephyr Services (\$199.95) at first seemed like the same thing, only it's slower (taking more than a minute to draw the full

disk space, which has an SAO (Smithsonian Astrophysical Observatory) star catalog of 270,000 stars that reach all the way to 12th magnitude.

As with *EZCosmos*, you can place the cursor on an object, have the system identify it, and then zoom in to a specific magnification—this time up to 999.9 powers, covering a field barely one-tenth of a degree in diameter. The only way to get a printout is by pressing PrintScreen, and you need a CGA monitor for that to work.

LodeStar—especially the expanded version—would seem to be best for the serious amateur who wants to plan an observation session or perhaps identify the contents of an astrophoto, cases in which precision matters more than speed.

Meanwhile, *The_Sky* 4.1, from Software Bisque, is meant to be used outdoors. Its control menus are shown in red so using the computer won't wreck your night vision. You can point and click your input from an onscreen keyboard chart without having to fumble at the keyboard in the darkness.

The star field is painted almost instantly on the screen—no tedious waits. You can zoom in on anything within view by moving the mouse cursor to the field you want to see and drawing a box and clicking. It was quite a thrill to zoom in on clusters like Pleiades.

The_Sky will take you down to two-tenths of a degree, where the moon or sun takes up most of the screen. However, only an outline disk is shown; no attempt is made to show the actual solar bodies. You're supposed to look for those yourself through your telescope.

In addition to showing the planets, *The_Sky* has a special display to show

and its actual location in orbit, which isn't evident from the edge-on view you get from Earth. You can also watch this miniature solar system in action by speeding up the pace—orbital movement is evident even with five-minute increments.

There's also a special eclipse display that shows lunar and solar eclipses for your location. You see the way the moon and sun will move across each other with the times of first and last contact and the times of maximum coverage. Earth's umbra during a lunar eclipse is seen in red—the color the moon actually appears during a total lunar eclipse.

The_Sky comes in three different packages: At \$75 for Level I, you'll see up to 10,000 stars and deep-sky objects at magnitude 5.5; for \$99 you can get the Level II version and see up to 45,000 stars and other celestial objects at magnitude 7.9; Level III, for \$175, shows 272,000 stars and objects to magnitude 9.

A telescope-link kit is also available for \$699. You mount sensors on the two axes of your telescope, and after you calibrate your telescope's setting on two selected stars, your cursor will point in exactly the direction of your telescope. It's pricey, but with the link kit, you can look at scores of objects in one evening with no time lost due to endless blind searches.

If *The_Sky* is intended for the serious amateur astronomer, *Dance of the Planets* from A.R.C. Science Simulation is intended for the serious amateur astrophysicist. Priced at \$195, it shows the celestial globe and stars therein, but that's incidental.

The opening screen shows a