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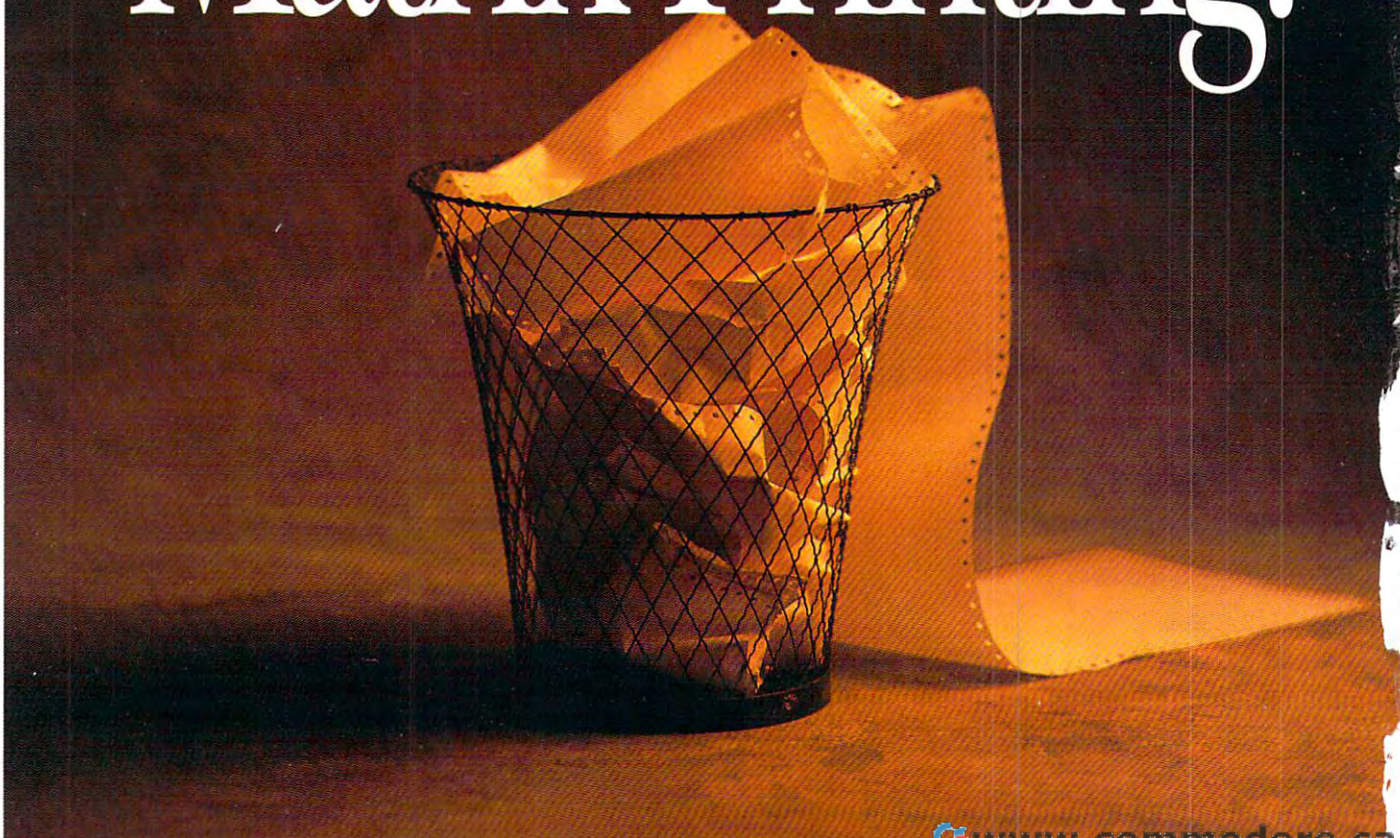

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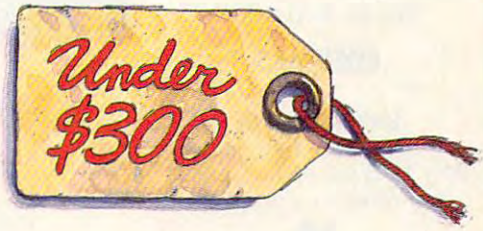

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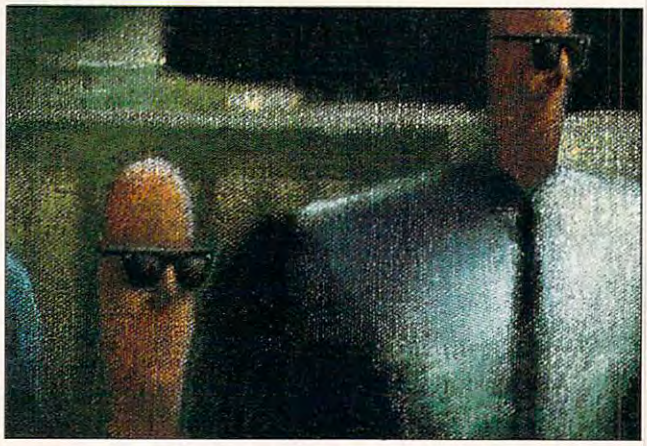

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Clifton Karnes

The year 1992 will probably go down in the computer history books as the year of the operating system. We saw Microsoft release Windows 3.1 and Windows for Workgroups, both of which brought the promise of Windows 3.0 to fruition. And we witnessed the release of OS/2 2.0, IBM's much-talked-about full 32-bit operating system. To counterpunch OS/2 and diffuse its impact, Microsoft also announced Windows NT, that company's full 32-bit operating system, planned to be released by the end of 1992, but delayed.

Usually, we don't know until a year is over whether it was the year of the LAN or the year of the dog, but the writing for 1993 already seems to be on the wall—or, more appropriately, on the desktop.

We'll see 1993 go down in the history books as the year of the Windows database. We saw the first volleys of the database wars in 1992, but big guns are going to be fired in 1993. Here's a guide to the players.

The year 1993 will go down in the history books as the year of the Windows database.

Preseason. In 1992, a couple of amazingly good Windows databases appeared. The most successful of these is Approach, an easy-to-use database that works with dBASE and Paradox files and uses the Windows interface to great advantage. In fact, we gave Approach a COMPUTE Choice Award as one of the best software products of 1992. And Approach 2.0, the latest version, is this issue's Productivity Choice.

Negotiations. Ashton-Tate invented the PC database market with dBASE way back in the days of CP/M. By 1990, however, Ashton-Tate was in trouble. It was obvious that someone was going to buy the company, but who? Whoever got A-T would get the huge, if somewhat troubled, dBASE market along with it.

Borland jumped in and quickly signed a deal with A-T. Borland already owned a significant piece of the DOS database market with Paradox. Buy buying Ashton-Tate, Borland increased its database holdings to 79 percent of that market.

Microsoft counterpunched by buying Fox Software, makers of the amazingly fast and powerful dBASE clone, FoxPro. Microsoft said there would be a FoxPro for Windows soon.

Pregame. Microsoft realized that bringing a product to market first is a big plus. There was no way to ship FoxPro for Windows in 1992, but the company was able to release Access, a powerful Windows database with an easy-to-use front end like Visual Basic. And Microsoft launched Access at an introductory lowball price of $99. Watch this one. It may come from behind and surprise us all.

That brings us to two of the biggest players in the Windows 1993 database game: Paradox for Windows and FoxPro for Windows.

Showtime. Microsoft's Access may have been released early, but Paradox for Windows was late. Originally planned for early 1992, the product was rescheduled to ship in January 1993. Was it worth the wait? In a word, yes. Paradox is dazzlingly powerful, full-featured, amazingly fast, and, perhaps even more amazing, easy to use.

Paradox for Windows isn't just Paradox for DOS translated into Windows. It's a redesign from the ground up, and it shows. The program makes excellent use of the Windows environment for both developers and end users, and it has the best visual design tools I've seen.

Early reports of FoxPro for Windows, still due to ship as I write this, show it to be an impressive product with the speed and power of its DOS brother and with excellent code compatibility with the DOS version.

In databaseland, while speed isn't everything, it's almost everything, and the question on everyone's lips is, Which is faster, FoxPro for Windows or Paradox for Windows? Based on examination of the DOS products, my guess is that they'll be about the same in speed. Both will work with Paradox DB and dBASE DBF files, and they'll cost about the same—roughly $795.

So here's a wrap-up of the major Windows database players to watch in 1993. First, there's the preseason star, Approach, and there's the pregame winner, Access. Then, there are the two contenders for the heavyweight title, Paradox for Windows and FoxPro for Windows.

And there's a good chance we'll have an exciting and entertaining halftime show with SuperBase for Windows and Clipper for Windows as headliners. ❐

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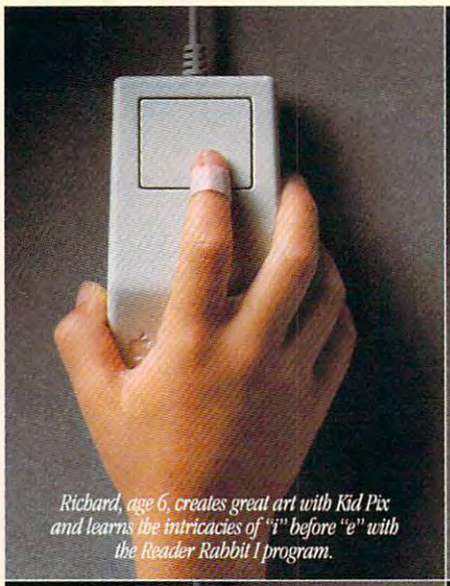
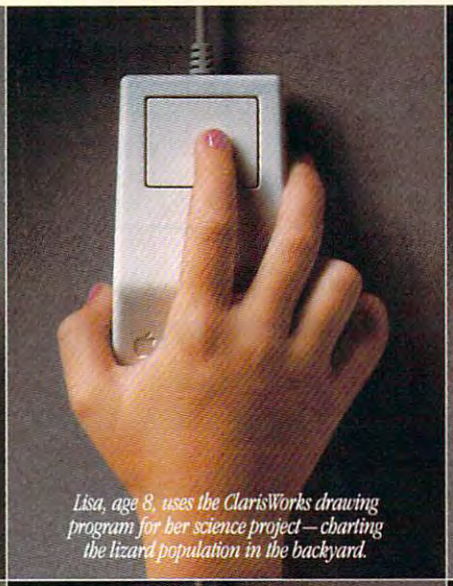
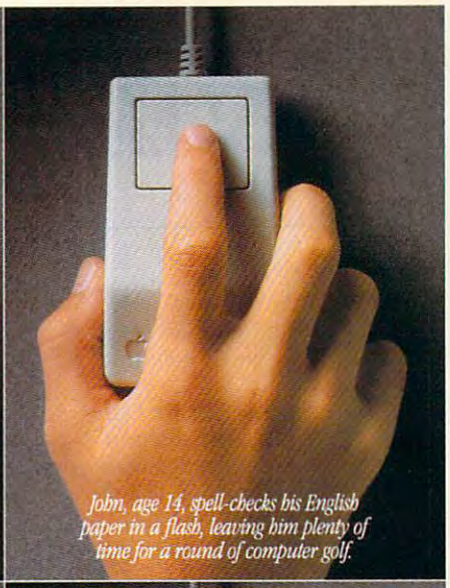


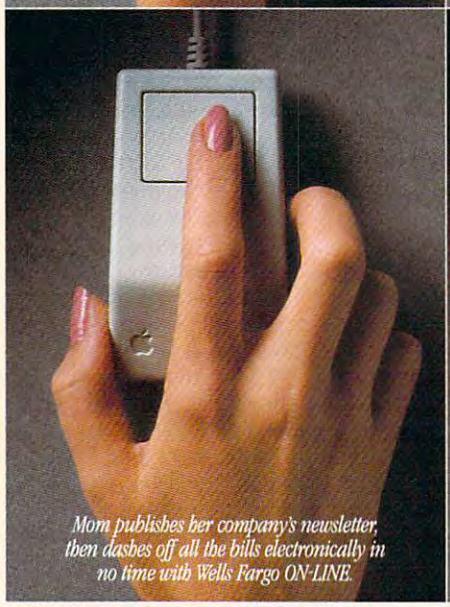
Richard, age 6, creates great art with Kid Pix and learns the intricacies of "i" before "e" with the Reader Rabbit I program.



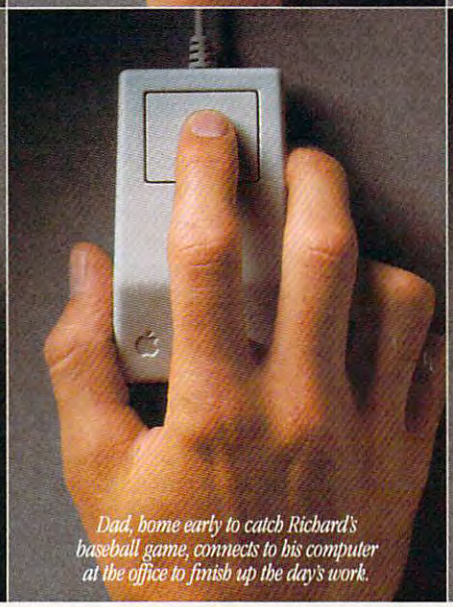
Lisa, age 8, uses the ClarisWorks drawing program for her science project—charting the lizard population in the backyard.



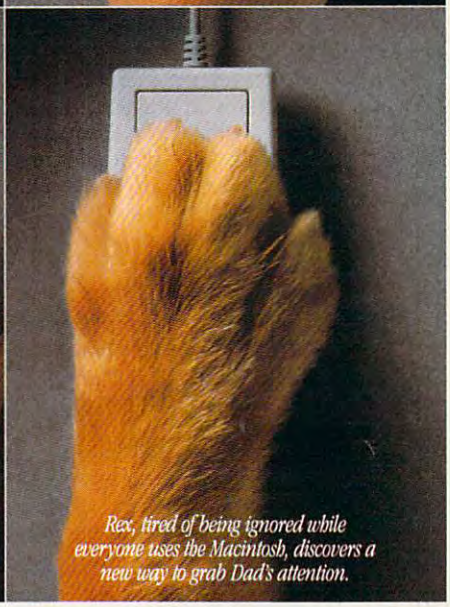
John, age 14, spell-checks his English paper in a flash, leaving him plenty of time for a round of computer golf.



Mom publishes her company's newsletter, then dashes off all the bills electronically in no time with Wells Fargo ON-LINE.



Dad, home early to catch Richard's baseball game, connects to his computer at the office to finish up the day's work.



Rex, tired of being ignored while everyone uses the Macintosh, discovers a new way to grab Dad's attention.

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TEST LAB

Edited by Mike Hudnall
Reviews by Tom Benford

Incredibly fast and powerful microprocessors supply the brains and brawn of today's computers. But the beauty of a system—the display your eyes follow hour after hour, day in and day out—can be just as important. And there's much more to a monitor than meets the eye. Should you opt for a larger monitor when you buy your next computer system? Should you upgrade from your present 14-inch monitor to a 15-inch or 17-inch monitor? What features should you look for, and what problems should you look out for? This month's Test Lab helps by examining ten monitors with a variety of features—three 15-inch monitors and seven 17-inch monitors, ranging in price from $595 to $1,789.

Knowing what to look for as you shop around is half the battle in your quest for the right monitor. Our grid of monitor features provides you with specifics about dimensions, video modes, operational specs, emissions standards compliance, and FCC certification. In his reviews, Tom Benford offers his expert evaluation of each monitor, commenting not only on performance but on ease of use and the distinctive features of these monitors.

In addition to the standard brightness, contrast, and horizontal and vertical controls, many of these monitors offer a pretty remarkable array of controls that handle everything from barrel and pincushion distortion to magnetization. Because not every application uses the same screen settings, some of these monitors offer factory-preset and user-definable settings. Once you've optimized the settings for a particular application, you can save them. Whenever you call up that application, the monitor automatically recalls the correct settings. With controls like these, not only do you improve the appearance of your apps, but you also work smarter and more efficiently.

For a detailed look at performance, check the grid with the monitor scores for the Video Obstacle Course in DisplayMate Professional. Tom Benford and his team checked each monitor for flicker, bounce, distortion, moirés, and a host of other problems, using the more than 30 tests in the VOC. The "Monitor Test Lab Methodology" sidebar details the lab's testing equipment and procedure, and you'll find a glossary to help you with terms that may be unfamiliar.

If you're in the market for one of these feature-rich, highly capable monitors, read on. The facts, figures, and evaluations in this Test Lab can help you make a more informed decision.

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The physical styling of the Hitachi/NSA SuperScan 15 monitor is nice and clean, but the monitor's good looks don't end there.

Positioned as an ideal monitor for business graphics and Windows applications, the SuperScan 15 delivers a 15-inch display in about the same amount of space required by the average 14-inch monitor. A permanently attached pedestal base provides a highly stable tilt-swivel platform while occupying a footprint only about 10½ inches square.

At the rear of the SuperScan 15, you'll find a permanently attached video cable fitted with a standard 15-pin D connector and an AC power outlet for plugging in the detachable power cord. The manufacturer has placed the adjustment controls at the front of the SuperScan 15, right where they should be for easy reach.

All of the controls occupy an apron that runs beneath the video display and, though not concealed by a door or flip-down panel, aren't visible from the user's perspective. The rotary dial controls are recessed about an inch from the edge of the apron, effectively removing them from view unless you lower your head to the same level as the monitor's base. Icons representing the functions of the corresponding controls appear on the apron lip, helping to keep the SuperScan 15's appearance neat and uncluttered.

As you look from left to right while facing the monitor, you'll see that the control complement consists of vertical position, vertical size, horizontal position, horizontal size, brightness, contrast, and a flush-mounted power switch with embedded LED power indicator. The manufacturer does not provide memory or degaussing circuitry in this monitor.

Generally speaking, the SuperScan 15 is an easy monitor to look at for extended periods, owing to its bright screen and good resolution. The monitor did, however, have a tendency to bow inward slightly on both left and right sides at the center of the screen and, since there is no pincushion compensation control, not much can be done by the user to correct it. Adjusting horizontal

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size and position made it somewhat less noticeable with a few applications, but there was no way of eliminating the inverse barrel distortion of the screen sides. Surprisingly, the screen's geometric linearity was excellent despite this.

Flickering seldom marred the SuperScan 15's display. Even with dot and crosshatch patterns that proved troublesome for other monitors, flickering on the SuperScan 15 was either totally absent or not as severe. The Video Obstacle Course caused the SuperScan 15 to flicker in two of the tests, but every other monitor covered here flickered in those same tests.

If there's an Achilles heel on the SuperScan 15, it must be moiré patterns. While generally very slight and only noticeable on large screen areas containing uniformly gray-shaded areas, the shimmering moirés were nevertheless visible on several of the Video Obstacle Course tests as well as with some DOS and Windows applications. Additionally, I noticed some screen bouncing during the screen and local regulation tests as well as during the mode-switching tests. Despite these problems, however, the SuperScan 15 turned in a very respectable score in the VOC.

If your needs and budget seem to point toward a 15-inch monitor as the best choice for you, then you should definitely consider SuperScan 15.

Circle Reader Service Number 371

IOCOMM THINKSYNC 5 CM-5128

IOcomm's ThinkSync 5 CM-5128 has some features that consumers should find attractive, but it turned in a generally disappointing performance.

The 15-inch monitor takes up about the same amount of physical space as the average 14-inch monitor and weighs in at the relatively light weight of 38 pounds. The CM-5128's physical appearance is Spartan and uncluttered, with all of the display controls ergonomically located at the front of the monitor, just below the display screen. A rocker power switch occupies the lower right corner of the monitor, with a green LED located just above it to signify when the power is on. You'll find it easy to adjust picture characteristics, thanks to convenient placement of the rotary dial controls for brightness and contrast next to the LED. This location proved to be a good one, as adjustment to the image brightness, contrast, or both was frequently necessary to maintain the best viewing characteristics when switching applications.

A drop-down panel door conceals the five additional knob controls, used for adjusting horizontal and vertical size and position; a fifth knob adjusts the screen's geometry (pincushioning). I used all five of these knobs extensively to readjust the screen while switching between DOS-based applications, since the CM-5128 has no digital memory for storing preferred settings. Windows applications did not require further adjustment once I set up the initial preferences.

On this monitor, the video cable is detachable. It plugs into the rear of the monitor, along with the AC power input.

The characteristic of this monitor that I found most objectionable is that the image "runs uphill." Presumably, the CRT isn't mounted perfectly square in the chassis mounting cradle. Whatever the cause, I found it most disconcerting to see the text at the left side of the screen about one-eighth inch lower than that at the right.

The CM-5128 found several of the tests in the Video Obstacle Course to be tough going as well. The display screen exhibited a slight red tinge at the left side and a red and blue tinge at the right side. The screen's uniformity was less than perfect, with variations in brightness in several areas, especially noticeable against light background colors. The screen also displayed better focus at the center than at the edges, along with a tendency toward "blooming" at the center (this was very apparent in test 5 of the VOC—Horizontal Versus Vertical Line Thickness).

Screen flickering and moiré patterns proved to be additional gremlins which made their presence known numerous times—not only during the VOC tests but also in 1024 × 768 mode when hires images with certain dot patterns (shaded gray backgrounds in particular) were being displayed. Streaking and ghosting were also noted, as well as screen regulation weaknesses

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and bouncing when I switched graphic modes.

Because of the "uphill" image and the problems encountered in the Video Obstacle Course, I cannot recommend this monitor.

Circle Reader Service Number 372

MAG INNOVISION MX15F

If the monitors covered here were in a beauty contest, the MAG InnoVision MX15F would probably walk away with top honors. It is indeed a handsomely styled 15-inch monitor that pleases the eye in many ways.

Devoid of any nonfunctional frills, the cabinet perfectly complements the flat-screen design of the MX15F. A detachable tilt-swivel base provides a stable and easily adjustable support for the monitor, although the unit also has its own rubber feet, which will come in handy if you decide not to use the tilt-swivel base.

MAG's placement of the monitor's controls up front and within easy reach makes sense. Rotary dials at the left side just beneath the video display allow you to adjust brightness and contrast. A flush-mounted power switch with green LED power indicator flanks the right side in the same position under the display.

In the center, a drop-down door conceals the other adjustment controls and indicators, including a digital LED mode indicator. A smoked window in the drop-down door lets you see the numerical mode indicator, and four small "portholes" in the door facilitate your monitoring any of the four LED status indicators. If you don't want to see these displays, you can use an auxiliary panel door, which doesn't have any window or portholes in it—a nice extra touch.

MAG INNOVISION
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Warranty: one year, parts and labor; two years on CRT

Planning to take your monitor abroad? No problem. The MX15F comes with a universal autoswitching power supply, which permits you to plug it in and use it anywhere in the world (you might still need a converter for your PC and other gear, however).

Eight plus/minus push-button controls adjust the picture attributes. You'll use pairs of these controls to adjust vertical size, vertical position, horizontal phase (position), and horizontal size. Additionally, MAG furnishes a program set/recall push button and a slider switch for selecting any of either the eight preset timing modes or eight user-defined modes. Memory recall is automatic for the factory presets with manual override possible.

The illuminated digital display and four LED indicators keep you abreast of the monitor's current mode and status. A single digit (1–8) in the mode indicator identifies the monitor's current video mode. Without the red user indicator illuminated, a number represents a factory preset mode; with the user/preset switch in the up position, the user LED is activated, and the mode indicator reflects which user-programmed mode is active. A green LED labeled SOG indicates when the incoming signal has a composite sync signal, while an amber LED lights up if the input is a composite signal. (These signals are relevant to users of Macs only.) The fourth LED, also red, goes on if the input signal exceeds the monitor's frequency range and the monitor cannot display the image satisfactorily. These features are sure to find favor with users who like to know what's going on at all times with their PC system, but this information probably won't mean too much (if anything) to the average user. That's probably why MAG provides the extra no-window panel door.

The MX15F's image is bright and well defined with excellent geometric linearity and uniformity across the entire viewing area. The only flaws detected using the Video Obstacle Course were a tendency to show moirés with some patterns, a minor bit of screen regulation deviation, and local distortion and some bouncing while changing video modes. Screen flicker, a weakness detected by the VOC on all the monitors covered here, was also present but not as pronounced or as objectionable as on some of the other monitors.

The MX15F has a lot going for it and makes a good choice if you're considering a 15-inch SVGA-capable monitor.

Circle Reader Service Number 373

MITSUBISHI DIAMOND PRO 17

If you're interested in upgrading to a large-screen monitor that has all of the leading-edge technological bells and whistles in addition to a superb image with rock-steady stability, the Mitsubishi Diamond Pro 17 may be just the ticket.

All of the Diamond Pro's controls are conveniently located at the front of the display. A drop-down door occupying the left half of the apron under the display houses some of the controls, while exposed flush-mounted

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push buttons fill up the right half of the apron and complete the control section.

The controls normally concealed behind the panel door include a pair of push buttons used to select the desired function for adjustment; the choices include horizontal position and size, vertical position and size, horizontal static misconvergence, and vertical static misconvergence. Two more push buttons are used to increase and decrease the settings of the selected adjustment, and a memory preset recall switch is located next to them.

The exposed controls consist of a pair of flush-mounted brightness push buttons (an embedded LED on the minus switch lights up when either of these controls is touched), a pair of push buttons for adjusting contrast (again with an embedded LED in the minus switch which signifies adjustment activity with either of these controls), and a momentary-contact degauss switch. An illuminated LED power indicator and a flush-mounted power switch complete the lineup of controls. The overall appearance of the monitor is clean and contemporary.

You'll find three connectors at the rear of the monitor: an AC power input connector, a 15-pin D jack, and a special-purpose 13W3 connector, used for connecting the Diamond Pro to a dedicated CAD workstation. This monitor also works with a color Macintosh computer; just use the optional cable/adapter assembly available from Mitsubishi.

MITSUBISHI ELECTRONICS AMERICA
Information Systems Division
5757 Plaza Drive, P.O. Box 6007
Cypress, CA 90630-0007
(800) 843-2515
(714) 220-2500
List price: $1,599
Warranty: two years, parts and labor

A small-footprint (about ten inches square) tilt-swivel base provides a stable platform for the monitor while making adjustments to the viewing angle effortless.

I found the image clarity and stability of the Mitsubishi pristine; color saturation and hue were vibrant and bright without a hint of ghosting, blurring, or streaking. In fact, the only flaws noted during some long sessions with the monitor were its tendency toward some slight barrel distortion (the sides of the screen are wider at the middle than at the top and bottom), with the toe-in appearance more pronounced at the bottom of the screen than at the top. And, as with every other monitor covered here, a screen flicker was also noticeable during two of the DisplayMate Professional tests in the Video Obstacle Course where high-resolution single-line raster images were displayed. The Diamond Pro proved to be unflappable in other VOC tests which were troublesome for other monitors (for example, screen regulation, local regulation distortion, and text-graphics mode switching).

The Diamond Pro is an excellent 17-inch monitor for virtually any type of work, from text to com-

MONITOR TEST LAB METHODOLOGY

To test the 15- and 17-inch monitors featured in this month's lineup, we used a computer system that includes a Mylex i486DX/50 motherboard with 32MB of RAM and 64K internal caching, mounted in a minitower case with a regulated and calibrated power supply from Triton Technologies.

The video card that we used throughout our extensive monitor testing is a Renoir Ultra-SVGA card, which is capable of all modes up to and including 1280 × 1024 with 16 colors and which is equipped with a full megabyte of video RAM and a Sierra HiColor RAMDAC chip for 32,768-color capability. The VESA driver that came supplied with the Renoir Ultra-SVGA card was automatically loaded at boot-up via an included line in the system's AUTOEXEC.BAT file.

Prior to testing, we set up and adjusted each monitor for optimal viewing, using the Setup utility in DisplayMate Professional.

All of the monitor tests were subjective. We conducted them with the DisplayMate Professional Video Obstacle Course test suite, which uses 33 test patterns to uncover video anomalies or substandard performance. We ran this test suite in DisplayMate video mode 105 (1024 × 768 interlaced). The displayed test patterns allowed us to identify common video irregularities, including blooming, defocusing, geometric linearity, moiré patterns, flicker, streaking and ghosting, and other conditions.

Mode 105 was selected for the test suites, as it's a high-resolution interlaced mode which all of the tested monitors are capable of displaying. It also makes certain video maladies such as flicker and ghosting more pronounced and thus more noticeable.

A jury of three CPTS staff members scrutinized each monitor for each test and voted using a 1–10 scale, with lower numbers representing poorer performance and a 10 representing a perfect score. We compiled the votes of these three testers for all of the tests and totaled the results. None of the monitors tested achieved a perfect score, although many scored in the high 9s, indicating excellent performance and viewing.

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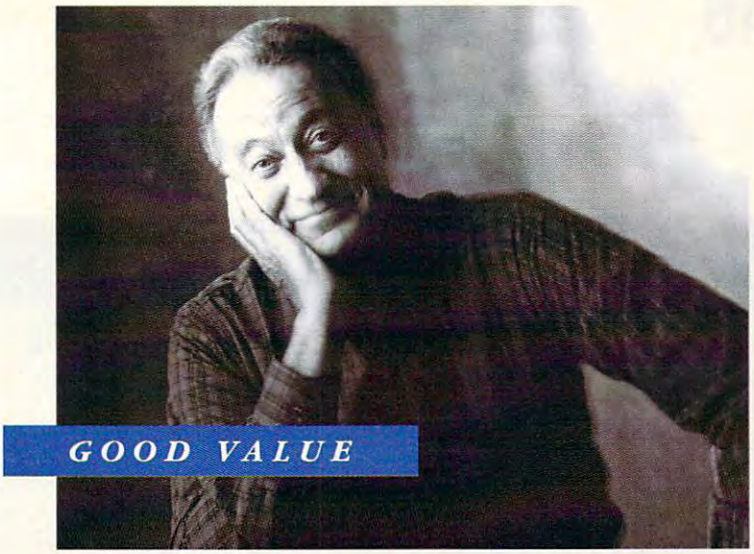

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DISPLAYMATE UTILITIES PROFESSIONAL VIDEO OBSTACLE COURSE TEST RESULTS[1]

	Hitachi/NSA SuperScan 15	IOcomm ThinkSync 5 CM-5128	MAG InnoVision MX15F	Mitsubishi Diamond Pro 17	Optiquest 4000DX
Screen uniformity and flicker	10	8	10	10	8
Freedom from background interference	10	10	10	10	10
Dark screen	10	10	10	10	10
Geometric linearity	8	6	10	8	9
Circular test pattern	10	10	10	10	10
Horizontal versus vertical line thickness	10	5	10	10	10
Line brightness versus thickness	9	8	10	10	10
Defocusing and blooming	10	8	10	10	10
Raster visibility	8	8	8	8	8
Resolution	8	8	8	10	8
Corner resolution	8	6	9	8	6
Normal and reverse video resolution	10	10	10	10	10
Line moiré pattern	9	8	8	10	8
Fine line moiré pattern	8	8	8	10	8
Dot moiré pattern	9	8	8	10	10
Fine dot moiré pattern	8	8	8	10	10
Horizontal color registration	10	8	10	10	8
Vertical color registration	10	10	10	10	10
Horizontal color registration blink	10	8	10	10	8
Vertical color registration blink	10	10	10	10	10
64 intensities for primary colors	10	10	10	10	10
Color timing	10	10	10	10	10
Digital color timing	10	10	10	10	10
White level shift	10	10	10	10	10
Black level shift	10	10	10	10	10
Two-dimensional streaking	10	10	10	10	10
Streaking and ghosting	10	8	10	10	10
Persistence	10	10	10	10	10
Screen regulation	8	8	8	10	8
Local regulation distortion	8	8	8	10	8
Text/graphics switching	8	4	5	10	4
AVERAGE TEST SCORE	9.32	8.48	9.29	9.81	9.06

[1]See the "Monitor Test Lab Methodology" sidebar for a full explanation of how the lab derived the results in this grid.

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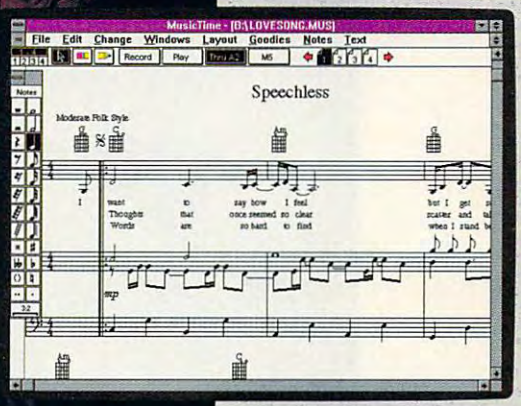

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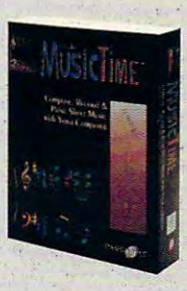

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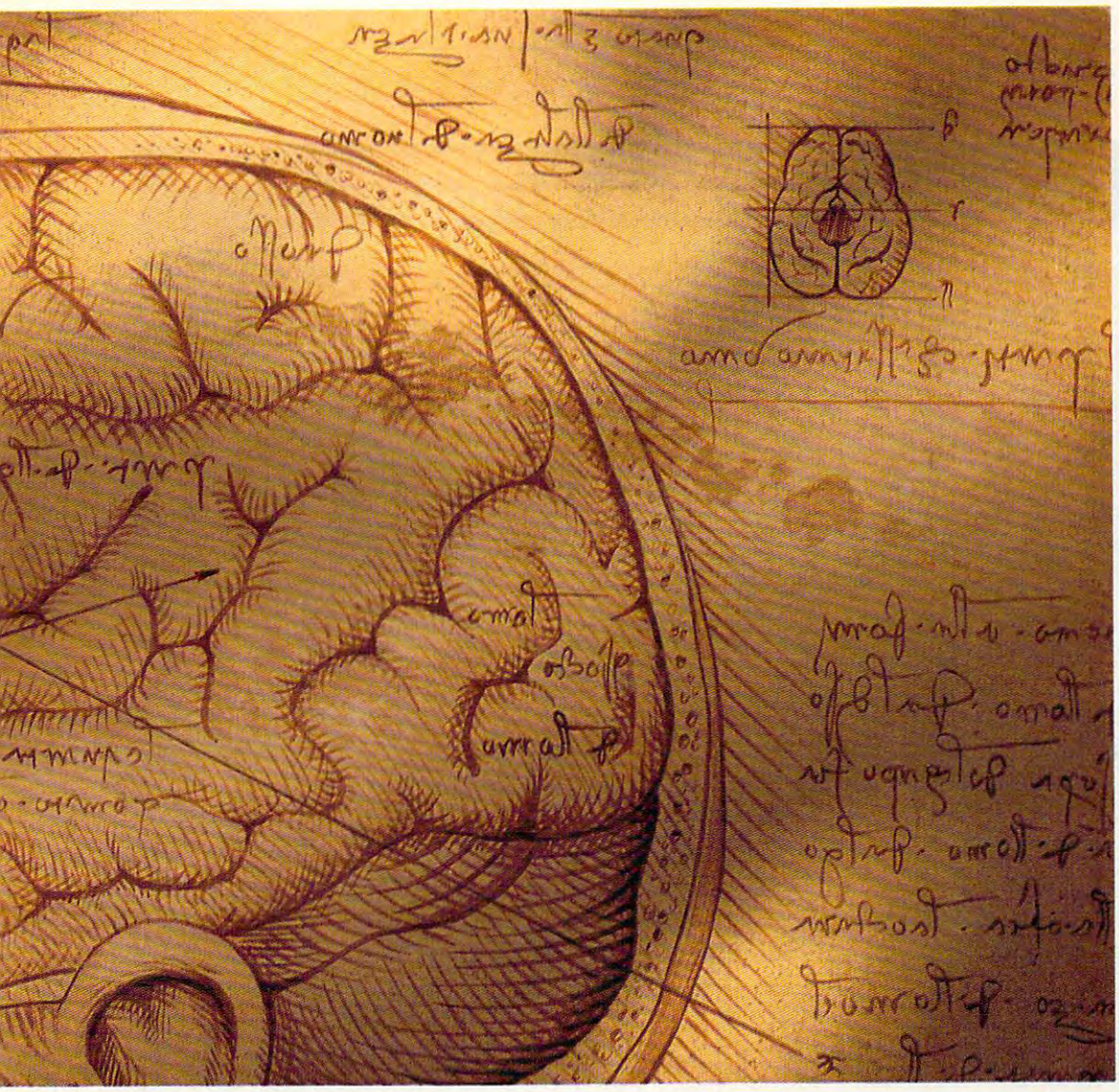

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DISPLAYMATE UTILITIES PROFESSIONAL VIDEO OBSTACLE COURSE TEST RESULTS[1]

	Samsung SyncMaster 5C	Samtron SC-726V	Sony CPD-1604S	ViewSonic 7	Zenith Data Systems ZCM-1790
Screen uniformity and flicker	10	10	10	10	6
Freedom from background interference	10	10	10	8	10
Dark screen	10	10	10	10	10
Geometric linearity	7	10	10	10	8
Circular test pattern	10	10	10	10	10
Horizontal versus vertical line thickness	9	10	10	10	10
Line brightness versus thickness	10	10	10	10	8
Defocusing and blooming	10	10	10	10	10
Raster visibility	8	8	8	8	8
Resolution	10	9	8	8	10
Corner resolution	8	6	8	8	8
Normal and reverse video resolution	10	10	10	10	10
Line moiré pattern	10	8	10	8	10
Fine line moiré pattern	10	8	10	8	10
Dot moiré pattern	10	10	10	10	10
Fine dot moiré pattern	10	10	10	9	10
Horizontal color registration	10	8	10	10	7
Vertical color registration	10	10	10	10	10
Horizontal color registration blink	10	8	10	10	7
Vertical color registration blink	10	10	10	10	10
64 intensities for primary colors	10	10	10	10	10
Color timing	10	10	10	10	10
Digital color timing	10	10	10	10	10
White level shift	10	10	10	9	10
Black level shift	10	10	10	10	109
Two-dimensional streaking	10	10	10	9	10
Streaking and ghosting	10	10	10	9	10
Persistence	10	10	10	10	10
Screen regulation	8	8	8	9	8
Local regulation distortion	6	8	9	9	8
Text/graphics switching	0	10	8	4	10
AVERAGE TEST SCORE	9.23	9.39	9.71	9.23	9.29

[1]See the "Monitor Test Lab Methodology" sidebar for a full explanation of how the lab derived the results in this grid.

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plex CAD design. Its image quality, ergonomic control placement, and extended-range video capabilities make it a good choice for the discerning PC user looking for a superior large-screen video display.

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OPTIQUEST 4000DX

Another 17-inch Super VGA monitor to break the $1,200 price barrier, the Optiquest 4000DX is also one of the more lightweight 17-inch monitors.

Featuring a 32-mode digital memory (the largest capacity of all the monitors covered here), the 4000DX comes with factory presets for 16 of the major video modes. You can store 16 additional settings (defined by you), all ready to be automatically recalled when you run the particular applications associated with them. The monitor always detects and displays the last mode stored in the user setting area when you first turn it on, and it checks all of the other user-stored settings before selecting a factory-set default mode. This negates the need for a manual memory recall switch, so Optiquest doesn't provide one on the 4000DX.

All controls are front mounted and exposed on the monitor, which has an otherwise frill-free appearance. They reside just below the display screen in the apron area of the monitor. To adjust your viewing angle, just use

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20490 E. Business Pkwy.
Walnut, CA 91789
(909) 468-3750
List price: $1,195
Warranty: one year

the supplied tilt-swivel base. If you elect to bypass the tilt-swivel base, you can set the monitor, which is equipped with four rubber-tipped feet, directly on the PC or desktop.

The brightness and contrast controls are traditional rotary-dial units, located at the right front corner of the unit, next to the rocker power switch; a small green dot-shaped LED power indicator appears just above the switch. The other controls include four flush-mounted push buttons and five additional green-dot LEDs. The selector push button lets you choose among the five controls used to make adjustments; once you select, the plus or minus push buttons adjust the value. A reset switch restores the original (factory) default value.

In addition to the usual brightness, contrast, and horizontal and vertical size and position controls, the 4000DX also provides a pincushion distortion control to compensate for horizontal and vertical edge curvature, which may occur in some video modes.

The overall picture quality was good, especially when you consider the CRT's .31-mm dot pitch; this is a larger pitch (resulting in a larger pixel) than that of any of the other 17-inch monitors reviewed here. There was a noticeable red tinge at the left screen border and a less objectionable yellowish halo all along the right screen border, which may be indicative of the electron guns being slightly out of alignment. This hypothesis is borne out by the fact that the green alignment was off during two of the DisplayMate Professional tests in the Video Obstacle Course.

The 4000DX also exhibited a tendency to produce moiré patterns whenever a tight, high-resolution pattern was displayed. Screen flickering was noticeable with hi-res patterns, and the focus at the outer edges and corners of the screen was not as crisp as at the center.

The 4000DX delivers digital memory and a large viewing area at a price that brings it within the affordable range of many PC users.

Circle Reader Service Number 375

SAMSUNG SYNCMASTER 5C

If you're looking for a large, ergonomic monitor ready to handle a variety of applications, you'll want to consider Samsung's SyncMaster 5C 17-inch color monitor.

The 5C features a .26-mm dot pitch, which makes it capable of handling 1280 × 1024 resolution as well as every other VGA and Super VGA mode. With the built-in digital memory, you can switch between video mode screen settings and optimal positions when you switch applications. You can save these settings for instant recall whenever you run a particular application again. The monitor permits storing up to 12 modes, all accessible via the front panel controls.

Beneath a drop-down door, you'll find the front panel with eight LEDs indicating the active functions. These include horizontal image shifting, horizontal image stretching and condensing, horizontal concaving and convexing (barrel distortion), vertical image shifting, and vertical image stretching and condensing (pincushioning).

To select the function you'd like to set or alter, use the function button; up- and down-arrow buttons augment and diminish the settings. A save button stores the current mode and position settings in memory. To demagnetize the screen, ridding it

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of any residual static charge buildup, use the degauss button. And to choose between the D-15 and BNC input ports, use the output selection button next to the arrow buttons.

At the rear of the computer, you'll find four discrete BNC connectors (used with Macintosh computers and special-purpose video peripherals) and a 15-pin D connector, along with two slide switches. The first switch selects either the high or the 75-ohm termination setting, and the other selects the input signal level (either 1.0 or .7 volts). Since the cable connections and switch settings don't change once the monitor is installed, the rear of the unit is a good location for these items.

A flush-mounted power switch with a built-in LED indicator is conveniently located at the lower right corner of the monitor, and Samsung has also placed the brightness and contrast controls here within easy reach for making any desired viewing adjustments. Ergonomically, the monitor rates a 10 for its well-placed control layout and easily adjustable tilt-swivel stand.

During testing (see the "Monitor Test Lab Methodology" sidebar), a few weaknesses of the 5C became apparent. The monitor had a marked propensity to bow inward slightly at both the left and right sides of the screen, although the bowing at the left side was considerably more pronounced.

The monitor also exhibited an annoying flicker on the tight resolution (single-line) patterns of the raster visibility and corner resolution tests, which detracted slightly from its overall performance scores. It also exhibited bowing during the screen regulation and local distortion tests, and it was totally unable to successfully complete the text/graphics mode-switching test in the Video Obstacle Course, blanking the screen completely during the test. These weaknesses affected its overall performance score.

Aside from these flaws, this large-screen monitor is handsomely styled and provides an excellent display for virtually any type of textual, graphics, CAD, or design work.

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Ridgefield Park, NJ 07660-0510
(800) 446-0262
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List price: $1,399
Warranty: one year, parts and labor

SAMTRON SC-726V

Samtron packs plenty of good features into its SC-726V monitor, while keeping the appearance utilitarian and simple.

Samtron provides rotary controls for degauss, horizontal size, vertical size, horizontal shift, vertical shift, brightness, contrast, and power. These controls extend inconspicuously beneath the apron on the front of the monitor and are identified by a series of embossed icons. Although a novel departure from the push buttons and slide switches found on many other monitors of this size and class, the rotary controls are quite functional and easy to access, which is what really counts in the final tally.

Samtron places a switch for manually selecting either 110-V or 220-V operation at the rear of the unit, along with a nondetachable cable fitted with a 15-pin D connector. A socket for inserting the detachable AC power cord completes the list of items found at the rear of the monitor.

The SC-726V doesn't come with digital memory or the ability to store user-defined screen settings. The monitor is equipped, however, with autosizing circuitry, so the absence of digital memory won't be a major issue for most users. The autosizing worked just fine with all of the applications I ran during my evaluation.

I found the overall image quality and display resolution surprisingly good for a monitor with such a low price tag. Aside from a tendency to produce moirés on high-resolution screen patterns, the image definition and clarity were certainly acceptable. The DisplayMate Professional Video Obstacle Course detected a slight misalignment of the blue gun registration on two of the tests. Local screen regulation and distortion are other areas that caused the SC-726V to receive less than perfect scores.

Samtron produces two varieties of the SC-726V. The standard version is the one supplied for this review, but the company

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MONITOR FEATURES

	Hitachi/NSA SuperScan 15	IOcomm ThinkSync 5 CM-5128	MAG InnoVision MX15F	Mitsubishi Diamond Pro 17	Optiquest 4000DX
GENERAL					
Screen size (in inches)	15	15	15	17	17
Dimensions (HWD, in inches)	14.88 × 14.09 × 16.29	13.97 × 14.65 × 15.50	13.80 × 14.00 × 16.30	10.02 × 16.14 × 17.32	16.80 × 16.10 × 18.10
Weight (in pounds)	36.0	38.0	36.3	47.4	41.8
Fixed/detachable video cable	fixed	detachable	fixed	detachable	fixed
MODES					
1024 × 768 noninterlaced	■	■	■	■	■
Super VGA	■	■	■	■	■
VGA (640 × 480)	■	■	■	■	■
MCGA	■	■	■	■	■
OPERATIONAL SPECS					
Maximum noninterlaced resolution (pixels)	1024 × 768	1280 × 1024	1280 × 1024	1280 × 1024	1280 × 1024
Vertical scanning frequency range (Hz)	50–100	40–100	50–120	50–130	50–90
Horizontal scanning frequency range (kHz)	30–58	30–65	30–68	30–64	31–60
Phosphor[1]	short persistence	short persistence	medium short persistence	short persistence	short persistence
Dot pitch or aperture pitch (mm)	0.28	0.28	0.28	0.26	0.31
CONTROLS					
Brightness	■	■	■	■	■
Contrast	■	■	■	■	■
Horizontal position	■	■	■	■	■
Vertical position	■	■	■	■	■
Horizontal size	■	■	■	■	■
Vertical size	■	■	■	■	■
Pincushioning	❐	■	❐	❐	■
Memory save	❐	❐	■	■	■
Automatic sizing	■	■	■	■	■
Degaussing	❐	❐	❐	■	❐
EMISSIONS STANDARDS COMPLIANCE					
MPR	■	❐	❐	■	■
MPRII-VLF	■	❐	❐	■	■
MPRII-ELF	■	❐	❐	■	■
FCC CERTIFICATION CLASS					
	B	A	B	A	B

■ =yes ❐ =no

[1]Short persistence phosphor is the most desirable. With this duration, the screen is less subject to ghosting and streaking.

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MONITOR FEATURES

	Samsung SyncMaster 5C	Samtron SC-726V	Sony CPD-1604S	ViewSonic 7	Zenith Data Systems ZCM-1790
GENERAL					
Screen size (in inches)	17	17	17	17	17
Dimensions (HWD, in inches)	17.50 × 16.50 × 17.90	16.00 × 16.00 × 16.80	14.00 × 13.75 × 16.13	16.69 × 16.25 × 17.00	16.64 × 17.49 × 17.99
Weight (in pounds)	48.3	48.5	44.0	42.7	56.0
Fixed/detachable video cable	detachable	fixed	fixed	detachable	fixed
MODES					
1024 × 768 noninterlaced	■	■	■	■	■
Super VGA	■	■	■	■	■
VGA (640 × 480)	■	■	■	■	■
MCGA	■	■	■	■	■
OPERATIONAL SPECS					
Maximum noninterlaced resolution (pixels)	1024 × 768	1024 × 768	1024 × 768	1280 × 1024	1024 × 768
Vertical scanning frequency range (Hz)	45–90	50–90	50–87	50–90	52–97
Horizontal scanning frequency range (kHz)	30–60	31.5–56.4	30–57	30–64	31–57.51
Phosphor[1]	short persistence	short persistence	short persistence	RGB short persistence	short persistence
Dot pitch or aperture pitch (mm)	0.26	0.26	0.25	0.28	0.26
CONTROLS					
Brightness	■	■	■	■	■
Contrast	■	■	■	■	■
Horizontal position	■	■	■	■	■
Vertical position	■	■	■	■	■
Horizontal size	■	■	■	■	■
Vertical size	■	■	■	■	■
Pincushioning	■	❐	❐	❐	❐
Memory save	■	❐	❐	■	■
Automatic sizing	■	■	■	■	■
Degaussing	■	■	❐	❐	❐
EMISSIONS STANDARDS COMPLIANCE					
MPR	❐	❐	■	■	■
MPRII-VLF	❐	❐	■	■	■
MPRII-ELF	❐	❐	■	■	■
FCC CERTIFICATION CLASS					
	B	B	B	B	B

■ =yes ❐ =no

[1]Short persistence phosphor is the most desirable. With this duration, the screen is less subject to ghosting and streaking.

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also produces the SC-726VL, which is the low-radiation model. The VL model features very low magnetic fields of less than 25 milligauss when measured 20 inches from the screen. This makes the VL model compliant with the Swedish MPR-II emission standards. Excessive radiation emissions are a significant concern for many PC users nowadays. Spending the extra dollars for the VL model, you can buy affordable peace of mind.

If you're itching to move up to a 17-inch monitor that is capable of running all of the current and emerging video display modes but the bottom line is a major factor in you purchasing decision, the SC-726V (or VL) may be the monitor you seek. It's certainly worth a look!

Circle Reader Service Number 377

MONITOR GLOSSARY

barrel distortion. In monitors and TV receivers, barrel distortion makes all four sides of the image curve out like a barrel.

degausser. A device that clarifies the color picture by means of coils within the set. The coils eliminate the magnetization which builds up around the monitor when it's moved around or when other electrical devices are brought too close to it.

flicker. An unevenness and rapid fluctuation in the overall picture intensity, particularly noticeable in shaded areas of an image but less intense than strobing. Flickering is produced when the field frequency is insufficient to completely synchronize the movement of the images.

interlaced display. A monitor in which the electron beam refreshes (updates) all odd-numbered scan lines in one sweep of the screen and all even-numbered scan lines in the next. Interlacing takes advantage of both the screen phosphor's ability to maintain an image for a short time before fading and the tendency of the human eye to average, or blend, subtle differences in light intensity. By refreshing alternate sets of lines on the display, interlacing halves the number of lines that must be updated in a single sweep of the screen and also halves the amount of information that must be carried by the display signal at any one time. Thus, interlacing updates any single line on the screen only 30 times per second, yet it provides the equivalent of a 60-cycles-per-second refresh rate.

moiré. A wavy or satiny effect produced by the convergence of lines. A moiré pattern is a natural optical effect when the converging lines in a picture are nearly parallel to the scanning lines. To a degree, this effect is sometimes due to the characteristics of the monitor's or TV's picture tube, although scanning frequencies and synchronization signals are more frequently responsible for the phenomenon.

multisync display. A monitor able to respond to a wide range of horizontal and vertical synchronization rates. Multisync monitors, also sometimes called multiscan monitors, are versatile in that they can be used with a wide variety of video adapters, since they can automatically adjust to the correct synchronization rate of the video signal.

noninterlaced display. A display in which the electron beam scans each line on the screen once during each refresh cycle. Noninterlaced displays effectively pay attention to every pixel on every line of the screen as the electron beam sweeps across and down the inner surface of the screen, refreshing the displayed image several times each second. This feature greatly reduces flicker, strobing, and user eyestrain, making noninterlaced displays preferable to interlaced displays.

persistence. A characteristic of some light-emitting materials (such as the phosphors used in CRTs) that causes an image to be retained for a short while after being irradiated (for example, by an electron beam in a CRT). The decay in persistence is sometimes called luminance decay. If the persistence of a phosphor is too short, the tendency of an image to flicker is increased; if the persistence of the phosphor is too long, images tend to smear on the screen.

phosphor. Any substance capable of emitting light when struck by radiation. The inside surface of a CRT screen is coated with a phosphor that, when excited by an electron beam, displays an image on the screen.

pincushion distortion. With this kind of distortion, the four sides of the image are curved inward, leaving the corners extending outward.

pixel. Short for *picture element.* One spot in a rectilinear grid of thousands of spots that are individually "painted" to form an image produced on the screen by a computer. Just as a bit is the smallest unit of information a computer can process, a pixel is the smallest element that a monitor and software can manipulate in creating letters, numbers, or graphics.

raster. A rectangular pattern of lines. On a video display, the horizontal scan lines from which the term *raster scan* is derived.

RGB. Short for *Red, Green, Blue,* a mixing model, or method of describing colors, used with many color monitors (or other light-based media as opposed to printed media). RGB uses the additive primaries method, mixing percentages of red, green, and blue to get the desired color. Adding no color results in black; adding 100 percent of all three colors results in white.

scan. In TV and computer display technologies, to move an electron beam across the inner surface of the screen, one line at a time, to light the phosphor that creates the displayed image.

scan line. On a TV or raster-scan computer monitor, one of the horizontal lines on the inner surface of the screen that is traced by the electron beam to form an image.

Super VGA. A superset of display modes which extend the resolution and color palette beyond VGA. Resolutions of 800 × 640, 1024 × 768, 1280 × 960, and 1280 × 1024 with palettes of 16 and 256 colors are included in the Super VGA ranges.

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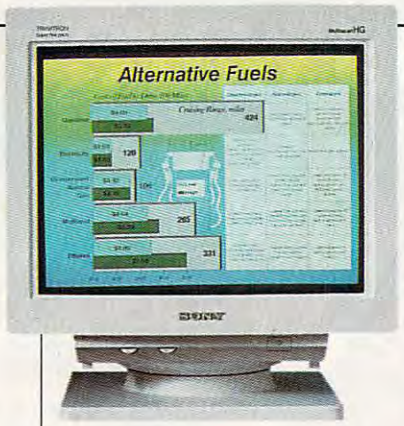

SONY CPD-1604S

The names *Trinitron* and *Sony* have become synonymous in the public mind in the 20+ years since Sony introduced its first Trinitron TV. Over 40 million Trinitrons have been sold worldwide since then, which might lead you to believe that Sony is doing something right. The dazzling display and excellent performance of the Sony CPD-1604S, which is based on Trinitron technology, provide solid testimony that Sony is, indeed, doing something right.

The 1604S has a flat screen diagonally measuring 17 inches. For its CRT size class, it boasts the narrowest dot pitch in the industry, an impressively fine .25 mm, delivering a crisp, finely resolved image approaching photographic quality in the Super VGA modes.

Mounted atop a highly stable tilt-swivel platform base, the 1604S puts the power switch, illuminated power LED, and rotary brightness and contrast controls at the front of the unit within easy reach just beneath the display itself. This gives the monitor a very clean, uncluttered look.

The automatic sizing switch and controls for adjusting horizontal and vertical size, horizontal shift, and vertical centering all reside in a recessed well at the left side of the monitor, about midway between the front and rear. Any adjustments to these controls will require either getting up and going over to the side of the monitor or, if space and cabling permit it, rotating the monitor on its swivel base 90 degrees to gain access to these controls. While these controls shouldn't normally require adjustment, it would be nice to have them up front at arm's reach should the user wish to do some tweaking. In fairness, however, the automatic screen-sizing circuitry worked well for all of the applications I ran during the review process; I found no reason to override the monitor's automatic control.

The rear of the 1604S houses the AC input connector jack as well as the video signal cable fitted with a 15-pin D connector. No degauss or memory setting or recall functions are included in this model.

The display of the monitor is truly outstanding, thanks to the ultrafine dot pitch and the black matrix background, a standard feature of the Trinitron technology. Virtually every type of image, from straight text to the most complex CAD drawing or 24-bit color TIF file, looks superb when viewed on this monitor.

The Video Obstacle Course in DisplayMate Professional once again proved to be a tough proving ground, especially in mode 105 (1024 × 768 with 256 colors). In this mode some flickering became evident on two of the tests which use very high-resolution one-line raster segments. During the screen regulation and local distortion tests, I noticed some bowing and bouncing as the test image blinked, and there was also some bouncing as video modes changed from text to graphics and back again during the last test in the series.

If you're thinking of moving up to a 17-inch Super VGA monitor, the 1604S should look really good to you. After all, it's a Sony.

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SONY
655 River Oaks Pkwy.
San Jose, CA 95134
(800) 352-7669
List price: $1,789.95
Warranty: one year, parts and labor; two years on Trinitron tube

VIEWSONIC 7

A 17-inch display, noninterlaced resolution as high as 1280 × 1024, and a 26-setting digital memory are just a few of the ViewSonic 7's attractive features. Mounted atop a small-footprint (ten inches square) tilt-swivel base, the ViewSonic 7 is attractively styled in a two-tone beige and putty color scheme. The manufacturer front-mounts all the monitor's controls for easy access, starting with a flush-mounted power switch and LED. Just below the power switch, you'll find plus and minus push buttons for adjusting the brightness, along with another pair for adjusting the contrast setting.

A drop-down panel door to the left of these controls conceals the remainder of the display controls. These controls consist of a pair (augment and diminish) of push buttons for horizontal position, a

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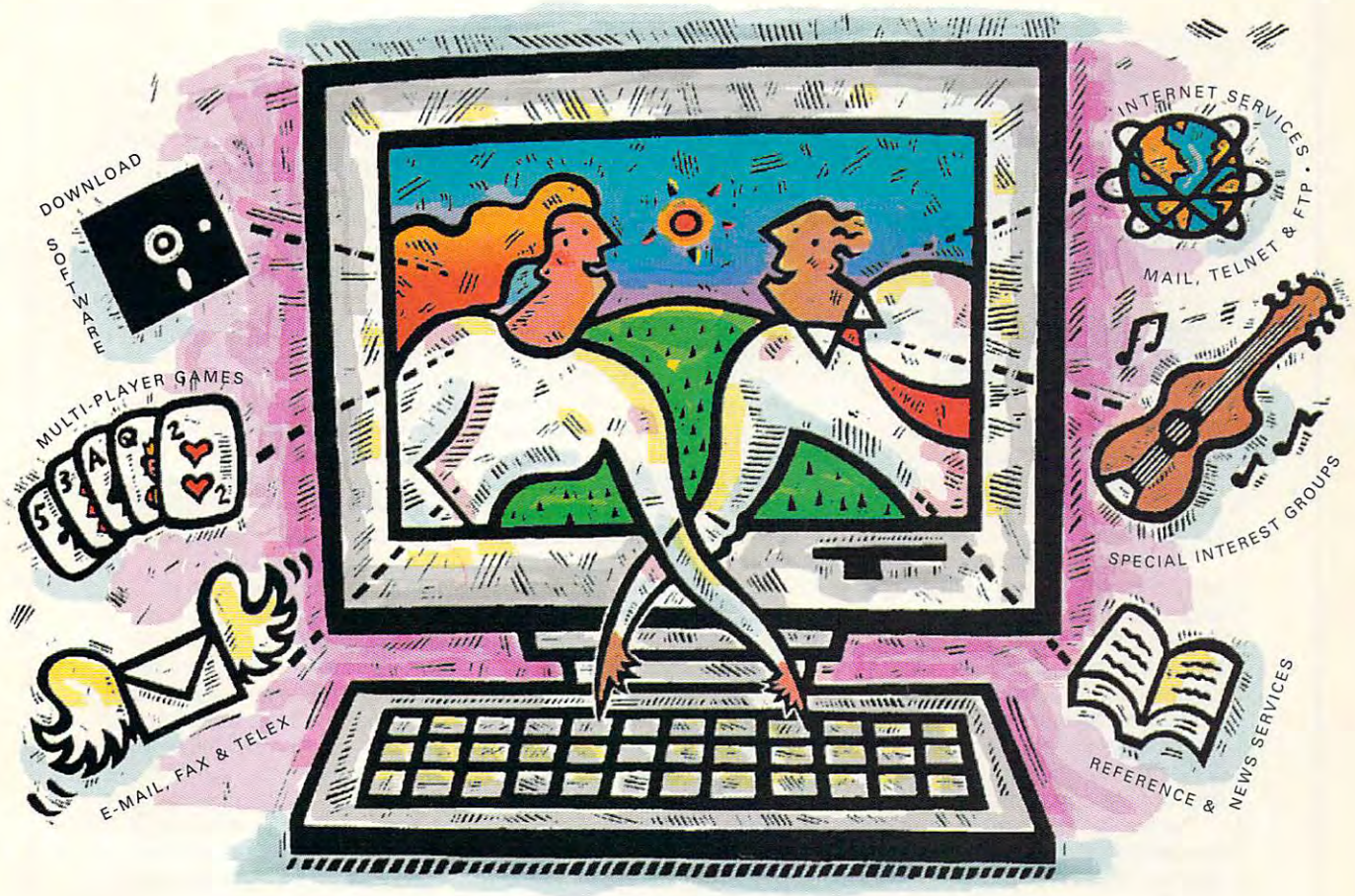

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pair for horizontal size adjustment, a pair for vertical position, another pair for vertical size adjustment, and a single push button for memory.

The rear of the unit provides access to the AC power connector and to a 15-pin D connector for attaching the video connector cable. Since this monitor is a multifrequency unit, you can also use it with color Macintosh computers and special-purpose CAD workstations simply by substituting the appropriate connector cable.

Twelve factory-preset timing modes are stored in the digital memory, and ViewSonic reserves a 13th memory position for custom timings in 1280 × 1024 resolution. You also have blank memory areas for storing 13 additional user-defined modes, and, if you like, you can override and reprogram all of the factory presets.

The memory recall is autosensing, which means that the monitor's sensing circuitry analyzes the signal coming from the video card and then compares it to its memory listing of preset (both factory and user) modes. When the circuitry finds the matching setting for that signal, the monitor displays the image according to those settings. Each memory storage area can contain data regarding the horizontal and vertical frequencies, horizontal and vertical polarization, and horizontal and vertical position.

Creating a custom memory setting is a simple procedure that merely involves adjusting the picture size and position exactly the way you like it and pressing the memory button to register the current mode settings. The next time you run that application, the autosensing circuitry will retrieve the settings and set up the display according to these preferences.

For a monitor with such laudable specifications and features, the ViewSonic 7's display was somewhat disappointing. While color, focus, and geometric linearity were all excellent on the monitor's bright, large screen, the screen exhibited a pronounced tendency for generating moirés with many high-resolution images and screen backgrounds. The ViewSonic 7 was also prone to flicker on tight-resolution patterns. This was particularly noticeable along the horizontal scroller bar in Microsoft Works and other Windows applications running in 1024 × 768 256-color mode using a Renoir Ultra-SVGA card. The monitor didn't rapidly make smooth transitions from text to graphics modes and back again either, producing more than a slight bounce and generating video "noise" on the screen during that segment of the Video Obstacle Course. Otherwise, it's a nice monitor that's handsomely styled and fully compliant with all of the current low-radiation standards.

Circle Reader Service Number 379

ZENITH DATA SYSTEMS ZCM-1790

ZENITH DATA SYSTEMS*
2150 E. Lake Cook Rd.
Buffalo Grove, IL 60089
(800) 553-0331
List price: $1,219
Warranty: one year

Zenith Data Systems (now a Bull company and no longer part of Zenith Electronics) presents its ZCM-1790 monitor as an ideal display for multimedia, CAD/CAM, and other high-resolution graphics applications.

The 17-inch monitor is housed in a very large cabinet that provides a 2-inch border on all four sides of the display, making it look larger than it actually is. This illusion is furthered by the monitor's tilt-swivel base, which occupies a good amount (approximately 12 inches × 13 inches) of desktop real estate itself. Size aside, the styling of the ZCM-1790 is functional, if somewhat Spartan.

Zenith places all of the controls within easy reach at the front of the monitor, just below the display screen. All controls are exposed and visible at all times; there's no drop-down panel to conceal them on the ZCM-1790.

All of the adjustment controls, including brightness and contrast, are push buttons rather than the wheels, knobs, or dial controls more commonly used. These push buttons are almost flush mounted. In addition to an LED power indicator next to the rocker On/Off switch, the manufacturer provides five other LEDs to designate which function control you've selected with the function-selector push button. Each of the adjustments is represented by an icon just above its corresponding LED, and the controls include vertical and horizontal size and position, in addition to brightness and contrast. An adjustment reset function resets all display adjustments to their default settings.

The video cable, with a standard 15-pin D connector, attaches permanently to the rear of the monitor, although the AC power cable is detachable.

The ZCM-1790 uses a flat screen based on flat-tension-mask technology, which, according to company literature, provides "excellent linearity." Using the tests in the DisplayMate Professional Video Obstacle Course in mode 105 (1024 × 768 with 256 colors), I found that the ZCM-1790 did not appear to live up to these claims, producing a noticeable bowing at the top of the

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screen. The display adjustment controls were unable to eliminate or compensate for it.

The review unit also displayed a reddish area (which can best be described as a rouge spot) about three inches in diameter at the lower left quarter of the screen. Again, I found no way to eliminate this problem using any of the monitor's controls. While this didn't seem to affect the performance of the monitor, it was somewhat distracting and was noticeable, even to the casual observer. I suspect that this rouge-spot phenomenon has something to do with the alignment of the monitor's red electron gun; I base this suspicion on the fact that the horizontal color and blink registration proved less than optimal in the Video Obstacle Course.

The screen gives the illusion of being slightly concave, although it's absolutely flat (I put a metal straightedge against the screen to check it). Apart from the slight bowing at the top of the screen and the rouge spot, the ZCM-1790 provides a bright, colorful display, and the CRT's .26-mm dot pitch provides excellent image resolution.

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ABOUT DISPLAYMATE PROFESSIONAL

If you happen to be a regular reader of the Test Lab section of COMPUTE, then you may recall my sidebar describing the original DisplayMate software product that was used for benchmarking and reviewing the monitors and video cards in the August 1992 issue. I thought that the original DisplayMate was an excellent product, and it was immediately inducted into our arsenal of test and evaluation utilities. Now, Sonera Technologies has taken a good thing a step further (several steps, actually) by adding extended VGA capabilities and a load of other nifty features in its new product, DisplayMate Professional.

Like the original version of the software, DisplayMate Professional provides a complete set of utilities for setting up, evaluating, testing, and adjusting your monitor and video adapter to get optimal performance. And because it supports all VESA-compatible Super VGA graphics modes including 800 × 600, 1024 × 768, and 1280 × 1024 in both 16- and 256-color modes, DisplayMate Professional is an indispensable tool for evaluating the performance of SVGA-capable monitors.

A nifty reporting feature has been added to the test suites so you can give the hardware being tested a numerical performance rating for each test. You can also include a single-line commentary on any peculiarities or on anything else you feel is pertinent. The test files can be saved to disk and printed using your favorite word processor. Having a hardcopy of your test results, complete with numerical ratings and comments, makes it very handy and easy to draw comparisons among several different pieces of hardware when you go shopping for a monitor or video card.

Although the lab's copy of DisplayMate Professional lacked the finished packaging and a printed manual (we received one of the early copies), the documentation did include a line-printer draft of the actual user manual. If it's any indication of the finished product, you can expect a well-organized, thorough, and clearly written manual.

Displays that meet with your approval at 640 × 480 don't always fare so well at the higher resolutions; 1024 × 768 and 1280 × 1024 modes really separate the wheat from the chaff when it comes to monitor performance, and that's where DisplayMate Professional excels. It's been designed and tested to run all of the VESA Super VGA graphics modes and adapters, and it's the only product currently available that can do so. The Video Obstacle Course test suite in these extended modes is positively grueling, and it really puts a monitor through its paces unmercifully.

In addition to the extended-mode test suites that comprise the package, numerous enhancements to the user interface of the program have been added to make it even easier and more versatile to use. You can customize, completely control, and even automate the test execution of DisplayMate Professional by creating simple user-defined command files. Constructing these files is very simple, consisting in most cases of merely specifying the name of the desired test along with the optional command line switches to include or exclude any special parameters, including the video mode the test will be run in and whether to keep a test report log.

The tests, video patterns, and VESA modes available make DisplayMate Professional one of the most sophisticated utility software products I've seen to date, yet it's so easy to use with its online help and prompts that even a novice user can test video hardware successfully within a few minutes of opening the package.

The $249 list price for the package may seem a bit steep at first, until you consider that spending only 10 hours a week staring at your computer monitor adds up to over 1500 hours in a three-year period. That's a long time to be viewing a screen that isn't properly adjusted or suffers from flickering or other anomalies that contribute to eyestrain.

And if you're considering the purchase of one of the larger-screen monitors, like the 15- and 17-inch monitors covered in this Test Lab, purchasing a copy of DisplayMate Professional will prove to be a sound investment when you go shopping and want to measure monitors using the same performance "yardstick." With large-screen monitors selling at or over the $1,000 mark, you shouldn't purchase one blindly. DisplayMate Professional provides a clear picture of which hardware looks the best. If you'd like to order DisplayMate Professional, contact Sonera Technologies in Rumson, New Jersey, at (800) 932-6323 or (908) 747-6886.

TOM BENFORD

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NEWS & NOTES

Jill Champion

Molecular Storage

CD players with multiple-disc changers can give you several hours of screaming guitars or whispering cellos—whichever you prefer. But imagine being able to store your entire music library on a single disc with the option of days—or even weeks—of continuous play with no repetition.

It sounds amazing, but researchers at the Department of Energy's Oak Ridge National Laboratory have developed a technology called surface-enhanced Raman optical data storage (SERODS) with a potential for mass storage that not too long ago would have been inconceivable. A 12-inch SERODS compact disc will be able to hold in excess of 100 times more information than today's standard 12-inch CD and 1.5 million times more than a standard 5¼-inch PC floppy disk. To put that in more concrete terms, a single SERODS disc could hold 18,000 sets of the *Encyclopedia Britannica*.

WatchIT!$_{TV}$ lets you view "Monday Night Football" while you view Monday night's homework.

Today's compact discs with read-only memory (ROM) store data in bits—a binary-digit system of 1s ("on" bits) and 0s ("off" bits) arranged sequentially into a meaningful code. The bits are formed when microscopic pits are burned into a disc using a laser, which results in the disc's surface being physically riddled with "peaks" (0s) and "valleys" (1s). The disc is read by a detector that distinguishes between laser light reflected from the peaks and light scattered by the valleys.

By comparison, a SERODS disc is based on an optical effect in which laser light shines on a molecule, and the molecule vibrates and scatters the light. The scattered light modulates at a frequency corresponding to the molecule's vibration, an effect called Raman scattering. When molecules are close to a microstructured metal surface, their Raman scattering is enhanced up to 100 million times. This phenomenon is known as surface-enhanced Raman scattering, or SERS, and it serves as the basis on which surface-enhanced Raman optical data storage operates. Because data is stored at the molecular level (no physical alteration such as burned-in pits occurs; molecules are simply manipulated), a SERODS disc dramatically outperforms ordinary discs.

Organizations in both government and private industry—including the entertainment industry—are now pursuing licensing agreements to use SERODS technology. That means you might soon be able to forget about a CD carrying case for your car's new Discman. Your entire music collection will play from one 12-inch CD. For more information, contact Oak Ridge National Laboratories Public Affairs, Attn: Darryl Armstrong, P.O. Box 2008, Oak Ridge, Tennessee 37831-6266; (615) 574-4160 (voice), (615) 574-0595 (fax).

TV in a PC

Picture-in-Picture television has been around for a couple of years now, but what would you think about a television picture in a window on your computer screen? If the idea sounds too futuristic—and expensive—to be true, think again. A mere $299 will buy WatchIT!$_{TV}$—a video board that lets you watch your favorite television programs on your PC screen while you work in any Windows or DOS application. Sounds complicated? Assuming your VGA card has a feature connector (most VGA boards do), the board installs in your computer in minutes—with only a screwdriver.

Instead of staying at the office, you can bring home your electronic paperwork and still catch "The Simpsons" on Thursday nights—without glancing away from your computer screen. Or, if you need to stay tuned constantly to financial markets or other news sources, you'll no longer have to race back and forth between the television set and your PC.

Position the television window anywhere on your computer screen and size it to one-fourth or one-sixteenth of your screen size. Want to take a break from your work? Display the television picture on your entire screen. Furthermore, you can capture the television image at any point and save it as a still image in any of a variety of popular formats, including PCX, BMP, BMP-24, and all TGA formats.

Use the onscreen pop-up "remote control" panel to change channels; adjust volume, color, and screen size; and save screen images—all without leaving your current ap-

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plication. And, you can use the programmable timer to turn on the television at any time and on any channel you select. And since WatchIT!$_{TV}$ will connect to an antenna, cable, VCR, or video camera, you can view video from a variety of sources—even use it to monitor the baby's room.

For private listening, earphones that hook into the video board are included with WatchIT!$_{TV}$, or you can plug in your own amplified speakers for regular listening. If you would like more information, contact New Media Graphics, 780 Boston Road, Billerica, Massachusetts 01821-5925; (508) 663-0666 (voice), (508) 663-6678 (fax).

Hook-up blues are a thing of the past with Unlimited Systems' KONEXX Konnector modem interface.

Lure of the Liberated

The effects of women's lib—specifically, where equal representation is concerned—are finally trickling down to one traditionally male-dominated area of computer role-playing games: that of the villain (or in this case, the villain*ess*). Not that any male adversary has ever been labeled a "tempter," but at least in Konami's latest release, Lure of the Temptress, developed by Revolution Software, the primary antagonist, Selena, has enough dirty deeds up her spiteful sleeves to out-evil the best of her macho peers.

To make matters even more interesting, Lure of the Temptress is played in Virtual Theatre, the latest in artificial-intelligence technology, where the game world advances and develops in realtime, evolving independently of your actions. Other characters take on a life of their own, and you never know what might happen. However, instead of controlling *only* your own character (a peasant, in this case), you're allowed to give commands to other characters as well, a key element to the game's outcome. In the medieval village of Turnvale, where your primary mission is to defeat the nefarious Selena, your actions *affect* rather than *dictate* what happens.

The driving force behind your desire to defeat Selena? If you guessed the very clichéd "to rescue a captive princess," give yourself a gold ball and chain. Perhaps the princess should take lessons from the liberated Selena.

Suggested retail price for Lure of the Temptress is $49.95. If you would like more information, contact Konami, 900 Deerfield Parkway, Buffalo Grove, Illinois 60089-4510; (708) 215-5100 (voice), (708) 215-5122 (fax).

No Mo' Modem Blues

Probably one of the most galling problems of portable computing is making peace with all the different kinds of hardware you encounter on the road. Say goodbye to the frustration of trying to connect your modem to a hotel telephone—or even to your office system. Unlimited Connections' KONEXX Konnector Model 112, a tiny, portable modem–interface device, is so simple to use you won't lose your cool when it's time to send data through your modem or fax board. The Model 112 lets you quickly and easily connect your computer's modem to almost any PBX, multiline, hotel, or motel telephone, including digital systems.

The Model 112 connects to a telephone line through your phone's handset—between the coiled handset cord and the base of the telephone—to provide an RJ-11 interface to the modem. In the office, the Model 112 eliminates the need for an expensive dedicated line. When out of the office, it operates from an internal battery, allowing you to send data from most hotel and office phones. With the included adapter, you can even connect to phones with the older hardwired handsets.

To use, you simply plug the short cord on the Model 12 into the handset-cord jack on the telephone base, plug the coiled cord from the handset into the handset jack on the KONEXX Konnector, and plug the telephone cord from the computer or fax machine into the dataport jack on the Konnector.

Powered by an internal 9-volt battery or the included AC adapter, the Model 12 Konnector features automatic voice/data switching and transfers data between 1200 and 9600 baud. Suggested retail price is $149. For more information, contact Unlimited Systems, 5555 Magnatron Boulevard, Suite J, San Diego, California 92111; (619) 277-3300 (voice), (619) 277-3305 (fax).

Companies or public relations firms with items of interest suitable for "News & Notes" should send information along with a color slide or color transparency to News & Notes, Attn: Jill Champion, COMPUTE Magazine, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. ❐

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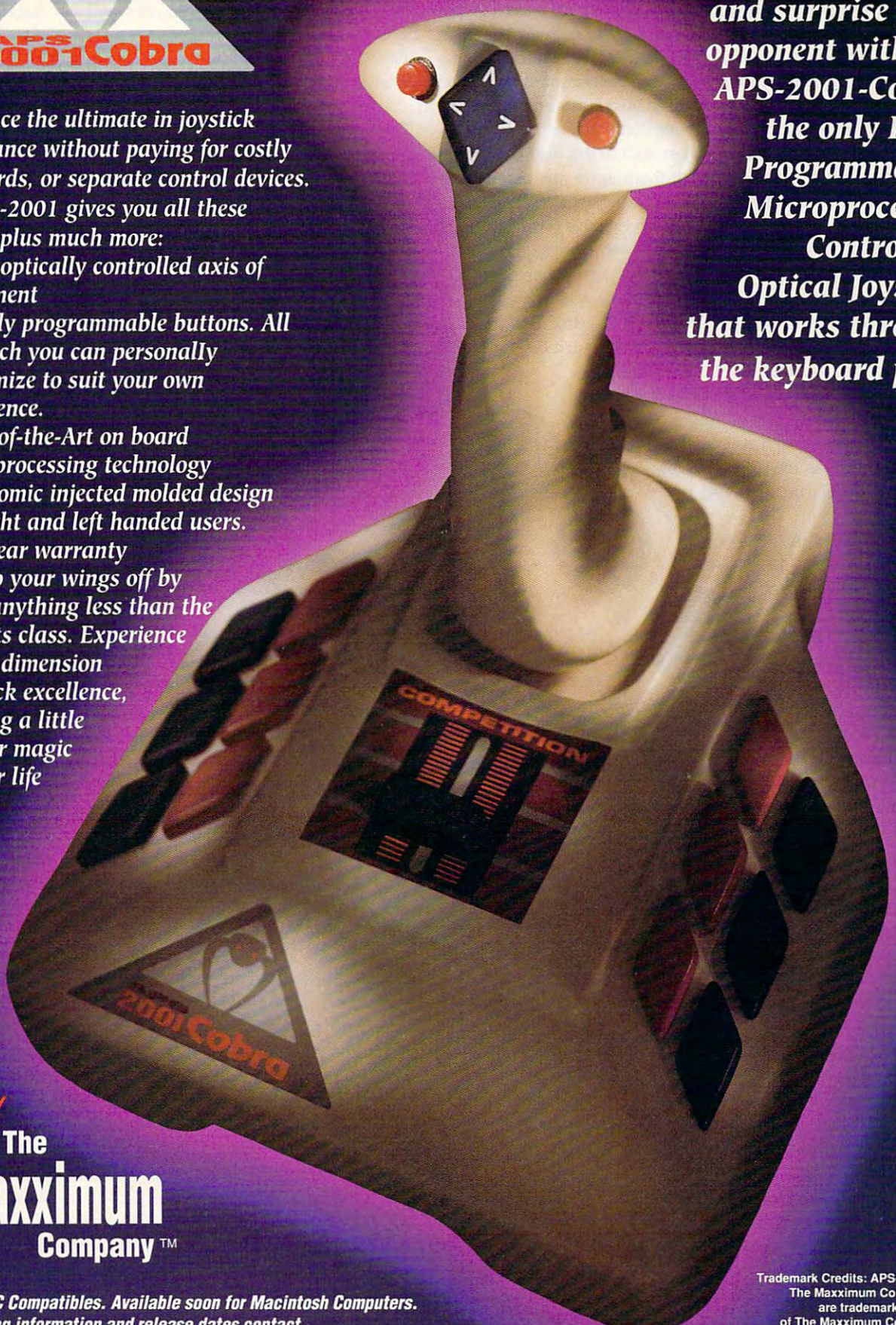

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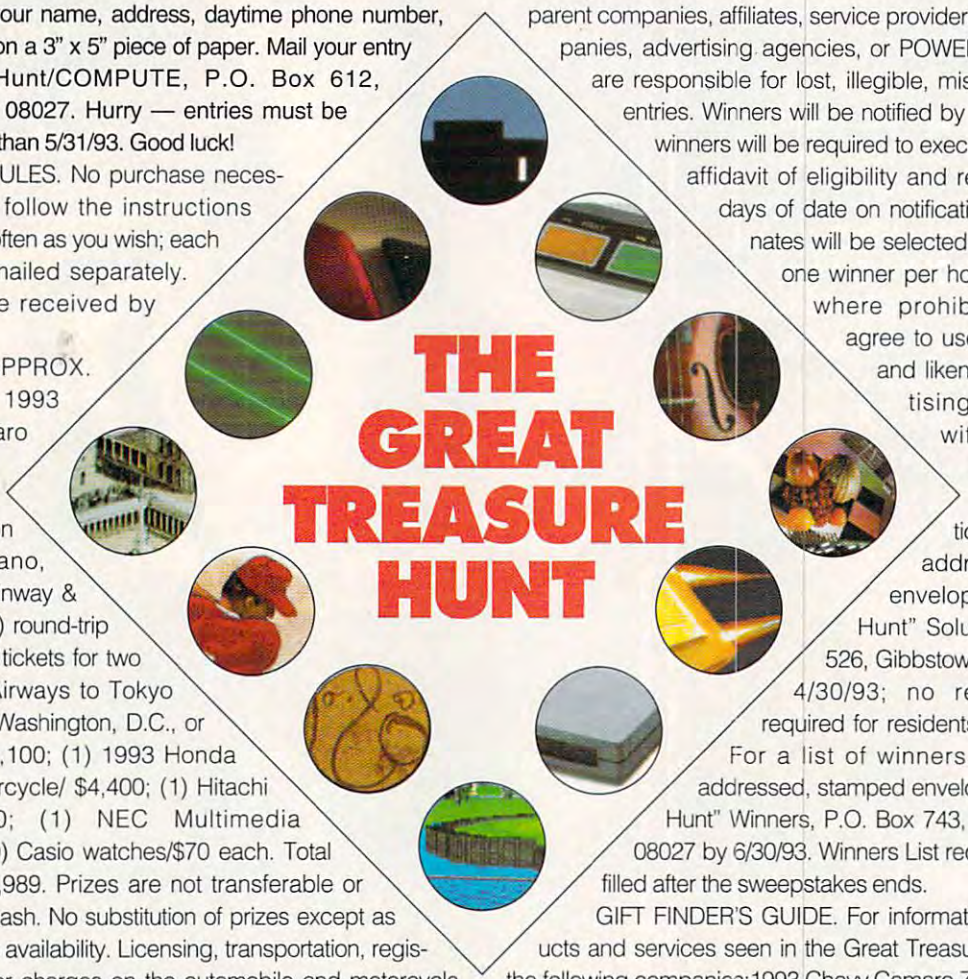
The 1993 Great Treasure Hunt is on, and it's easy to enter. HOW TO PLAY: Each of the dozen picture discs shown on this page is a portion of a photo or illustration in an advertisement appearing in this issue of OMNI. To solve the Treasure Hunt, find the ads from which the discs were taken, and note the page number for each. If an ad appears on the inside or outside of the front or back cover, count that page number as zero. If there is no page number, turn to the **next numbered page** and use that number. If there is no numbered page between the ad and the end of the magazine, stop at the inside back cover, and use zero as your page number. Then add up all 12 numbers. That is the solution you'll need to enter.

Now, print your name, address, daytime phone number, and the solution on a 3" x 5" piece of paper. Mail your entry to: Treasure Hunt/COMPUTE, P.O. Box 612, Gibbstown, N.J. 08027. Hurry — entries must be received no later than 5/31/93. Good luck!



OFFICIAL RULES. No purchase necessary. To enter, follow the instructions above. Enter as often as you wish; each entry must be mailed separately. Entries must be received by 5/31/93.

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For solutions, send a self-addressed stamped envelope to: "Treasure Hunt" Solutions, P.O. Box 526, Gibbstown, N.J. 08027 by 4/30/93; no return postage required for residents of VT and WA. For a list of winners, send a self - addressed, stamped envelope to: "Treasure Hunt" Winners, P.O. Box 743, Gibbstown, N.J. 08027 by 6/30/93. Winners List requests will be fulfilled after the sweepstakes ends.

GIFT FINDER'S GUIDE. For information on the products and services seen in the Great Treasure Hunt, contact the following companies:1993 Chevy Camaro Z28: Contact your local Chevrolet dealer. Boston GP-178 grand piano: The Boston Piano Company, 37-11 19th Avenue, Long Island City, N.Y. 11105 Tel: 1-800-842-5397; For All Nippon Airways: Contact your travel consultant or call ANA at 1-800-2-FLY-ANA (1-800-235-9262); Honda Nighthawk 750 Motorcycle: American Honda Motorcycle, 1919 Torrance Blvd., Torrance, Ca. 90501-2746; Hitachi 50-inch Ultravision TV: Hitachi Home Electronics (America), Inc., 3890 Steve Reynolds Blvd., Norcross, Ga. 30093 Tel: 1-800-HITACHI; NEC Multimedia Gallery: NEC Technologies, 1255 Michael Drive, Wood Dale, Ill.60191 Tel: 1-800-NEC-INFO; CASIO Poseidon Watches: Casio, Inc., 570 Mt. Pleasant Avenue, Dover, N.J. 07801 Tel: 1-800-962-2746.

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FEEDBACK

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Being Constructive

I'm looking for software for the construction trades. Can you give me the name of a company that makes this kind of specialized software?

DWIGHT HOLMAN
LITTLE ROCK, AR

Check out Timberline Software, 9600 SW Nimbus, Beaverton, Oregon 97005; (503) 626-6775. Timberline also produces specialized software for property managers, architects, and engineers.

Multimedia Update

In your recent Test Lab of multimedia upgrade kits, you stated that the Pro AudioSpectrum 16 did not have MPU-401 compatibility. That was true at the time the piece was written, but since then, this compatibility has been added to the board.

CLAIRE MERRIAM
MEDIA VISION
FREMONT, CA

Border Guard

I want to print out a text file by typing *copy filename prn*, but my printer prints right through the perforations. Is there any way to control the length of page when copying a file to PRN?

ABIGAIL FURTH
KANSAS CITY, MO

There's no way to control the Copy command, but here's a simple BASIC program that intelligently breaks a file into lines and prints them. When you run the program, it will ask for the name of the file to print. You can enter the complete path at this prompt. The third line sets the width of the printed page. The fourth line sets the length of the page in lines.

```
INPUT "File to type"; a$
OPEN a$ FOR INPUT AS #1
linelength = 50
pagelength = 20
top:
WHILE (i < linelength) AND NOT
  (EOF(1))
a$ = INPUT$(1, #1)
b$ = b$ + a$
i = i + 1
WEND

WHILE LEFT$(b$, 1) = " "
i = i - 1
b$ = RIGHT$(b$, i)
WEND
FOR k = 1 TO i
a$ = MID$(b$, k, 1)
IF a$ = CHR$(13) THEN
MID$(b$, k, 1) = " "
i = k
GOTO printer
END IF
NEXT

WHILE (i > 0) AND (a$ <> " ")
a$ = MID$(b$, i, 1)
i = i - 1
WEND
printer:
IF (i = 0) OR (i = linelength) THEN
LPRINT b$
b$ = " "
i = 0
ELSE
a$ = LEFT$(b$, i)
LPRINT a$
i = (linelength - 1 - i)
b$ = RIGHT$(b$, i)
END IF
j = j + 1
IF j > pagelength THEN j = 0:
  LPRINT CHR$(12)
IF NOT EOF(1) THEN GOTO top
CLOSE 1 END
```

File Opener

I have several data files on a floppy disk. What coding can I use to open different files from the same GW-BASIC program?

ARNOLD MOSS
BRONX, NY

You saw the technique in the previous program. The components of the file-opening command are Open, followed by the name of the file, followed by the use you intend to make of the file (Input or Output in GW-BASIC), followed by the number of the file. For example, the following little piece of code opens the files called AUTOEXEC.BAT and CONFIG.SYS for input as #1 and #2 and SYSTEM.FIL for output as #3. It uses a variable in place of the filenames to show how this is done. If you prefer to specify the file to be opened, just place its name in quotation marks where you see FILENAME$ in the example. If you're using a different BASIC, leave off the line numbers.

```
1 READ FILENAME$
2 OPEN FILENAME$ FOR INPUT
  AS #1
3 READ FILENAME$
4 OPEN FILENAME$ FOR INPUT
  AS #2
5 READ FILENAME$
6 OPEN FILENAME$ FOR OUTPUT
  AS #3
7 WHILE NOT EOF(1)
8 LINE INPUT #1, a$
9 REM Note that you access the
10 REM file by its number (#1)
11 REM rather than its name.
12 PRINT #3, a$
13 WEND
14 WHILE NOT EOF(2)
15 LINE INPUT #2, a$
16 PRINT #3, a$
17 WEND
18 CLOSE
19 REM CLOSE with no arguments
20 REM closes all open files.
21 END
22 DATA "C:\AUTOEXEC.BAT",
  "C:\CONFIG.SYS",
  "C:\SYSTEM.FIL"
```

If you're really interested in BASIC programming, you should move up to a higher-powered BASIC, such as QuickBASIC, True BASIC, or PowerBASIC.

None of Your BBS

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FEEDBACK

We received a few letters about this. BBS *stands for* Bulletin Board System. *A BBS is a computer system that you can call using your computer and modem. The BBS might have shareware programs, special-interest groups, and data files of interest to you. CompuServe is a BBS, but most BBSs are small, noncommercial services run by computer hobbyists who charge little or nothing.*

The term has been in wide use for so long that it didn't seem necessary to spell it out. Thanks for pointing out the error of our ways.

SMARTERDrive

In Clifton Karnes's "Productivity Choice" review in the October 1992 issue, he mentions that SMARTDrive can be turned on or off. How do I disable SMARTDrive?

DAN E. QUACKENBUSH
PORT HADLOCK, WA

Assuming that you're using Windows 3.1, you'll find that SMARTDrive is now an EXE file instead of a SYS file. That makes it a lot more accessible.

To see all that you can do with SMARTDrive, type its filename followed by the /h parameter, as in smartdrv /h. *(Most DOS 5.0 commands will give you help if you type the command followed by /? or /h.) That will display a menu of options including + and -.*

These options turn the caching on or off for a given drive. To turn the caching on for your C drive, type smartdrv c+, *and to turn it off, type* smartdrv c-.

The Other 560K

I've just purchased a new 3½-inch double-sided, high-density disk. The box is labeled 2MB, which I take to mean that the disk can store 2MB. The problem is that my PC will only format to 1.44MB. How can I format the disk to its full capacity?

MIKE PERRY
CENTREVILLE, VA

You can't format it to its full capacity. Or rather, you already have. A large portion of the information on any disk is invisible to you. The 2MB referred to on the box is its unformatted capacity. The formatted capacity of a 2MB floppy is 1.44MB. Adding to the confusion, the new 2.8MB ED floppies have 4MB unformatted capacity.

Grandmaster

I'm writing in response to your article "Check and Mate" about chess games. Grandmaster Chess, which wasn't mentioned in the article, is guaranteed to beat Chessmaster 3000 as well as Sargon V and has also defeated Zarkov in head-to-head play. Grandmaster Chess features Super VGA graphics and digitized voices for only $59.95. As reflected in its name, we offer the Grand Master of chess programs.

JAMES WHEELER
INTRACORP
MIAMI, FL

Double, Double

Try out the following little program.

```
FOR i% = 0 TO 22
IF i% * i% <> i%^2 THEN
   PRINT i%
NEXT
```

Most of the values between 0 and 22 will show a different result from these supposedly identical commands. The same thing happens in QBASIC and QuickBASIC.

What's going on?

PETER MILNES
PIERREFONDS, PQ

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Since QBASIC and QuickBASIC use the same interpreter, it isn't surprising that they yield the same result. The differences are caused by rounding errors.

Before any value can be worked on by your computer, it must be converted into binary numbers. The operation is then performed on the binary numbers. Finally, the binary values are converted back into decimal numbers. The conversion process usually involves some loss that shows up in most BASICs in one operation or another. This loss is called rounding error.

Despite the discrepancies that your program illustrates, the difference between the values isn't very significant. Try this change to your program to see how large the difference between the squares is.

```
FOR i% = 0 TO 22
IF i%*i% <> i%^2 THEN
   PRINT i%, i%*i%-i%^2
NEXT
```

Note that the numbers are accurate to 17 to 18 decimal places—between a hundredth of a quadrillionth and a quintillionth.

To put this into perspective, a quintillion miles is equal to about 1.5 billion light years (or about a tenth the width of the known universe). There are about 150 quadrillion microns between the sun and the earth and about 1.5 quintillion microns between the sun and Saturn.

The good news is that the rounding error is very easy to deal with. If you assign the value to a variable, for example, it's truncated to its true value.

Although we weren't able to get a statement from Microsoft to this effect, we suspect that the powers function (^) actually uses logarithms. You will generate similar errors if, instead of raising to a power, you simply add the logs of the numbers as in the following.

```
PRINT EXP(LOG(x%)
  +LOG(x%))
```

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. Letters submitted to "Feedback" become the property of General Media International. ❐

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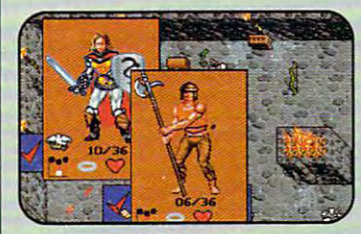

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10 WAYS TO SUPERCHARGE WIN

WITH A LITTLE HELP FROM OUR RESIDENT EXPERT, YOU CAN MAKE WINDOWS RUN LIKE A CHAMP.

BY WILLIAM HARREL

No doubt about it, Windows takes the doldrums out of PC computing. We no longer must stare at the boring, unforgiving DOS prompt. It's easier and more fun to launch and manage applications, and the impact of our work is enhanced by Windows' ability to display millions of colors and play sound. Even computer games are more exhilarating. However, on its own, Windows is still somewhat cranky and unexciting. If not configured properly, it can be excruciatingly slow. And you can't really get the full potential of many Windows applications without additional hardware.

Computer users (especially Windows enthusiasts) are on a constant quest to get more performance from their machines. To help you, here are ten fairly inexpensive ways to soup up Windows, making it run faster and making the ride more interesting. So, reach beyond the ordinary and give Windows some pizzaz.

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DOWS

Improving Performance

Because of the huge amounts of code required to run applications in a graphical environment, Windows encounters several bottlenecks while running on your computer. Your CPU spends a lot of time waiting for other parts of the computer. Most often, these clogs occur during hard disk accessing and while displaying data on your monitor. The first five ways you can soup up Windows are methods to speed up your system's performance.

1. Install additional RAM. On a system with only 1MB or 2MB of RAM, a surefire way to speed up Windows is to add more memory to your computer—which, nowadays, is quite inexpensive. On most machines you can add memory for well under $50 per megabyte if you shop around. While most software for Windows requires only 1MB–2MB RAM to run, many programs benefit greatly from having an additional 2MB–4MB to stretch out in. More of the program code can load into memory, resulting in less disk accessing. When you're working on large documents or graphics, it's faster if all of the file is in RAM. And you can use the extra memory to improve the performance of SmartDrive (the disk cache bundled with Windows) or to install a RAM drive.

2. Optimize SmartDrive. Before Windows 3.1, computer pundits almost unanimously recommended replacing SmartDrive with a third-party product. However, the latest version, 4.0, is as fast and proficient as most of the others. What SmartDrive does is to reserve a portion of system RAM as a temporary storage bank. When you execute a command from the hard disk, depending on the size of the cache, SmartDrive scoops up and loads not only the code needed to execute the command but also blocks of code on either side of the command. The theory is that the computer will probably soon be called on to use the surrounding code as well. And you'd be surprised how often the theory proves true. So, up to a certain point, the larger the cache, the less often your system has to call to the hard disk—your computer's slowest component—for information, thus causing your system to run faster.

When you installed Windows, SmartDrive was also installed to load from your AUTOEXEC.BAT file, one of the files DOS reads while the computer boots. SmartDrive configures itself according to available system memory. It also has the ability to make itself smaller when Windows is running, to provide more memory for your Windows applications. The default settings are shown below.

If you add more RAM to your system or you don't run a lot of programs simultaneously, you can cut down how much you access your hard disk by

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DEFAULT SETTINGS

System RAM	Size in DOS	Size in Windows
1MB and less	All extended RAM	No cache
1MB–2MB	1MB	256K
2MB–4MB	1MB	512K
4MB–6MB	2MB	1MB

hard disk by changing the size of your cache. Do so by editing AUTOEXEC.BAT in a text editor or in Windows' SysEdit. To set the cache to 1MB while using either DOS or Windows, for example, the SmartDrive entry should read C:\WINDOWS\SMARTDRV.EXE /e 1024 1024. In this example, SmartDrive loads into extended memory (/e) and is 1MB in size while in DOS and while in Windows. Keep in mind, though, that a cache bigger than 2MB does little good and in some cases can slow down your computer.

There are many other configuration options to enhance SmartDrive's performance. To get a list of them, type *smartdrv /?* at the DOS prompt. There is additional information on SmartDrive in chapter 14 of your Microsoft Windows User's Guide.

3. Install a RAM drive. If your computer has more than 4MB RAM, you can further reduce disk accessing by using part of the memory as a RAM drive. A RAM drive is a portion of system memory that DOS sets aside and treats as an additional fixed disk. Windows and many Windows applications create temporary files on your hard disk as you work. You can tell DOS to save temporary files to the RAM drive, which allows Windows to save and access the temporary files faster.

Use RAMDRIVE.SYS, which should be located in either your Windows or DOS subdirectory (or both), to create a RAM drive. Using a text editor or Windows' SysEdit, include the following line in the CONFIG.SYS file in the root directory on your hard disk: DEVICE=C:\WINDOWS\RAMDRIVE.SYS 2048 /e. This example creates a 2MB RAM drive in extended memory (use /a for expanded memory). The RAM drive is given the letter of the next drive on your system. If, for example, you have just one hard drive, drive C, the RAM drive will be drive D.

Now you need to tell DOS to use the RAM drive for temporary files. Do so by adding the following line to your AUTOEXEC.BAT file: SET TEMP=D: (or your RAM drive letter, if different). Note that if there is already a SET TEMP= statement in your AUTOEXEC.BAT, you need to be sure to delete it.

4. Install a graphics accelerator. Windows' graphics environment is both pretty and easy to work with, but it demands a lot of your computer to display all those windows, scroll bars, and icons on your monitor. If you spend too much time waiting for screen redraws, you can really supercharge Windows by adding a graphics accelerator, such as Diamond Computer Systems' SpeedStar 24X. Depending on your needs, graphics accelerators range from a few hundred to several thousand dollars—with the price usually determined by how many colors are available at which resolutions and the amount of RAM on the boards.

Graphics accelerators speed up your system by taking the actual processing of the graphics data (which, when displaying 16.7 million colors at 1024 ¥ 780 resolution, is substantial) from the CPU. This allows your computer's processor to work on other tasks, such as calculating a spreadsheet or doing a mail merge.

5. Install a data compression utility. If Windows and its applications are nothing else, they are disk hogs. Depending on your system and how you configure Windows, the environment itself can eat up the better part of 10MB. And many Windows applications require at least 5MB, with several using upward of 20MB. With appetites like that, it doesn't take many programs to devour a 40MB or 60MB fixed disk. Until recently, your only recourse was buying a new hard disk. But now, thanks to data compression utilities such as Stac Electronics' Stacker, Integrated Information Technology's XtraDrive, and Addstor's SuperStor Pro you can inexpensively double the storage capacity of your hard disk.

Data compression software works slightly differently from product to product. Some programs, such as Stacker, create a separate partition for compressed files; others, such as XtraDrive, do not. For slower machines, such as 80286s and slow 80386s, some companies also make compression boards that work with the software to speed up compression. However, if you use a fast 80386 or 80486, data compression software

Adding Sound to Windows Events

Are you tired of Windows beeping at you every time you turn around? After installing your sound card, use this procedure to assign sound clips to Windows' events.

Certain events in Windows—Exclamation, Question, Top, and others—have beeps assigned to them. For example, when you're installing some applications, Windows displays a dialog box and beeps at you each time the setup program calls for another floppy disk. Once you've installed a sound card, you can assign WAV sound clips to this and other Windows events from Control Panel by using these steps. First, from Program Manager, double-click on the Control Panel icon. Next, in ControlPanel, double-click onSound. Finally, select the Enable Sound System check box.

Windows is shipped with several WAV sound clips. When you open the Sound dialog box, all the WAV files in your Windows directory are listed in the Files list box. To assign a file to a specific event, select it in the Events list; then select the sound you want assigned to it in the Files list. You can hear the sound by clicking on the Test button. When you close the dialog box, the sound system is activated.

You can copy and delete WAV files from the Windows directory at will, and you can assign an event to any sound you want. For example, when I make a mistake that causes a Critical Stop, a voice admonishes me with an indignant "Wrong!" You can have a lot of fun with sound, especially if you take the plunge and add a microphone.

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is sufficient. In most cases, you'll hardly notice the difference between the time it takes for these products to compress and decompress files and the time required for normal operation. And sometimes, such as in loading and decompressing executable program files, the process is actually faster than loading an uncompressed file from the hard disk.

Especially impressive is Stacker 3.0 for Windows and DOS, which allows you to control data compression from inside Windows. The Stackometer gives you up-to-the-second data on compression ratios and disk performance, allowing you to fine-tune Stacker to your machine and application.

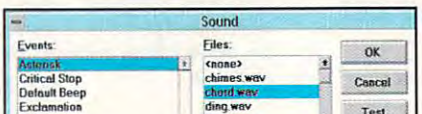
Give Windows a New Face

While Windows' Program Manager, File Manager, and outline fonts offer definite advantages over computing in a DOS-only environment, they are by no means perfect. Depending on how you work, there are many options for making Windows (and your documents) better looking and more efficient. Try one or more of the next three options to make launching programs and loading documents easier, to automate tasks, and to improve on the standard-fare fonts (Times and Helvetica equivalents) that ship with Windows.

6. Install a new front end. The Windows application market is loaded with products that replace or enhance Program Manager. Some features that most of them have in common include the ability to launch a group of applications in various application window sizes and positions for performing specific tasks, memory and system resources management, macros, drag-and-drop printing and file loading, a way to change keyboard configurations, and even the option to select functions to assign to the right mouse button. Between shareware and commercial products, there may be as many as 50 of these utilities, and they vary in features and functionality. Five of the most popular are Hewlett-Packard's Dashboard and New Wave, hDC Computer's hDC Power Launcher, Symantec's Norton Desktop for Windows, and XSoft's Rooms.

All but New Wave let you decide whether to replace Program Manager or run the utility over it. For example, Dashboard (above) creates a strip that looks like a car dashboard, complete with instrument gauges, that you can place anywhere on your monitor. You can assign often-used programs to the dash for one-click access, and you can create layouts consisting of several applications—such as, say, graphics, DTP, and word processor—for a desktop publishing task. Memory and system resources permitting, you can have up to nine layouts open at one time. And there are, of course, many other features, such as a fuel gauge that constantly displays available memory, one-click printer configuration, and an alarm clock. Dashboard (and Power Launcher) can also be configured to run on top of other windows, even when inactive, so that Windows' shell functions are always just a mouse click away.

Power Launcher offers many of the features of Dashboard and several others as well. You can, for example, reconfigure your keyboard and mouse and even create a separate set of tools for each of your programs. The program even helps take some of the confusion out of Windows' powerful OLE (Object Linking and Embedding) and DDE (Dynamic Data Exchange).



To assign sounds to Windows events, select Sound in the Windows Control Panel.

With a microphone, making recordings in Windows is as easy as clicking an icon.

Rooms uses an office-building metaphor, allowing you to separate tasks into virtual desktops called rooms and suites. Norton Desktop is a group of utilities (such as a file viewer, an automatic backup utility, a scheduler, a data recovery utility, and an icon editor) that you can run from the Norton Desktop shell or from a Norton program group in Program Manager. New Wave, which requires a substantial commitment to install and use, actually changes the way Windows operates by giving your desktop a Macintosh-like feel—tasks separated into folders and a trash can for deleting files.

7. Install a macro utility. One thing Windows sorely lacks is a good macro language. Macros, of course, are small programs containing recorded keystrokes and programming commands that allow you to automate tasks, along the same lines as macros in your word processor. There are enormous benefits to a universal macro language that works across all Windows applications. You can use them to merge data from one program to another, program timed events (such as data transfers in the middle of the night when long-distance rates are lower), and perform countless other tasks. Recorder, the utility currently shipping with Windows, is hardly adequate (hardly worth mentioning, for that matter). Microsoft plans to include a macro language in future Windows releases, but for now we must rely on third-party utilities. Luckily, most of the ones available are quite good.

Some of the shell utilities, such as Norton Desktop, Power Launcher, and New Wave, include macro languages, and they even allow you to play macros from the shell. These are the most efficient and the easiest to use. Two good stand-alone macro products are Publishing Technologies' BatchWorks and AutoSoft's AutoRun. While they have slightly different interfaces, the idea behind them is the same: recording and playing back actions in Windows.

8. Install TrueType fonts. A truly notable addition to Windows 3.1 is the built-in TrueType font rasterizer.

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(Version 3.0 users should install Type 1 fonts.) TrueType fonts are easy to install and manage, and they print and display faster than fonts used in earlier versions of Windows. However, the program is shipped with only a few TrueType typefaces: Courier, Ariel, and Times New Roman. You can improve the appearance of your drawings, presentations, and documents by installing additional fonts.

TrueType font packages abound. When looking for one, consider collections that contain a variety of strictly business serif and sans-serif fonts, such as Bodini and Universe, as well as a few decorative fonts, such as Cooper Black or Old English. Decorative fonts work well in display ads and fliers. Beware, however: Not all TrueType fonts are created equal. Since the release of Windows 3.1, the market has been deluged with TrueType font collections. For best screen and printer reproduction, choose font collections from reputable type foundries, such as Bitstream and Agfa. Two good collections are AgfaType Desktop Styles and Microsoft's TrueType Font Pack for Windows.

If you're reluctant to switch to TrueType because you already have an extensive Type 1 collection, consider a font conversion utility, such as FontMonger from Ares or AllType from Atech. These programs handily convert Type 1, Type 3, and other formats to TrueType outlines, as well as vice versa—TrueType to other formats. FontMonger also lets you create your own font sets from EPS drawings, and you can even alter existing fonts to create your own unique collections. Or you can create a font made up of logos and symbols you use often.

Where to Buy

Call the manufacturers listed for the latest pricing information. Many have great deals on upgrades and bundled packages.

AgfaType Desktop Styles—$79.00 (for 39 TrueType fonts)
Agfa
(800) 424-897

FontMonger for Windows—$149.95
Ares Software
(800) 783-2737

AllType—$59.95 (converts to and from Type 1, Type 3, TrueType, Intellifont, and Nimbus-Q)
Atech Software
(800) 786-3668

AutoRun—$119.00
AutoSoft
(404) 594-8855

Viva Maestro Pro 16—$229.00
Computer Peripherals
(800) 854-7600
(805) 499-5751

Sound Blaster Pro—$229.95
Creative Labs
(800) 998-5227

SpeedStar 24X—$249.00
Diamond Computer Systems
(408) 736-2000

hDC Power Launcher—$99.95
hDC Computer
(206) 885-5550

Dashboard—$49.00

New Wave—$99.00
Dashboard and New Wave 4.1 bundle—$134.00
Hewlett-Packard
(800) 554-1305

XtraDrive—$99.00
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(800) 832-0770

Pro AudioSpectrum 16—$299.00
Media Vision
(800) 845-5870

TrueType Font Pack for Windows—$69.95
Microsoft
(800) 426-9400

BatchWorks—$99.95
Publishing Technologies
(800) 533-1744

SuperStor Pro
Addstor
(800) 732-3133

Stacker 3.0 for Windows and DOS—$149.00
Stac Electronics
(619) 431-7474

Norton Desktop for Windows—$179.00
Symantec
(800) 441-7234

Rooms—$99.00
XSoft
(800) 626-6775

Listen to Windows

The final two ways you can optimize Windows boost its multimedia capabilities. Perhaps frilly accessories to some, these improvements can enhance your enjoyment and thus your productivity.

9. Add a sound board. To take full advantage of Windows' multimedia capabilities, you should install a sound board. Once a niche market, PC sound is catching on like wildfire. Leading software vendors, such as Microsoft and Lotus, have released multimedia versions of some of their more popular products. Word for Windows & Bookshelf, for example, integrates WinWord with Microsoft's multimedia reference library, Bookshelf. Bookshelf's encyclopedia contains numerous narrated animations that demonstrate processes such as solar eclipses, continental drift, and others. Not only does the dictionary provide a word's spelling and definition, but it also pronounces it for you. The multimedia version of Lotus 1-2-3 has a complete automated help system that provides narrated examples of spreadsheet procedures. And a number of inexpensive presentation software packages—Asymetrix's MediaBlitz and Macromedia's Action!, to name two—allow you to create your own multimedia shows.

When buying a sound board, make sure that it meets Microsoft's MPC standards, and, if you want the best quality, make sure that it's a 16-bit card. It should also have jacks for CD-ROM output and a microphone. Creative Labs' Sound Blaster Pro is one of the most popular and least expensive; however, Computer Peripherals' Viva Maestro Pro 16 and Media Vision's Pro AudioSpectrum 16 are also quite good.

If you want to talk back to your computer, look for Computer Peripherals' Viva Maestro Pro 16VR voice recognition system, which should be released before you read this. This board comes complete with a headset and allows you to control

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your computer with voice commands such as "open," "cut," "paste," and so on. According to Computer Peripherals, you can train it to execute any commands your applications normally perform.

To hear the sound produced by your sound card, you'll also need speakers. Labtec makes several good pairs, ranging from $20 to $100. When buying speakers for your PC, make sure that they're shielded so that their magnets won't damage your monitor. And, since sound boards don't crank out a lot of wattage, your new speakers should also be self-amplified.

10. Add a microphone. Perhaps one of the least expensive ways to have fun with Windows—and enhance your multimedia prowess—is to install a microphone. Unlike almost everything else on your computer, this is the one peripheral that doesn't require its own card and software. The jack is built into your sound card, and Windows' Sound Recorder utility is waiting, ready to capture your voice and whatever else you want to record.

Installing a microphone is almost too easy. You can get one at the neighborhood Radio Shack or other electronics stores for a little over $10. If you plan to do high-end multimedia presentations, you'll want a better microphone, but for most home and small business uses, the inexpensive ones are fine. I use an $11 Realistic microphone with my system. There are, of course, hundreds of other ways to soup up Windows, and the technology is changing all the time. I'm looking forward to the day when my computer will load and unload the dishwasher and feed my fish. ❑

Why TrueType Prints Faster Than ATM

Does TrueType print faster than the leading Type 1 font rasterizer, Adobe Type Manager (ATM)? The answer is yes, but not always noticeably so. When using TrueType fonts, Windows enhances printing speed by reducing the amount of data that's downloaded to the printer.

On LaserJets and compatible printers, TrueType speeds performance by streamlining the font information downloaded during printing.

Instead of sending an entire page in the form of a huge bitmap as with ATM, Windows sends only the characters needed to print the document when using TrueType. New characters are not sent until they're encountered in the document. Unused characters are not sent at all. Since individual characters are downloaded rather than entire font files, no time is wasted sending and processing unnecessary data.

On PostScript printers, imagesetters, and slide recorders, the same process (downloading only necessary characters) is used, as well as yet another optimizing technique. Smaller point sizes (14 points and smaller on 300-dpi laser printers) are downloaded as bitmaps, rather than as outlines. The bitmap files (Type 3 fonts) are smaller and therefore don't take as long to download.

When you're printing short documents, such as letters and memos, the speed gained from this process is hardly noticeable. But TrueType can really speed printing of long documents or those that contain a lot of different fonts at various point sizes. The longer your document, the more time you save.

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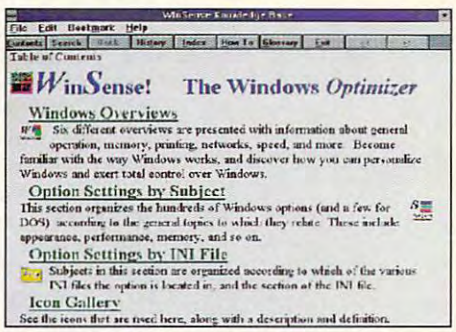

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WINDOWS WORKSHOP

Clifton Karnes

TWO KEYBOARD MAGIC TRICKS

One of the best ways to enhance Windows is right under your fingers—the keyboard.

Windows is a mouse-driven environment, and much of its power and ease of use comes from the mouse. But don't sell the Windows keyboard short. When it comes to speed, you simply can't beat keyboard commands, especially if your hands are on the keyboard already. As you probably know, Windows has a fair number of keyboard shortcuts built in, but there's plenty of room for more, and that's this column's topic.

First, much of Windows' interface is standard across applications. Most windows have a title bar, menu bar, and scroll bars (if they're needed), and the windows themselves can be moved and resized. You'll also note that almost every menu bar includes entries for File and Help. Digging deeper, if you examine almost any File menu, you'll see entries for New, Open, Close, Save, Print, and Exit. This structure is all part of Windows' standard interface, and it's one of the reasons that Windows is so easy to use—the parts of different applications that work the same way have the same menu choices.

If you look at the keyboard shortcuts in several different File menus, however, you'll see a variety of key combinations. The Save command, for example, may be Shift-F12 in one application, F2 in another, Ctrl-S in a third, and many programs will have no shortcut key at all. Unlike menu options, shortcut keys are not standard.

You can change all that, however, with Windows' Recorder.

Let's say that you want Shift-F12 to save the current file in all your Windows applications. I use Shift-F12 because it's the shortcut in Word for Windows and I've grown accustomed to it, but you can substitute any key combination you'd like.

To get started, run any Windows program that can save files, and fire up Recorder. To make sure Recorder is not recording mouse movements, go into Options, Preferences and select Ignore Mouse. Next, name your macro Save (or something similar) and choose Shift-F12 for the key combination. Now, choose Macro, Record and press Alt-F, S in your application. Alt-F activates the file menu, and S selects the Save command. Stop recording and, under Options, Properties, select Playback to Any Application. Now, Shift-F12 will save the current file in any Windows program that follows the minimum Windows standards.

You can probably think of other Windows shortcut keys that might be worth implementing. Open, Save All, and Close are possibilities.

The second keyboard shortcut I'm going to discuss involves running DOS under Windows. One of Windows' most famous shortcut keys is Alt-F4, which closes the active window. This is a quick way to exit any Windows app. Unfortunately, it won't work in a full-screen DOS session under Windows nor in a DOS box under Windows. With a little help from ANSI.SYS, however, we can create an Alt-F4 macro that will close a DOS window.

What our macro will do is simply map the strings for Ctrl-C (to end any running tasks) and the Exit command (followed by a carriage return) to the Alt-F4 key combination. It might be dawning on you that this macro will only work at the DOS prompt or when a program that Ctrl-C can exit from is running. That's true, but those instances will probably cover most of the times you need a quick DOS exit.

OK. The first thing you need to do is put ANSI.SYS in your CONFIG.SYS file, if it isn't already installed. Use the line DEVICE=ANSI.SYS or DEVICEHIGH=ANSI.SYS.

Next, we need to create an ANSI.SYS macro file that's going to look like this.

```
←[0;107;3;"EXIT";13p
```

Here's a rundown on what this bizarre-looking string does. The ← is the escape character. The [starts the macro. The number 107 is the Alt-F4 macro shortcut key. The number 3 represents Ctrl-C. "Exit" is, of course, Exit, and 13 is the number for a carriage return.

To create this macro, run the DOS Edit command (found in DOS 5.0 or higher) or run any editor that will let you embed an escape code in a file. To enter the escape character in DOS Edit, first press Ctrl-P, then Esc. Then, enter the remaining characters exactly as shown above and save the file.

To install this macro, you simply type it at the DOS prompt. For example, if you named this file ALT-F4.TXT, you install the macro with the following command.

```
type alt-f4.txt
```

The easiest way to use this macro is to put the line above in your AUTOEXEC.BAT file. If ANSI.SYS is installed, and this macro is installed before you run Windows, the Alt-F4 key combination will be available in any DOS session run under Windows.

To test this macro, exit Windows (if Windows is running), type *alt-f4.txt* at the DOS prompt, and rerun Windows.

Now, run DOS Prompt, either in a window or full screen; when you press Alt-F4, you'll exit—fast. ❐

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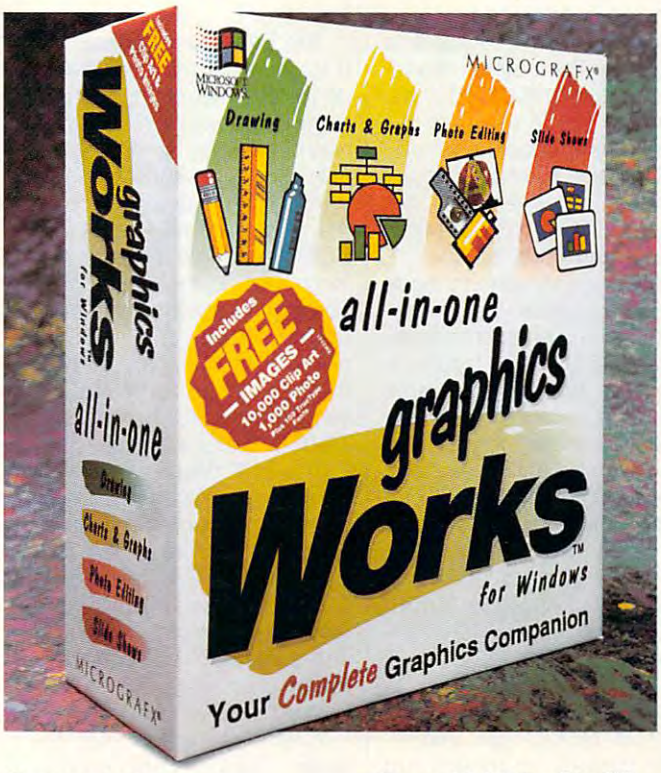

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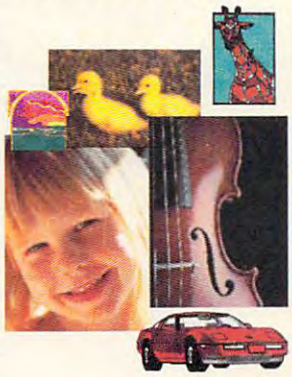

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PROGRAMMING POWER

Tom Campbell

OPEN UP YOUR WORLD

If you've ever wondered how to open up your programs to data from the outside world, the 1-2-3 worksheet format probably came to mind. It's easy to use, especially if you stick to the basics—labels, numbers, dates, and so on—because it was made public in the product's first release.

Later formats weren't made public by Lotus, but everything that you need is on CompuServe's LOTUSA forum, library 9, under the name WSFF.ARC.

The worksheet format is elegantly simple and extensible.

The worksheet format, elegantly simple and extensible, is made of variable-length records as follows:

Bytes 1–2: Record type
Bytes 2–3: Length of record body
Bytes 4–*n*: Record body

In the two-byte quantities (such as record type and record length), numbers are stored in the standard Intel fashion: the first byte is the remainder when the number is divided by 256; the second byte is the quotient. These two-byte values are often called words. The first byte is called the least significant byte (LSB), is the lower part of the word, and is stored first. The second byte is called the most significant byte (MSB). As we'll see later, sometimes the length word will be 0, and there will not be a record body.

A worksheet file is made up of at least two records: the BOF (Beginning Of File) and EOF (End Of File). The BOF also serves as a version indicator; it's different among WKS, WK1, and WK3 files. For our purposes, the original WKS file will be fine, as any program that imports worksheets supports it. Since information on the newer WK1 and WK3 formats wasn't made public, applications are less likely to read them.

The BOF record contains a 0 for each of the type bytes, so the BOF record type number is 0. The next two bytes represent the length word, which tells how long the rest of the record will be (it does not count the type or length words). The BOF record is only two bytes long: the 2 in the length word comes first and is stored in the LSB; the MSB contains 0. For a WKS file 04 04, the body of the BOF record contains the version bytes BOFRecord: DATA 0, 0, 2, 0, 04, 04.

The EOF doesn't need any version info; it consists solely of the type word—who has a value of 1 and is stored as a byte value of 1 followed by a 0 byte for the MSB—and a length word, whose value is 0. These two items make the minimum legal WKS file, EOFRecord: DATA 1, 0, 0, 0.

A label is sandwiched between. The WriteLabel subroutine lets you pass any text, along with row and column info. It automatically creates a label at the specified row and column. Cell A1's row value is 0 and column value is 0; B2 would be 1,1; D4 would be 2,3; and so on.

Download WSFF.ARC for the numeric format. The listing that follows here begins with labels because they can be converted to numbers once they're in the program.

```
' Create a Lotus wks file with labels in it using QuickBASIC.
DECLARE SUB WriteLabel (Label$, LRow!, LCol!, Handle!)
Filename$ = "test.wks"
Handle = FREEFILE
OPEN Filename$ FOR OUTPUT AS Handle

RESTORE BOFRecord
FOR Index = 1 TO 6
 READ NextVal
 PRINT #Handle, CHR$(NextVal);
NEXT Index

WriteLabel "This is cell A1", 0, 0, Handle
WriteLabel "This is cell C2", 2, 1, Handle
WriteLabel "This is cell D4", 2, 3, Handle

RESTORE EOFRecord
FOR Index = 1 TO 4
 READ NextVal
 PRINT #Handle, CHR$(NextVal);
NEXT Index

CLOSE Handle
'
BOFRecord:
DATA 0, 0, 2, 0, 04, 04

EOFRecord:
DATA 1, 0, 0, 0

SUB WriteLabel (Label$, LCol, LRow, Handle)
 ' 15 is the record type.
 PRINT #Handle, CHR$(15);
CHR$(0);
 ' Write the length of the
 ' string, plus 6 for the format,
 ' column, row, and prefix. The extra
 ' 1 is for the 0 byte that ends
 ' the label.
 PRINT #Handle,
CHR$(LEN(Label$) + 7);
 ' End the label with a 0 byte.
 PRINT #Handle, CHR$(0);
 ' The format byte.
 PRINT #Handle, CHR$(245);
 ' The row.
 PRINT #Handle, CHR$(LRow MOD 256);
 PRINT #Handle, CHR$(LRow \ 256);
 ' The column.
 PRINT #Handle, CHR$(LCol MOD 256);
 PRINT #Handle, CHR$(LCol \ 256);
 PRINT #Handle, CHR$(39);
 FOR i = 1 TO LEN(Label$)
 PRINT #Handle, MID$(Label$, i, 1);
 NEXT i
 PRINT #Handle, CHR$(0);
END SUB
```


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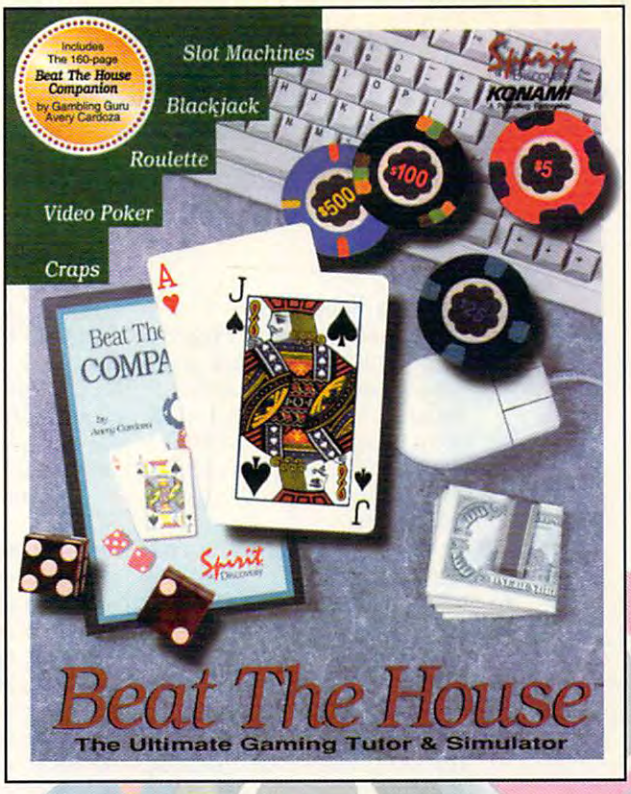
Some play for fun...



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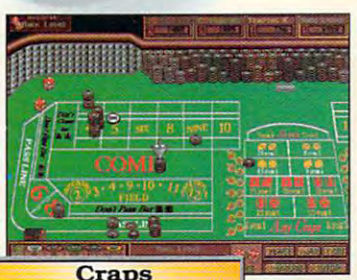

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TIPS & TOOLS

Edited by Richard C. Leinecker

Keyboard magic with tiny TSRs and feeding parameters to DOS commands automatically

Send In Your Tips

Except for one, this month's tips were all written by yours truly. I ran out of those terrific letters I've become accustomed to. I'd like to thank those of you who've submitted tips, though. If you've been thinking about sending something in, there's no time like the present.

A large number of you have sent in Debug scripts that sound great, but I can't use them unless you also send in the source code. It wouldn't be a wise practice to run programs blindly because they might have the latest virus or a hard drive format routine. If you've sent in a Debug script without source code, please resubmit the tip and include the source code.

RICHARD C. LEINECKER
MIAMI, FL

Soup Up Your Keyboard

Here are two utilities that let you customize your keyboard links. One program adds a click when you press a key, and the other lets you take advantage of the larger keyboard buffer size by stuffing it with text strings.

```
debug keyclick.com
File not found
-e 100 b8 09 35 cd 21 89 1e 4c
-e 108 01 8c 06 4e 01 b8 09 25
-e 110 ba 1c 01 cd 21 b4 31 ba
-e 118 20 00 cd 21 50 51 e4 60
-e 120 a8 80 75 1f 3c 1d 74 1b
-e 128 3c 38 74 17 3c 36 74 13
-e 130 3c 2a 74 0f e4 61 34 02
-e 138 e6 61 b9 88 13 e2 fe 34
-e 140 02 e6 61 59 58 9c 2e ff
-e 148 1e 4c 01 cf
-RCX
CX 0000
:4c
-W
Writing 004c bytes
-Q
```

If you run Checksum (July 1992 "Tips & Tools") on this program, the number 035 should appear on your screen. To run the program, just type *keyclick* at the command line. It'll stay memory resident and keep clicking until you reboot your system. It takes up 912 bytes of conventional RAM.

```
debug stuffkey.com
File not found
-e 100 2b c0 8e c0 be 80 00 ac
-e 108 0a c0 74 41 ac 3c 0d 74
-e 110 3c 3c 20 74 f7 4e 26 8b
-e 118 0e 80 04 26 8b 16 82 04
-e 120 ac 3c 0d 74 28 26 8b 3e
-e 128 1c 04 3c 7e 75 02 b0 0d
-e 130 2a e4 26 89 85 00 04 47
-e 138 47 3b fa 7c 02 8b f9 26
-e 140 3b 3e 1a 04 74 05 26 89
-e 148 3e 1c 04 eb d3 b4 4c cd
-e 150 21
-RCX
CX 0000
:51
-W
Writing 0051 bytes
-Q
```

If you run Checksum on this program, the number 119 will appear on your screen.

Just type *stuffkey "test string to stuff"* to run the program. If you want a carriage return, use the tilde symbol.

RICHARD C. LEINECKER
MIAMI, FL

DOS Command Line Tips

DOS 5.0 has given us plenty of switches to customize the way directories are displayed, but it's tedious to type those command line switches every time you call up a directory. There's a special DOS 5.0 environment variable named DIRCMD. You can use it to set the default switches for your directories.

If you want to use the /od and /l switches, just add a line to your AUTOEXEC.BAT file as follows.

```
set dircmd=/od /l
```

Then, every time you call up a directory, it'll be sorted by date and displayed with lowercase characters.

You might get tired of typing in a volume name at the prompt when you format disks. You can preset the volume name with a command line switch. If you want to name the disk MYDISK, type *format a: /v:mydisk*. If the volume name will have spaces in it, you'll have to use quotation marks, as in *format a: /v:"mydisk ii"*.

You can clean a disk of files and subdirectories easily by formatting with the /q switch. Technically, the disk won't actually be formatted, but you will clear the file allocation table and directories. Therefore, you can only use this option on a disk that's already been formatted. Still, that's a whole lot easier than deleting a bunch of embedded subdirectories. Just type *format a: /q*.

Do you get impatient with Format when DOS tries to see if there's any information on the disk to preserve so that it can be unformatted? I've never formatted a floppy disk by mistake, only to find that I needed to recover files from it. When I type *format*, I want it done. To avoid the long delay while DOS inspects your disk, all you have to do is add a /u command line switch. To format a disk unconditionally, you would type *format a: /u*.

RICHARD C. LEINECKER
MIAMI, FL

Batch File Tips

Many programming languages have a switch statement that makes program organization much easier. The batch file language doesn't have that, but the For statement can act as a kind of switch statement. It's really handy for jumping to a part of the batch file according to a com-

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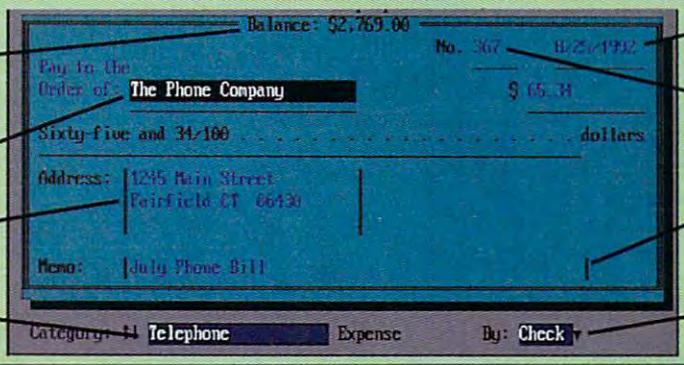

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Coping with mixed-case arguments in batch files and touching your files from DOS

mand line argument. Here's an example.

```
FOR %%P IN (XY xy WIN win
 WP wp) DO IF "%1"=="%%P"
 GOTO %1
ECHO Invalid parameter given
 or no parameter given
ECHO Correct inputs are XY, WIN,
 or WP
GOTO END
:XY
ECHO Run XyWrite
EDITOR
GOTO END
:WIN
ECHO Run Windows
WIN
GOTO END
:WP
ECHO Run WordPerfect
WP51
:END
```

If one of the parameters you're looking for is an argument, the batch file will branch to the correct label. This works because Goto isn't case sensitive. It doesn't handle instances of mixed case like Wp or Xy.

You can also use the same trick with returned error levels. Note that for this technique the values must be in ascending order.

If you have a utility that runs and returns an error level, then you can scan for a match with a batch file routine like this.

```
FOR %%E IN (0 1 2 3) DO IF
 ERRORLEVEL %%E GOTO
 CASE%%E
ECHO Correct value not found
GOTO END
:CASE0
ECHO Do the stuff here that's
 the choice for 0
GOTO END
:CASE1
ECHO Do the stuff here that's
 the choice for 1
GOTO END
:CASE2
ECHO Do the stuff here that's
 the choice for 2
GOTO END
:CASE3
ECHO Do the stuff here that's
 the choice for 3
GOTO END
```

One of the biggest pains when taking arguments for batch files is the case sensitivity. It's not that hard to have a lowercase and an uppercase comparison, but what if users mix cases? Here's an example of how your batch file can run into trouble.

```
IF "%1"=="COMPUTE" GOTO
 COMPUTEMAG
IF "%1"=="compute" GOTO
 COMPUTEMAG
```

If you type *COMPUTE* or *compute*, you're OK. But if you type *Compute* or *COMpute*, your logic fails.

There's a way to fix this with a trick. It takes advantage of the fact that DOS always capitalizes environment variables created with the Set command.

```
ECHO OFF
IF "%1"=="" GOTO END
SET %1=$$
IF "%COMPUTE%"=="$$" GOTO
 COMPUTEMAG
ECHO Not COMPUTE Magazine
GOTO END
:COMPUTEMAG
ECHO Yes COMPUTE Magazine
:END
SET COMPUTE=
```

What happens is that the statement SET %1=$$ creates an environment string called COMPUTE and sets it equal to a string of $$. Then, the comparison IF "%COMPUTE%"=="$$" is true if COMPUTE is the argument.

RICHARD C. LEINECKER
MIAMI, FL

Touching Tale

I have a utility that came with Turbo Pascal called Touch. It updates file dates and times without my having to load the files into an editor and resave them. That's important when I compile, but it can also be important for doing backups.

You don't need a special program, though; with DOS you can do pretty much the same thing. Here's a line that shows you how.

```
COPY /b filename +,,
```

If you wanted to update the time and date of a file called MYSTORY.TXT, you'd type *copy /b mystory.txt +,,*.

A batch file makes touching files in DOS a lot easier. Here's one I created and called TOUCHIT.BAT. Remember never to use wildcards with this batch file.

```
ECHO OFF
IF "%1"=="" GOTO MIS
IF "%1"=="/h" GOTO MIS
IF "%1"=="/?" GOTO MIS
COPY /b %1 +,,
GOTO END
:MIS
ECHO This program updates files'
ECHO times and dates without
ECHO loading them into memory.
ECHO The format for this
ECHO command is
ECHO TOUCHIT filename
ECHO where filename must be
ECHO the name of a file. You
ECHO cannot use a mask
ECHO (no wildcards).
:END
```

THOMAS E. HINES III
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HARDWARE CLINIC

Mark Minasi

INTERRUPTS MADE EASY, PART 2

How interrupts work, and how to choose the interrupts that will work best for you

Last month, we started looking into what interrupts are and why they're important. This month, we'll look more closely at interrupts.

For those just joining us, I explained last month that an interrupt is a means whereby an input/output device on a PC gets the attention of the PC's CPU so that the input/output device can direct the CPU to move some data around.

For example, the keyboard controller on your PC must get the attention of the CPU every time you press a key on your keyboard. It has to do that because the keyboard controller has only enough storage to hold onto one keystroke. If the CPU doesn't handle the keystroke in the controller quickly, it may become overwritten by a newer keystroke, losing the original keystroke forever. I explained that on some systems the keyboard controller can't force the CPU to pay attention to it; instead, it must wait for the CPU to periodically ask the keyboard controller if the controller has a keystroke. Such a process, where the CPU checks the controller regularly, is called polling, and it's used in lieu of interrupts in some applications.

I then discussed how the interrupt on the printer port greatly affects whether or not your system can print under Windows and OS/2. Additionally, I explained that putting more than one device on the same interrupt will generally cause both devices to fail.

This month, we'll pick up where we left off, with a discussion of how you can avoid those interrupt conflicts. That'll lead to a discussion of interrupt priorities.

Suppose that you're going to insert a new circuit board in your PC; let's say it's a Sound Blaster Pro (SBPro) from Creative Labs. You want to avoid the evils of interrupt conflicts, so what should you do? Not all add-in cards need an interrupt, so there may be nothing to worry about. The first order of business, then, is to check the documentation that came with the board to find out if an interrupt will be needed.

The SBPro is a well-documented board (thanks, Creative), and one of the first items discussed is how to insert the board and test it with the included diagnostic software. The documentation tells you that the SBPro does, indeed, need an interrupt channel (as well as an input/output address range and a Direct Memory Access, or DMA, channel, but that's a discussion for another day). The SBPro is a 16-bit board and, as such, could in theory be designed to use any interrupt between IRQ2 and IRQ15. (Recall that interrupts are called IRQs and that a 16-bit card has access to interrupts numbered 2 through 15. IRQ0 and IRQ1 aren't available via the bus slots because they're already used by the timer and the keyboard, respectively.) The SBPro offers the option of using IRQ2, IRQ5, IRQ7, or IRQ10; it comes from the factory set for IRQ7.

Now, it just won't do to leave the interrupt at IRQ7, as that interrupt is reserved, as you learned last month, for LPT1, the primary parallel port. Leaving the SBPro at IRQ7 could cause problems for printing. The worst of it is that the printer port conflict usually won't show up immediately. I often see a message on the online forums that looks something like this: "I'm trying to run Wing Commander II. The opening music comes up, the credits roll, and all looks well. But as soon as one of the characters starts to speak, the system locks up." (I used a Wing Commander example because I play the game, but the same messages show up on other game and nongame forums.) The reason why the opening music is all right but the speech locks up the system is that music is generated differently than speech. Exactly how that all works is a topic for another column—but it's true, believe me. Anyway, the root cause of the lockup is the SBPro conflict. Change the interrupt, and the problem will go away.

How, exactly, do you know which interrupts are already taken in your system and change the interrupt that the SBPro uses? Or more generically, how do you change the interrupt that any board uses?

The first question is actually the tougher one. You'd think that it would be a childishly simple matter to run a program that would tell you which interrupts you're already using. Unfortunately, that's not the case. There are many programs that attempt to detect interrupts, but there's no definitive way to detect interrupts with software.

These programs work either by tracing information in your device drivers or by simply looking up interrupt correspondences. In the first case, they analyze any device drivers or TSRs that you have loaded to see which hardware interrupts they're designed to work with. These interrupts go on the list of already-taken interrupts. In the second case, there are, as I explained last month, standard interrupt settings for the basic hardware that you find in virtually all PCs. If the diagnostic program detects a floppy drive controller in your system, then it knows that IRQ6 is taken, as the floppy controller uses IRQ6 by default. Notice that if you have a nonstandard flop-

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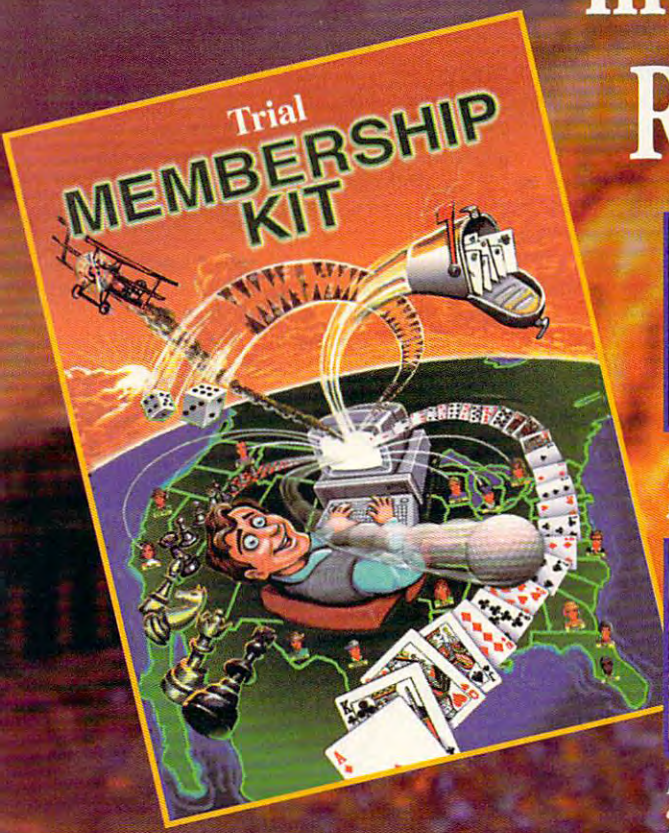

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py controller, the diagnostic program won't be accurate.

Now you can see that programs that claim to detect your interrupts for you are at best good guessers and at worst totally wrong. If you must use one of these programs, however, you can increase the probability that it will work correctly by making sure that you load all the device drivers and TSRs that are relevant to your hardware—your network drivers, your mouse driver, and so on. Having said that, however, let me reiterate that this isn't the right way to find out which interrupts your system uses. In the particular case of the SBPro, for example, I've found only one program that's capable of detecting its presence on my PC—QAPlus. No other diagnostic program that I've run can locate the SBPro's interrupt, save for the diagnostic program that comes with the SBPro.

There's no substitute for knowing what's in your system.

This leads me to the right way to figure out which interrupts you're already using—the documentation that comes with your PC and its add-in boards. Chances are that you have a normal COM1 and COM2 using IRQ4 and IRQ3, respectively; a normal floppy controller using IRQ6; and a normal parallel port using IRQ7. You should avoid using IRQ2 because it's the connection to IRQ8 through IRQ15. You shouldn't use IRQ8 because your system clock uses it. IRQ13 is used by your coprocessor, and IRQ14 is used by the hard disk controller.

So which interrupts are used by the slightly strange boards you may have in your system, such as a local area network board or a scanner interface? The only way to know for sure is to check the documentation that came with the boards. I'll tell you what I do to keep track of interrupts on my system: I tape a large envelope to the side of my PC. (It's a tower, so there's plenty of space. If your PC isn't in a tower case, you can tape the envelope to the monitor.) I keep an index card in the envelope that tells me which interrupt each board in that system uses.

Before moving on the second question (How do you change the interrupt that the SBPro uses?), let me stress the essential nature of keeping and reading the documentation that comes with the board. I know it's a pain, but there's no substitute for knowing what's in your system, rather than guessing.

The SBPro documentation says that you can choose IRQ2, IRQ5, IRQ7, or IRQ10. IRQ2 should be avoided, and 7 is out; again, it's sad that 7 is the default. IRQ5 would be OK, and so would 10. But I've run into many boards that don't offer any interrupts but the ones in the 2–7 range, so it seems a good policy to use IRQ10 when possible. Let's do that with the SBPro. To actually tell the SBPro to use IRQ10, you have to move a jumper on the board itself. Again, the SBPro is better documented than the average board, and the jumper locations for the various interrupt choices are right on the board. There's a row of pins labeled IRQ2, IRQ5, and so on. Many companies, in contrast, label the pins JP1-1, JP1-2, and the like, requiring you to constantly look at the manual. In this case, you just remove the jumper that's currently across the IRQ7 position and move it to the IRQ10 position.

On some boards, choosing interrupts is even easier. You just run a program (supplied with the board) that essentially sets the jumper with software—no fiddling around with jumpers is required.

Even though the board is in, you're not done yet. You have to load the driver programs that use the SBPro (or whatever new board you're installing), and you typically must inform those drivers of the interrupt (and possibly the DMA and input/output address) that the board is set to.

Besides the concern about not putting two boards on the same interrupt, does it matter which interrupt you choose for the SBPro? It may, due to the nature of the different interrupts.

Interrupts in the PC world are prioritized. The device on IRQ0 gets the highest priority, and the device on IRQ15 gets the lowest priority. That sounds like a real hidden gem of a piece of information, but it's not all that terribly important. It usually makes sense to put slower devices on the higher-priority interrupts. That's because a slower device generates fewer interrupts per second than a faster device, and if two interrupts appear at the same time, the higher-priority item gets served first. If the faster device has a higher priority, the slower device might never be served.

Is that important in a real-life sense in the PC world? Well, here's one application. If you're going to communicate at a high speed over your modem, use COM2 rather than COM1. COM1 uses IRQ4; COM2 uses IRQ3. That means COM2 has a higher priority than COM1. Suppose you're in Windows downloading data over your communications line and you move your mouse. If the serial port attached to the mouse has a higher priority than the serial port accepting data, you could theoretically lose data on the serial port. I've only seen that happen, however, with modems that can blast data into a PC at 38,000 bps or more. ❐

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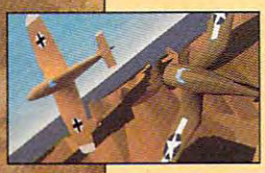

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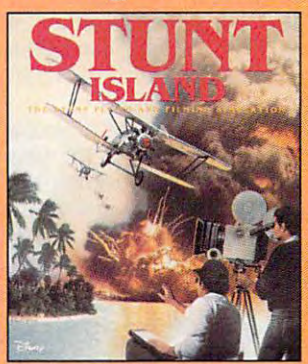

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INTRODOS

Tony Roberts

WINDOWS USERS STILL NEED DOS

DOS may seem to be losing importance, but don't bet on it. Every Windows user needs DOS, too.

Unless you have the world's most extensive collection of Windows software, you may find yourself at the DOS prompt a dozen times a day. Why? Maybe you don't have a Windows file compression utility, so you hop to DOS to unzip a compressed file. Maybe you want a quick directory listing of all the files on your hard disk with a certain extension, and you find it easier to get a directory from DOS than from File Manager.

Perhaps you'd rather create directories and copy files from the command line, or maybe you have several favorite DOS utilities for which there just aren't any good Windows equivalents.

Hopping back and forth between Windows and DOS, however, isn't without its problems. Sometimes, you forget Windows is running and try to run it again. Occasionally, you try to run a DOS command such as Chkdsk, which shouldn't be run while Windows is active.

Here are a few tips for those of you who combine Windows and DOS. And I'm speaking here of Windows 3.1 and DOS 5.0. If you haven't upgraded to the latest versions, you're running a hobbled system.

Prompt Response

How would you like to have a special prompt when you're running a DOS session from Windows? It's easy to do this by setting the WINPMT environment variable. The best place to do this is in your AUTOEXEC.BAT file, right after the Prompt command. Try this, for example: SET WINPMT=Windows is active.$_$_pl.

When DOS is running as a child of Windows, you'll see the prompt reminding you that Windows is active; otherwise, when DOS is running alone, you'll get your regular prompt.

A DOS Imitation

If you like to issue commands at a command line but you don't want to leave Windows, take a look at a program such as WinCLI (Eschalon Development, 110-2 Renaissance Square, New Westminster, British Columbia, Canada V3M 6K3; 604-520-1543; $35 for shareware registration).

WinCLI gives you a DOS-like environment in a Windows window. You'll have access to many DOS commands, including Attrib, CD, Copy, Dir, Del, Label, MD, Type, Path, Prompt, Rename, and RD. With these commands at hand, you can carry out most of your file management chores without having to leave Windows.

In addition, you can start any Windows or DOS program simply by typing its name at the WinCLI prompt. And the nice thing about WinCLI is that it looks and behaves like a Windows program. If you run windows in standard mode, you'll probably find WinCLI faster and more efficient than a true DOS box.

A Better-Than-DOS DOS

If you really like DOS and want to take full control of your DOS sessions, you'll like EDOS—Enhanced DOS for Windows (Firefly Software, 1594 SW Fifth, Gresham, Oregon 97080; 800-248-0908; $39.95).

EDOS gives you all kinds of control over DOS sessions started under Windows running in 386 enhanced mode. With EDOS, you can do all the following.

- Run DOS sessions as large as 736K.
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- Use Alt-F4 to close a DOS session.
- View or print the Windows clipboard from the DOS prompt.

In addition, EDOS gives you several tools to fine-tune your DOS sessions so they're running at optimum speed. The Systime and Boxtime commands can show you how much processing time a DOS application is receiving from Windows, and the Prif and Prib commands permit you to modify a DOS session's foreground and background priorities.

Other EDOS commands allow you to add memory to a DOS session, to change the time slice allocated by Windows, and to set the background or exclusive settings for the session.

If you don't like having a surfeit of PIF files hanging around your system, you can start your DOS sessions with the default PIF and use EDOS commands, either at the command line or in batch files, to modify the session parameters as needed.

On the other hand, if you're already swimming in PIF files but you can't remember which PIF goes with what, EDOS has a solution. From any windowed DOS session, you can choose PIF Editor from the Control Menu to view and edit the PIF that controls the current DOS session.

Another welcome EDOS feature is that it disables dangerous DOS commands, such as Chkdsk, Fastopen, Assign, and Append.

If you really like to call all the shots, in and out of Windows, you'll be happy with the control EDOS provides. ❐

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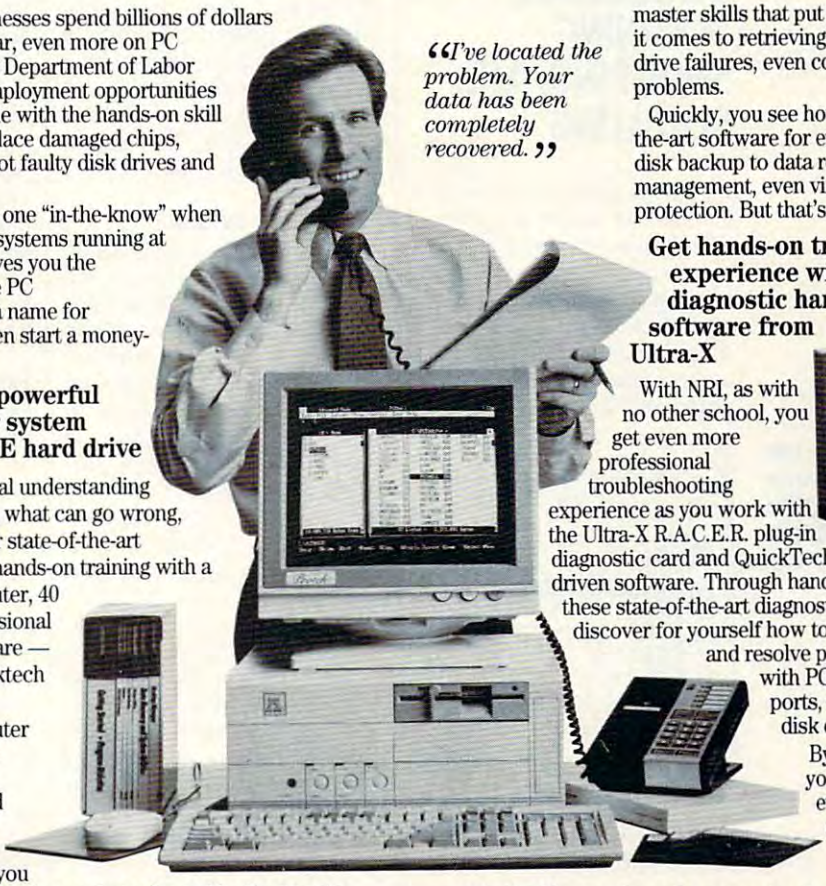

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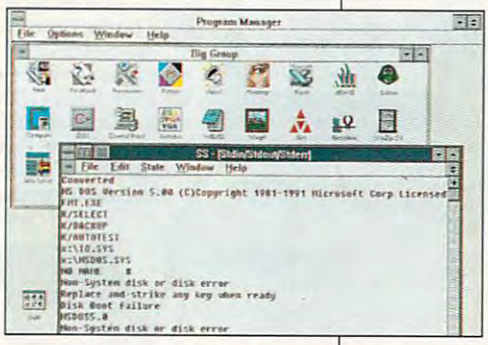
Tony Roberts

SCHEDULING, PLANNING, SNOOPING, AND SCROLLING

If you like utilities, this issue's PC disk is worth a gander. With these programs you can run a special batch file of the day, take a quick disk status snapshot, review DOS activity after it has scrolled off the screen, and peer into cryptic command files.

SuperSnooper lets you discover hidden information in programs you use every day.



And to go with those utilities, the disk includes a couple of applications: a home planner and a label manager to put your PC to work.

A Batch a Day

Many people rely on a weekly routine to help keep them organized. Laundry on Monday, pizza on Tuesday, bowling on Thursday, banking on Friday. If you'd like to set up a weekly routine for your computer, Daybat is the answer.

James Sheppard's utility simply determines the day of the week and then runs a batch file for that day. This allows you to run certain programs or perform specific PC maintenance chores, such as a virus scan, on a regular schedule.

Sheppard, a BBS sysop, created the program at the request of a fellow sysop who wanted to spread out his BBS maintenance chores over the course of a week. Some time later, Sheppard decided to put the program to use himself, so he updated it a bit and released it as shareware at the same time. The registration for Daybat is $5.

What's Left on Disk?

Managing disk space has always been a challenge. Today's systems, with large hard drives subdivided into multiple partitions and network drives increasing storage options, are harder than ever to cope with.

To get a speedy snapshot of the mass storage picture on your system, try Disk Left. Just a quick screen gives you the stats on drives A–Z if you have them. This program tells you at a glance where you can store those multimegabyte graphics you can't bear to delete.

Paul Muñoz-Canon offers Disk Left as a free program.

Furniture Mover

If you're tired of shoving that sofa from one end of the house to the other only to find it doesn't fit, boot up Home Plan and let your computer do the heavy work.

Home Plan is a mini-CAD program that helps you create and print floor-plan–type drawings. The software even includes a small library of standard home furnishings—beds, sofas, fixtures—that can give you a quick start in organizing your dream home.

Programmer and home planner Charles Herndon has been working on Home Plan for several years. The program started out as a fairly crude BASIC program, but it since has become a more polished program constructed in Turbo Pascal.

Home Plan features automatic dimensioning, adjustable cursor speed, square footage calculations, and optional display of framing (studs, joists, etc.). The program includes online help that puts all important commands only a keypress away. Home Plan is shareware with a $20 registration fee.

SuperSnooper

Find the hidden text in program files with SuperSnooper. In this ingenious adaptation of programming columnist Tom Campbell's Snooper program, COMPUTE editor Clif Karnes has created a single program that can run both from the DOS prompt and from within Windows.

SuperSnooper lets you see beyond the binary to discover hidden information about the programs you use every day. When the program is activated, it displays all of the ASCII text strings contained within a file. With SuperSnooper you can peer into forgotten utilities to locate help text, or you can search for undocumented switches and commands.

When you run the program from within Windows, you'll be able to scroll back and forth through the output, and you'll be able to use Windows' Cut-and-Paste feature to duplicate or move information.

There is no fee for SuperSnooper.

Scroll Through DOS

One of the most frustrating aspects of working with DOS is that once something's scrolled off the screen, it has gone forever. JCSCROLL solves that problem by creating a scrollable buffer through which you can review the directory listing or text file

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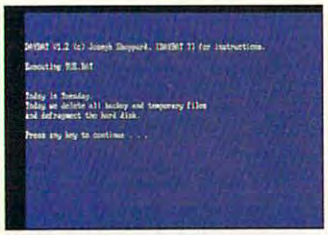
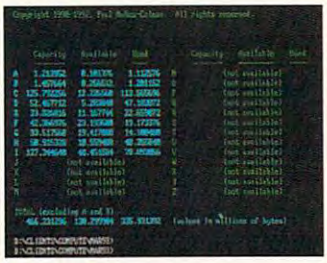
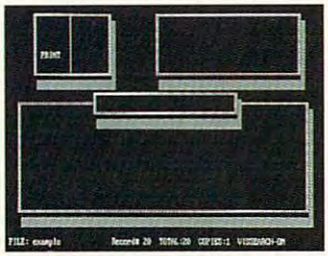


Daybat



Disk Left

Home Plan



The Ultimate Label Manager

that just flew off your screen.

The program, created by Jeffrey Chasen, installs as a TSR. DOS behaves as normal until you press the hot key that activates JCSCROLL. Then, you can browse through as many as 150 lines of text at your leisure. JCSCROLL, which is offered as shareware with a $10 registration fee, also can be activated from within text applications. For example, it's possible to review recent DOS activity from within word processing software.

The program uses 4K of memory for every 25 lines of buffer space reserved.

Ultimate Label Manager

Addressing envelopes is a task I dread. Handwriting as bad as mine surely must tax the automated sorting equipment at the post office.

Enter The Ultimate Label Manager, a name and address database from Jeff Napier's Another Company. This nicely designed program gives you full control over a small mailing list, whether it's a database of your family and friends or business contacts.

The program lets you enter labels and then edit them, search them, delete them, or print them. There's a large note area associated with each label that can be used to jot down notes about your friends or customers.

The Ultimate Label Manager includes a Zipsort option that will sort your database by zip code to make it easier for you to comply with bulk mailing regulations. The program prints label information to standard 3½- × 15/16-inch labels and will print, notes and all, on standard 8½- × 11-inch paper.

You can print from 1 to 60,000 copies of any label, so the program works for diskette labels as well as mailing labels. The Ultimate Label Manager is shareware with a registration fee of $29.95.

So Why Register?

The software included on COMPUTE's PC disk is created by programmers who've invested their time and energy into developing reasonably priced programs. These programs are made available as shareware, which permits you to use and test them before buying. ❐

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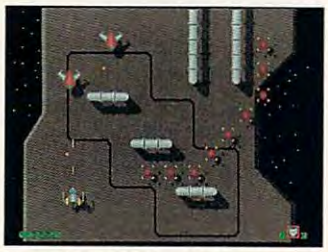
SHAREPAK

Steve Draper

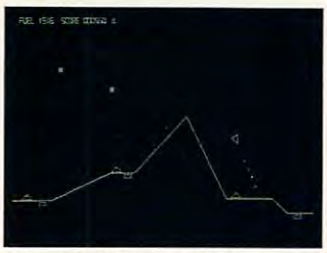
FUTURE CLASSICS

This month, COMPUTE's SharePak brings you three outer space shoot-'em-ups. Each of these three arcade space games is packed with all the features you'd expect to find in a commercial package costing upwards of $40. Two of these gems, STARFIRE and Xerix, were programmed in Australia and give you a glimpse of the shareware quality in the land down under.

March's SharePak features three out-of-this-world programs.



Save humanity from alien invaders in STARFIRE.



Conquer faraway worlds with GRAVITON.

STARFIRE

With six levels of action worthy of coin-op arcades, STARFIRE is for one or two players. As usual, the Earth is under attack by a cowardly race of conquering aliens. This time they're called the Sloboids, and they're sending six huge "mother destructor craft" toward Earth. Each ship carries weapons capable of destroying entire planets, so all of mankind is threatened.

You must destroy the huge the alien mother ships which are currently headed toward Earth. As you swoop down across the bow of each ship, then fly across the deck, you'll encounter heat-seeking missile launchers, gun turrets, and enemy fighters. You also have to avoid the various structures and pipes that protrude from the deck.

The situation isn't as hopeless as it seems. Your ship is far from defenseless. Use laser cannons and bombs to destroy enemy craft, gun turrets, and missiles.

STARFIRE requires an IBM PC or compatible running at 12 MHz or faster and VGA graphics. Joystick, mouse, and Ad Lib and Sound Blaster card support are provided. The registration price is $20 (Australian dollars).

Xerix

Xerix (eXtended Enemy Response and Infiltration eXperiment) puts you in command of that project. Your mission is to stop a huge alien structure that's hurtling toward the Earth and emitting deadly radiation. After an unmanned probe is destroyed, the World Council decides to send you in the lone Xerix spacecraft to destroy the giant object. You don't know how you'll stop the alien craft, but you're Earth's only chance.

The object of the game is simple: You must guide a fighter through a strange structure with two different levels and destroy or avoid the many enemy obstacles that stand in your way. The alien structure's weapons are formidable and range from bouncing space mines to multiturreted bomb launchers. Destroy the end-of-level alien, a guardian of the alien ship, to advance to the next level. You'll need sharp reflexes to finish this mission.

Xerix features 256-color VGA or MCGA graphics and Ad Lib and Sound Blaster sound card support. Other features include multilevel and multirate scrolling, expanded and extended memory support, and mouse and joystick support.

Xerix requires an IBM PC or compatible, a VGA or MCGA video display, and a hard disk or floppy disk with 500K free. A computer with a processor speed of 10 MHz or faster and a hard disk is recommended. Xerix is a free program.

GRAVITON

GRAVITON is a challenging arcade game with the appearance of color vector graphics and with the look and feel of arcade games like Asteroids and Star Castle.

Your mission is to invade four solar systems, each with a sun and four planets. Each planet has three types of defenses: defenders, floating mines, and enemy spaceships. To conquer each planet, you'll have to destroy every defender on the planet,-while constantly swooping down to pick up fuel from enemy fuel dumps to power your ship. There's only one important rule to remember: Don't let your ship touch anything.

As if that's not enough to worry about, this game goes beyond its arcade predecessors and adds the influence of gravity to the game. You can use gravity to your advantage or try to fight it. Learning to control your ship is the key to success in this game.

GRAVITON features a high-score file, sound, and a keyboard-scanning TSR that allows much better realtime play than standard BIOS calls.

GRAVITON requires an IBM PC or compatible running at 12 MHz or faster and EGA or better graphics. The registration price is $10. ❐

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Z WOLAK

BACK IT UP WITH TAPE

Tape backups have never been so economical. You may even find that they're less expensive than the floppies that would be necessary to back up today's huge-capacity hard disk.

You've heard it a hundred times before: Back up your hard disk. It may be as unglamorous as flossing your teeth, but backing up is an absolute necessity if the information stored on your hard disk is important to you. One day, some strange twist of fate will scramble your presentation data four hours before you need it, wipe out the Great American Novel an hour before you intended to print a copy for your agent, or destroy a year's financial data on April 14. Virtually everyone with a computer has a hard disk horror story to tell.

Fortunately, the options for backing up have broadened in recent years, and several of the backup strategies have payoffs beyond just maintaining a healthy level of data redundancy (as well as your sanity).

Floppies were once the only cost-effective method for backing up a personal computer's hard drive; the other choices were either nonstandard or expensive beyond belief. Things have changed, and now quite a few options have emerged that are less expensive and bothersome than floppies.

Probably the most useful backup device is the tape drive unit. Tape backup units reside in a floppy bay of your computer (or on the desk beside it) and use digital data tapes to store large chunks of information in sequential order. Due to the unit's relative simplicity, the cost of a tape backup isn't much more than that of a floppy drive, and when you factor in the cost of the tapes, the cost per megabyte of storage comes out strongly in the consumer's favor (quarter-inch tape cartridges run anywhere from $30 to $80).

A tape unit is different from a floppy or a hard drive in many ways. It's not seen by your computer as a traditional drive unit. You can't change to the tape from the C prompt and load a file. And tape units are slow and sequential, having to fast-forward or rewind to find the appropriate file or group of files.

Tape units can, however, store the contents of your entire hard drive in a single pass, giving you the option of a nearly painless restoration of your data after a crash (several Tylenols might still be needed). Also, because of its ability to save large chunks of information, a tape drive is useful in several other data-intensive situations.

Cartridge tape drives come in two general flavors: drives that use 6000-series tapes and can store up to 1.35 gigabytes of data, and drives that use mini or standard cartridges (2000-series cartridges). The least expensive tape drive, and the type best suited for the single-station PC, is an internal quarter-inch drive unit that uses the 2000-series tapes. This unit fits into a spare 5¼-inch drive bay (though Iomega makes one to fit into the smaller 3½-inch bay) and is run either by your computer's own floppy controller unit or more efficiently by an independent controller card.

A tape drive isn't fast. The standard speed is 500 kilobits per second, but some controllers can boost this to one megabit per second. And thanks to good software, the backup procedures can be scheduled to run during times when you're not around.

A tape cartridge is different in many ways from a standard audiocassette. The most notable difference is in the movement of the tape itself. An audiocassette contains only audiotape, which is moved by individual drive

By Paul C. Schuytema

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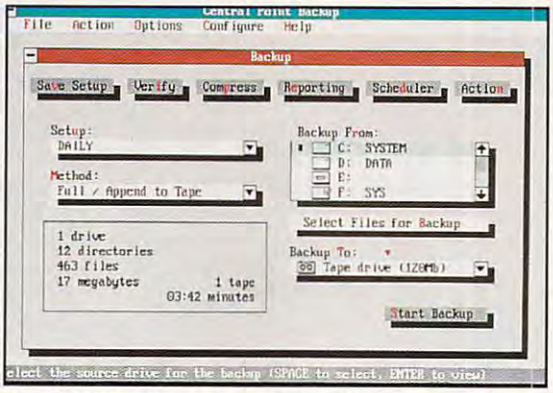
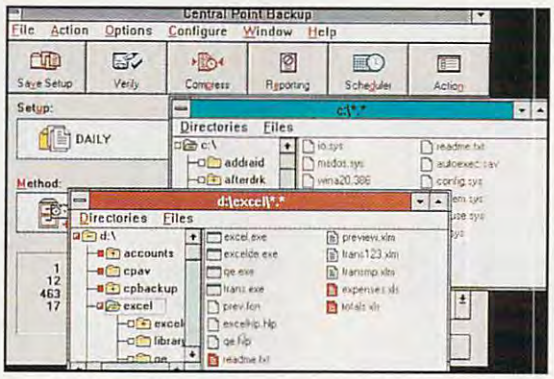
motors that fit into the take-up hubs.

A quarter-inch data cartridge contains a drive system as well as the tape itself. A belt actually contacts the tape on both reels, allowing the drive unit to operate the tape with only one motor, which contacts the belt capstan. The cartridge itself takes care of maintaining tension and a constant speed as the tape moves from one reel to the other. The linear velocity of the tape is equal to the speed of the belt, no matter how much tape is on either hub. There's no need for a pinch roller or clutches for the take-up hubs. This makes it possible for the tape drive to be as simple (and inexpensive) as possible.

Quarter-inch tapes record with either 20 tracks (QIC-40) or 28 tracks (QIC-80) across the tape. The information about each tape's contents is stored at the beginning of the tape, and a program must search there first to find the location of a block of information. It will then fast-forward into the tape the indicated number of feet and see if the data is there. Since there is no explicit tracking information, a tape drive will often overshoot or undershoot and will have to adjust its position. Needless to say, a tape's speed is much slower than that of disk-based media.



Central Point Backup for DOS offers menus and mouse support.



Central Point Backup for Windows provides backup in a graphical environment.

Beyond the QIC tape format, tape drives are also available in 4-mm digital tapes (DATs). These drives are considerably more expensive than QIC-2000 drives, but a 4-mm tape can store as much as two gigabytes of data on a single cartridge. This larger capacity puts it beyond the practical need of most single-computer users, but it's a viable format for huge files, networks, and industrial applications.

Another type of drive is the helical-scan unit. A helical-scan drive uses either a 4- or an 8-mm tape for a capacity of up to five gigabytes per cartridge. The helical-scan system records information at an angle, utilizing a rotating head much like a VCR's; this allows more information to be accurately placed on a length of tape than a standard QIC format.

The Hardware

Let's take a look at a selection of

Things to Watch Out For

Most drive manufacturers label their drive's capacity in the most favorable light. A 120MB drive is actually a 40MB drive that can use a 60MB extended-length tape which has the capability to hold 120MB with optimum data compression.

Most backup software will give you an estimate of backup time and space. While drive manufacturers give you a best-case estimate, the software will give you a worst-case estimate for time and compression (it will generally take less time and space than the software tells you).

Try to find out what the best hardware-to-software matches are before you purchase either. A great drive may not be recognized (even if installed correctly) by the backup software you're considering. When in doubt, call the manufacturer. The software maker will know more about the hardware than the hardware maker will know about the software.

Try to find a drive with more than enough capacity to back up your entire hard disk. A 120MB tape drive may or may not be able to back up your 120MB drive on a single tape.

Find a tape drive that uses a widely accepted data format (such as the QIC-40, QIC-80, or Irwin format).

If you're using your tape drive to shuttle information between two computers, use a format that can be read by different hardware and software products, like the QIC-40 or QIC-80 format. Also, make sure your software is set to record in this format, not in its own format.

Remember that a tape backup file, even if it contains your whole hard disk and all of its component directories, is only a stream of data and not a collection of individual files. Therefore, you can't access part of a backup file or a single directory in your hard disk backup. Since the tape records only the bits stored on your hard disk in one long stream, it doesn't know the difference between a directory name and an INI file. It's up to your backup software to interpret the tape's data stream into a coherent directory structure.

If you want your backups in discrete units, you have to organize your backup files yourself. Try making one backup of all your graphic-related directories, another with your word processor directories, and yet another with your database directories. This way, you can access related groups of files (or directories) on your tape cassette. Backing up in smaller, directory-based units will also speed your backup time. By breaking your backups into smaller units, you won't affect your overall directory structure in any way; backup programs take great pains to make sure that when you restore your hard disk, the proper directories are in the proper places.

Many backup programs have a hard time dealing with screen savers. Turn off your screen saver before backing up.

A tape drive system is not like just another drive. You can't access it from the C prompt, and most software must be trained to search out a tape device the first time the device is installed. It's a special-function unit with very limited uses.

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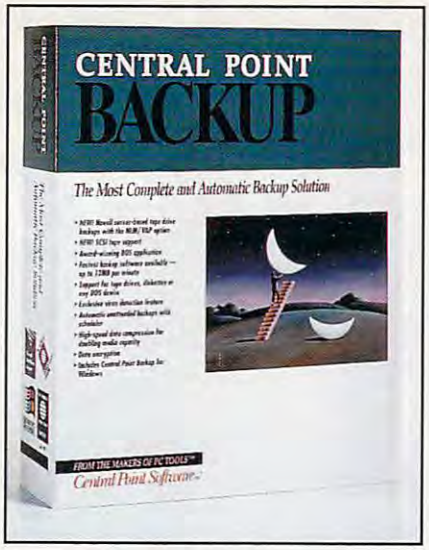
the hardware products you can use for backup.

Jumbo 120 and Jumbo 250. One of the least expensive drives, Colorado Memory Systems' Jumbo 120 is a strong contender for the best value. A drive unit can be fairly simple, and the Jumbo 120 is a no-frills unit. Fortunately, you really don't need the frills, and the Jumbo drive (also available in a 250-megabyte size) does its job very well.

The Jumbo 120 is a QIC-40 drive, while the Jumbo 250 uses the QIC-80 format. The drive installs into a spare full-size drive bay and comes with a cable allowing you to piggyback it onto your floppy controller card (be sure to ground the unit according to the instructions). The drive works well even if you already have two floppy drives (in addition to your hard drive)



Central Point Backup

connected to the card. While the Jumbo will work well with nearly all floppy controllers, the manufacturer warns that there may be some compatibility problems, and an extensive compatibility chart is included. (The Jumbo 120 will work on XTs and ATs, while the Jumbo 250 requires an AT-compatible computer.)

The Jumbo comes with its own software package, but like most manufacturer-supplied software, it leaves something to be desired. However, the Jumbo drive works effortlessly with most third-party backup software.

Accutrak A250 and EzPort A250 EP. The Irwin Accutrak drive is similar to the Jumbo 250, except that Irwin drives use Irwin's own tapes and backup format (the serpentine format, with either 20 or 32 tracks on the tape). The internal drive installs easily

Installing an Internal Tape Drive

Installing any peripheral in your computer requires equal amounts of caution and confidence. The computer is a very sensitive device, and it must be handled with care. The power supply inside the computer is also capable of delivering dangerous jolts of electricity. But armed with common sense, you'll find an installation project can be quick, easy, fun, and even a learning experience.

The first course of attack is to study your installation manuals thoroughly before you open the computer case.

Generally, when installing a tape drive, you'll install a controller card first (if the system has one). If the system doesn't come with its own controller, it will probably use your floppy drive controller. Then, you'll install the tape drive. Dog-ear the page in your controller manual where it discusses the default settings for the card (such things as address, interrupt request, and DMA channel—all information telling your computer where to find and how to access your tape drive). In about 70 percent of the cases, the default settings are fine; but if you have a second hard drive or a modem or any of a multitude of other peripherals installed in your computer, you may have an address conflict.

Before you approach installation, be sure to unplug your computer's power and the power of any peripherals. Open up your computer case. If you have never opened it up before, refer to your computer's general manual to see how the case cover comes off. Some cases are hinged, but most are opened by removing screws in the back panel and pulling the case toward the front of the machine.

Follow the controller card instructions carefully, and try to place the controller in a slot with some space around it. You're going to have a big ribbon cable coming off the card, and you want the airflow to be as free as possible. Note that some cards require a power connection while others do not. (Hint: Read ahead, and connect the ribbon cable before you fit the card into the slot—there isn't going to be much room for your fingers once the card is installed. Generally, cable connectors on the card are marked with a 1 or some other mark and cables are marked with a red wire. The red wire goes on the end marked with a 1.)

After the card is in place, next comes the drive. Locate a suitable drive bay and check out what type of installation you'll need: plastic slide bars or a metal chassis. Generally, the manufacturer will supply what you need for either type of installation. Slide the drive in, and see if the screw holes align as they should. Make sure the drive isn't disrupting other components in your system.

Pull the drive out, and try to pull the ribbon cable and power cord through the bay. It's much easier to make the connections in the light of day than to fiddle around in the dark corners of your computer, trying to get the pins to match up properly. After you make the connections, slide the drive back in and secure it according to the manufacturer's instructions.

For the moment, leave your computer uncovered and power it back up. Follow the software instructions, then test out the drive. If you leave the computer open, it will be easier to change the addressing options if the software can't find your tape drive or if the installation program tells you that there's a conflict.

If there is an addressing problem, it can manifest itself in several ways. Sometimes, the software will tell you that there's no tape drive connected. Other times, it will tell you that one or another of the addressing options isn't valid.

If either of these things happens, shut off your computer and unplug it, turn back to your controller card instructions, and try out some other combinations. The manufacturer will generally let you know other addressing-option combinations to try. Stick to the manufacturer's combinations; trying to create your own combinations may harm the controller or the tape drive.

Be sure to power down, unplug the system, and touch something metal to discharge any static in your body before putting your hands inside the computer case.

Once your software recognizes the drive, power the system back down and close your computer up. Power back up, and you're ready to go. (See the feature titled "World of Conflict" for more information on address conflicts.)

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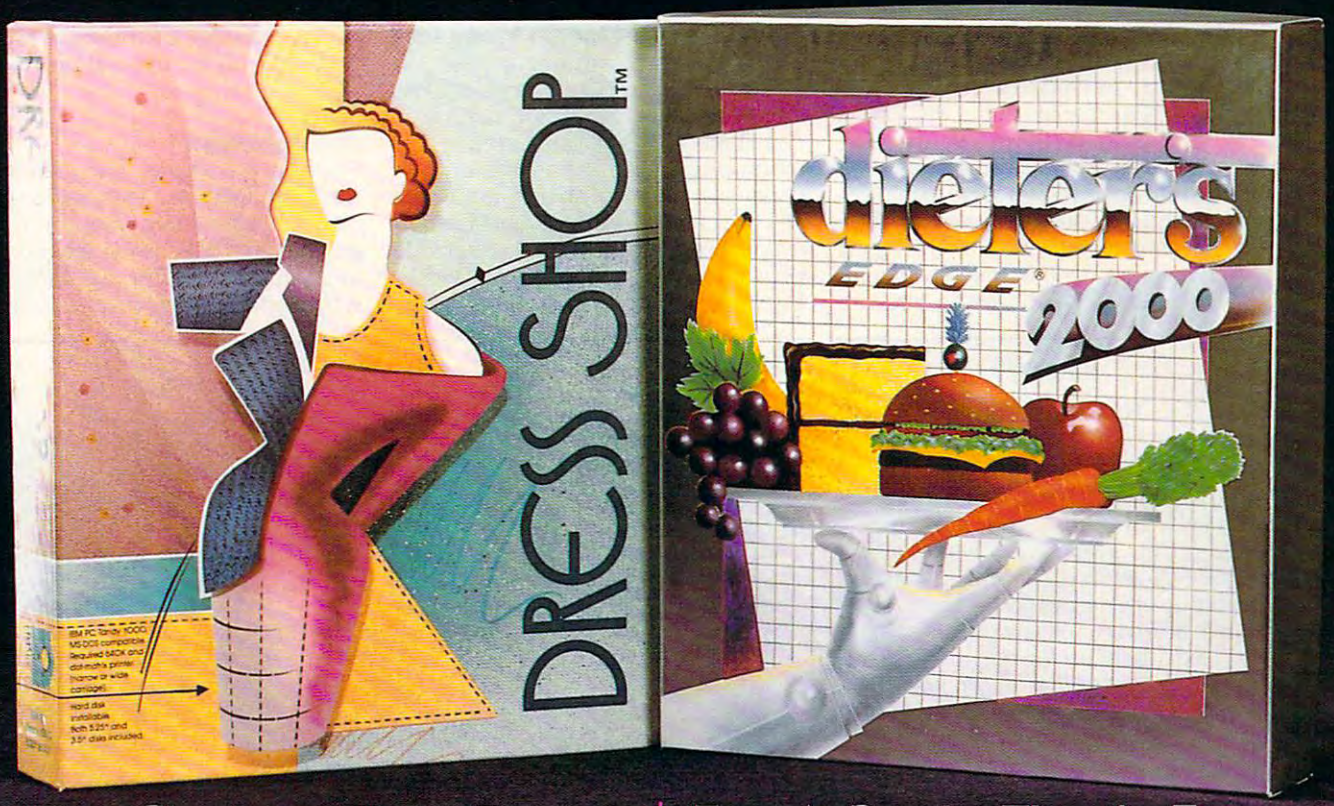
FIT HAPPENS



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and can work with either your floppy controller or a dedicated card (though there's a substantial speed increase with a dedicated controller). Since Irwin uses its own format scheme, you are limited to the manufacturer's supplied software. I was able to get Central Point Backup (see below) to write to the drive using Central Point Backup's own backup format (not QIC), and it worked fine.

Irwin also manufactures the EzPort drive. Basically the same tape unit, this drive is external and uses your computer's parallel port for data exchange (the drive provides an additional printer port as well). This limits you to using Irwin's software exclusively, but the trade-off is ease of installation and a system that is entirely portable (drive and all) from computer to computer. This drive would make a useful addition to a small office with several computers. It's an inexpensive means to support sneaker net on a mass scale.

Tape250 Insider. Iomega has just released its Tape250 Insider tape drive, which fits into the smaller 3½-inch drive bay in your computer. This is a great plus, since not much else can fit there. The drive is rated at 250 megabytes, and it has the unique capability of being able to read both QIC (40 and 80) and Irwin tape formats. The Insider can be connected to your floppy controller, but it works best with Iomega's one-megabit-per-second card, which installs into a spare slot in your computer.

I noticed that the drive didn't seem as sturdy as the others I've mentioned, and it wobbled when I inserted a tape (even though the chassis was securely mounted), but the unit performed properly despite this minor design problem.

The Iomega drive comes bundled with Central Point Backup for both DOS and Windows.

The Software

While tape drives generally come bundled with their own manufacturer-specific software, dedicated third-party backup applications can be a productive investment. While not all software works with all tape drives (it's a good

Recovery from a Hard Disk Failure

Sooner or later, your hard disk will fail. So be sure to have a floppy boot disk available at all times. If your whole hard disk goes, getting your machine up and running will take some time, so be patient.

First, boot up the computer, take a deep breath, get out those DOS disks, and reinstall DOS (and Windows, if you have to) on the hard drive. If you can't boot from the hard disk, boot from a floppy (you *do* keep a bootable floppy on hand at all times, don't you?) and attempt to log to the hard disk. Once you get to the hard disk, check to see what files are still available. If nothing seems to be available, thank your lucky stars that you kept regular backups and proceed to reformat the hard drive. If you can't log to the hard disk, you should try to reformat it. When the hard disk is formatted, install DOS. Then, install a utility program and check out the disk.

When you are satisfied that your hard disk is operating properly and your operating system is installed, it's time to install your backup software, run the software, and restore the last full backup of your disk. Then, restore the latest data backups, and you should be up and running as if nothing had ever happened. Nightmare averted!

Remember to be patient, to be prepared, and to take the inevitable with a sense of humor. You'll wow them at your next office party as you tell the tale of how you rescued your data from the edge of the void.

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idea to find out if your drive and the software you're interested in are compatible before you buy either; call customer service if you have any questions—that's what it's there for), most packages are flexible enough to allow a wide range of options.

Generally, backup software allows you to do four things:

- Back up your files on demand
- Back up your files at a specified time (whether you're there or not)
- Restore your files
- Compare files on your hard disk against files already backed up

When you're backing up files, you can choose to back up either the entire hard disk or only certain files or directories (generally those files and directories that change most often). These selections can be saved to a file so that each user can have his or her own set of preselected files, even from the same computer system.

Colorado Memory Systems' Jumbo 120 internal tape drive

The software will also allow you to compress your files to save space on the tape cartridge, disk, or other storage medium. Most programs also have tape-specific functions available, such as formatting and erasing a tape, as well as displaying a directory of what has been previously backed up on any tape cartridge.

Fastback Plus. Fastback Plus is a very fast, very intuitive backup package (note that, as of this writing, only the DOS version of Fastback Plus supports QIC tape drives). Selecting specific files and saving those selections to disk is simple.

Though the program backs up very quickly, the manufacturer warns that there may be problems when making high-speed backups from a fast 386 or 486 machine. Fifth Generation Systems recommends that you compare your backup data each time to make sure that it's safe.

One powerful feature of Fastback Plus is the ability to create macros to automate and customize your backup operations. Macros can be created by recording all of the steps needed to perform any particular operation. The macro files are ASCII files that can be edited with the included text editor. Fastback Plus includes a complete guide to its macro command language in the user's manual.

Another very useful feature of Fastback Plus is its ability to create a snapshot of your hard disk's files. A snapshot doesn't record the actual data, but only the directory and file structure of your disk. You can use the snapshot function to take a picture of your disk at an optimum state (with no help files, for example). Then, when you need to restore your data, you can use the snapshot to filter the restoration to your own preferences.

Central Point Backup. Combining an intuitive interface with all the options you'll ever need, customizable support for nearly all types of backup devices, and a very fast backup rate, Central Point Backup is a stand-alone version of the hard disk backup program found in Central Point Software's PC Tools utilities package.

When you first load Central Point Backup, it will ask if you want to configure your system. It will automatically find floppy drives, removable hard drives, and some tape drives. Other tape drive systems have to be manually configured, and Central Point Backup has a very good search function that will locate most drives. If you have to manually configure a drive, you must supply the address, IRQ, and DMA

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channel.

Selecting specific files to back up is easy with Central Point Backup. You have a visual display of your hard disk tree, and you can select or deselect files or entire directories or paths. If you save the file selection, the next time you load that setup, Central Point Backup will scan the hard drive for any additional file changes and append those to your list of files to back up.

Central Point Backup also allows you to print out the file structure of your hard disk and provides password protection and virus scanning.

The Norton Backup. The Norton Backup supports tape drives and performs nearly as well as Central Point Backup. However, it only supports tape drives connected through your floppy drive controller and doesn't recognize drives with their own controller cards.

The Norton Backup, like Central Point Backup, provides several user levels. At the advanced level, the user can select various data compression schemes, cancel overwrite warnings, and provide password protection. The Norton manual is the best I've seen, giving good advice and providing a separate pamphlet on recovering from hard disk failure, including a section on how to get up and running using Norton's Emergency Restore program.

Irwin EzPort external tape drive

Backing Up Right

Don't do full backups too often unless you're running a network whose configuration changes from day to day. When you do a full backup, break it into two parts: applications and data. This strategy not only saves time, but if you have to restore your hard disk, then you'll be optimizing it as well (be sure to restore the applications first). If you change, upgrade, or add applications, consider doing another full backup.

Analyze your own working environment to determine the best backup strategy (suggestions abound in the manuals, but it's more effective to tailor a backup program to your own needs). What programs do you use most often? Do you work with many files or a single file during the day? Try to organize your hot working projects into directories that you can back up as a unit.

If your computer runs constantly, set up a scheduled backup for the evening, when you're gone. Be sure to turn off your screen saver (it won't matter if you also turn off your monitor when you leave at night).

Test out a scheduled backup before you rely on it. The scheduling program is a memory-resident program that might interfere with other programs on your system.

For normal uses, a complete backup every month or so, with a daily backup of all your latest files, will be all the protection you'll ever need. This is the first line of defense against both disk crashes and viruses.

Hard Drives, Easy Choices

Hard disks are taken for granted on today's PC systems. It's difficult to imagine what life was like when there was just a box full of floppies for all of your software and data. But like all things taken for granted too long, a hard disk can and will fail (Murphy's Law stacks the deck against you). Most of the time, the failure doesn't mean the end of your hard disk's life—just the end of any important data you've neglected to back up.

Backing up offers the safeguard of redundancy to protect the time, money, and effort you've invested in your data. You can back up to floppy disks manually using the DOS Backup command, but with the size of today's hard drives, a quarter-inch tape system is a better alternative. The price is reasonable, the media are readily available and standardized, and the software is on the shelves.

If you have a really large hard disk, Tandberg Data (805-495-8384) and Sankyo Seiki have developed a 2 GB QIC technology. The least expensive Tandberg unit, the Panther 2000, costs $3,495. It can back up data at a rate of 300K per second, or 2.4 Mb per second.

Soon, Bernoulli drives and magneto-optical drives (and perhaps other formats yet to be imagined) may be the alternatives of choice, but for now, the price for these options is still too high to justify their use as backup systems for a personal computer's hard drive.

Only you know how valuable your data is. But if you need protection, a tape drive unit is the way to go. ❑

Hardware and Software

Irwin Accutrak A250 (internal)
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Irwin EzPort A250EP (external)
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Archive
Maynard Electronics Division
36 Skyline Dr.
Lake Mary, FL 32746
(407) 263-3500

Central Point Backup
$129 (Windows or DOS)
Central Point Software
15220 NW Greenbrier Pkwy., #200
Beaverton, OR 97006
(800) 445-4208
(503) 690-8088

Jumbo 120MB Tape Backup System (internal)
$250
Jumbo 250MB Tape Backup System (external)
$350
Colorado Memory Systems
800 S. Taft Ave.
Loveland, CO 80537
(800) 346-9881
(303) 669-8000

Fastback Plus
$189 (Windows or DOS)
Fifth Generation Systems
10049 N. Reiger Rd.
Baton Rouge, LA 70809
(800) 873-4384
(504) 291-7221

Tape250 Insider (internal)
$299
Insider 90 Pro (internal Bernoulli drive)
$799
Iomega
1821 W 4000 S
Roy, UT 84067
(800) 925-3657
(801) 778-1000

The Norton Backup
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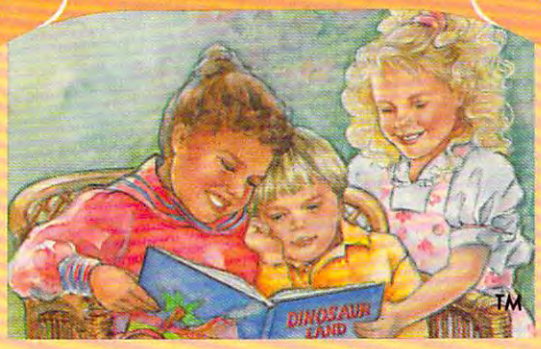

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PERSONAL PRODUCTIVITY

Philip Chien

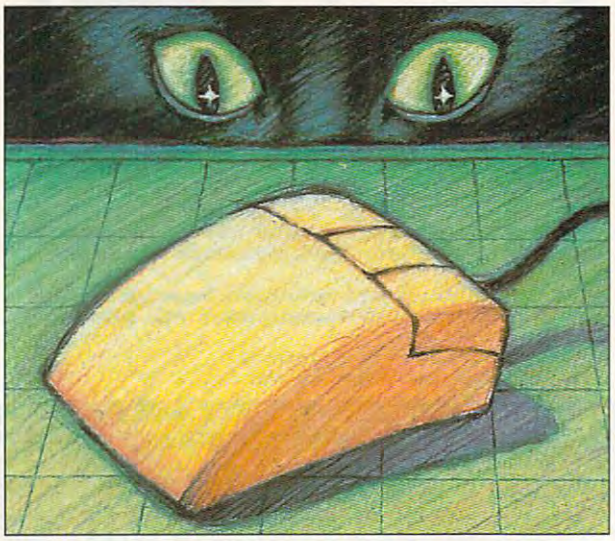
MOUSE EVOLUTION

In this day of WYSIWYG word processors and GUIs, pointing devices are considered requirements instead of options. With all of the different pointing devices available, there's plenty of confusion.

The key difference among pointing devices is how movements are measured. Absolute devices like digitizing tablets have a 1 : 1 correspondence between the pointer's location and the position on the screen. While these devices are excellent for sketching, they require large hand movements for most operations. Most pointing devices use relative motion. When the device is moved, the cursor moves a proportional distance on your screen. Accelerated-movement pointing devices require less hand motion to operate.

As a rule, pointing devices connect to a serial port (serial mouse) or to a special controller card (bus mouse). The primary advantage of a bus mouse is that it doesn't take up one of your serial ports, while a serial mouse costs less because it doesn't need an additional card.

A properly installed pointing device, with software designed to use it to the limit of its capabilities, will enhance any computer.



Here are three typical pointing-device upgrades. One of them might be right for you.

Installing a serial mouse. It's extremely simple to install a serial mouse. Just plug it into a spare serial port. Serial mice use standard DB-9 serial connectors. Most will include an adapter for computers with 25-pin serial connectors.

Your device should come with a software driver. The driver should be compatible with Microsoft or Mouse Systems drivers. Follow the directions to install the MOUSE.COM or MOUSE.SYS driver, configure your programs to tell them to use your mouse as an input device, and you're ready to go.

Upgrading a serial mouse to a bus mouse. For many users, the two standard serial ports will be occupied by a mouse and a modem. But what happens if you need to install an additional serial device? It's possible to add more than two serial ports to a computer, but another solution is to convert from a serial to a bus mouse.

Bus mice have slightly better software support than serial mice and are slightly more efficient. A serial-to-bus converter consists of a half-slot controller card with a DB-9 connector. Your pointing device is plugged into the card, which converts the device's signals so they look like those of a bus mouse. Any serial pointing device that looks like a mouse (for example, a trackball) can be attached.

The important things to remember when converting a serial device into a bus device are that you must upgrade your driver to the bus driver supplied with the card and that your programs must be reconfigured to indicate that you're using a bus mouse.

Upgrading to a more sophisticated pointing device. Your computer may have come with an inexpensive mouse. While that mouse may be adequate for simple tasks, you might want a better pointer for fine-resolution desktops, CAD, or drawing applications. If you're using a new pointer with the same physical connector (for example, if you're replacing a serial mouse with another serial device), then you may be tempted just to leave the software drivers alone, particularly if everything appears to be working properly.

This solution works because most pointing devices emulate the Microsoft Mouse, and a new device usually will work with your existing drivers. However, if you don't update your drivers, your software won't recognize the device's special enhancements.

To use your pointing device to its full potential, install the drivers that came with your new device and reconfigure any program that lists your device among its choices. If you have a program that doesn't specifically support your pointing device, it's appropriate to select a generic mouse or pointing device.

One of the simplest upgrades is just to make sure you're using the latest Microsoft driver for your standard mouse. Microsoft drivers come with most Microsoft products. If your mouse does more than the standard Microsoft mouse, check periodically with your manufacturer for upgrades. Most manufacturers operate bulletin boards where these drivers can be downloaded free of charge.

A properly installed pointing device, with software designed to use it to the limit of its capabilities, is an excellent enhancement for any computer. Try out a few pointing devices before deciding which one to use. The variety of options assures that one will be perfect for your work. ❐

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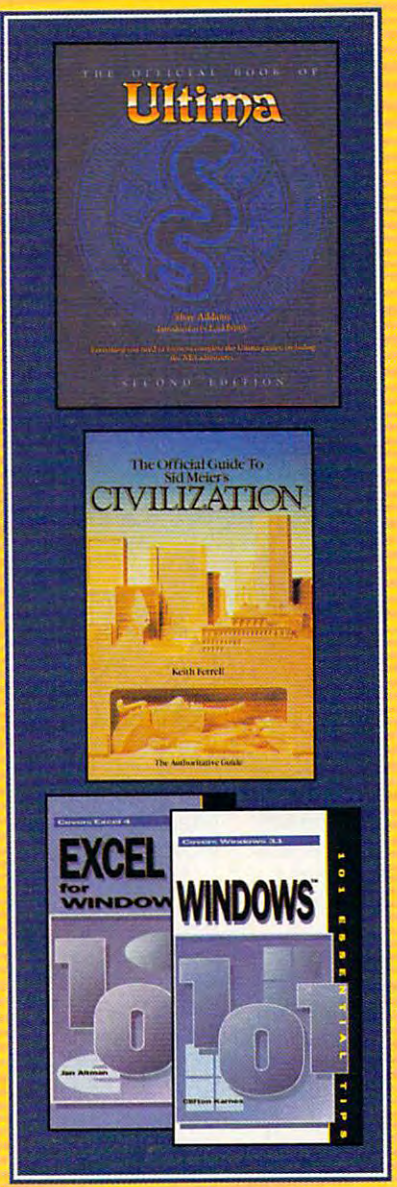

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PRODUCTIVITY CHOICE

This powerful database heats up the Windows market.

Richard Rapp

APPROACH FOR WINDOWS 2.0

Love it or hate it, no one can deny Windows' overwhelming success in both the home and business markets. Applications like Excel and Ami Pro offer enough power and flexibility to handle almost any job that comes along. But despite its excellent applications, Windows has been woefully deficient when it comes to database management systems. Until recently, that is.

Approach for Windows has changed the picture. Its initial version offered plenty of features and an easy upgrade path from existing database packages. Now, in version 2.0, it provides the speed and power necessary to make it a leader in the Windows database market.

One of Approach's main strengths has always been its excellent compatibility with existing products. Third-party products enable it to access DB2 databases, and it can also import and export data from both Lotus 1-2-3 and Microsoft Excel.

For network users, Approach supports most major networking systems. Best of all, there are no LAN packs to buy and no special setup is required. System security features have also been upgraded in version 2.0, offering a variety of record-locking and password-protection options.

Approach's designers have updated its interface with Windows 3.1 in mind. It now uses the most current versions of Windows' common dialog boxes to maintain consistency of look and feel with other Windows 3.1 applications. It also sports new thermometer gauges to show the progress of sort and find operations, and it has a preview-mode button to allow the user to access this frequently used option with a single mouse click.

Approach offers the user many options for manipulating data and uses the Windows environment to good advantage with its PicturePlus fields. These fields enable it to handle some data types not supported by standard databases. Validation options allow the user to enter data automatically in some cases or to ensure that it meets specified criteria. Approach also supports check boxes, radio buttons, and several styles of pick lists to help ensure fast, consistent data entry.

PicturePlus fields have been greatly enhanced since Approach's original release, and they offer some interesting possibilities. Using Windows' OLE capabilities, they allow the user to store objects created in other applications in Approach databases. Such objects could be graphs, charts, pictures, or even sounds. The objects maintain a link with the applications in which they were created, so with a simple mouse click, that application can be called up and the object edited. For graphical objects, Approach supports most of the popular formats, including BMP, EPS, PCX, and TIFF.

Approach's paper metaphor makes designing forms and reports a snap. Graphical objects represent fields, headings, subtotals, and the like, and the user simply drags them into place with the mouse. Optional rulers and a user-definable grid help keep everything aligned properly. Pages can include headers, footers and multiple fonts, and you can specify automatic insertion of the time, date, and page number. Files can include up to 50 forms, reports, and mailing-label definitions, a hefty increase over the previous limit of 16 definitions per file. Approach can also perform mail merges.

The program makes short work of producing mailing labels. If you use Avery-brand labels, you simply choose the appropriate part number from a pick list, and Approach formats the labels au-

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tomatically. No hassle, no bother, no wasted time. Approach can handle about 50 different styles of labels, so even if you're using a different brand, you can probably find one that works. If not, you can still easily create custom formats.

At the heart of this program, though, lies a powerful relational database. Approach allows up to ten databases to be joined at a time, in any combination of file formats. It also presents a graphical depiction of the relationship among joined databases, so you can confirm that you performed the operation correctly. You can create one-to-one, one-to-many, and many-to-one relations with a few mouse clicks, and Approach handles much of the formatting of information from the child records automatically. In network environments, you can choose between pessimistic record locking, in which only one user at a time may access a particular record, or optimistic record locking, in which Approach allows simultaneous access but keeps users informed as changes are made.

Approach uses a form of query by example to specify search criteria. It displays a blank version of your regular data-entry form, and you simply type the search criteria into the appropriate fields. The criteria may contain wildcards or specify a range of values, and searches can be case sensitive or not. A new wrinkle in Approach's search capabilities is its ability to perform "sounds like" searches. This feature enables Approach to find records that are phonetically similar to the search criteria, so that finding oddly spelled last names, for example, is no longer a hassle.

Though Approach doesn't support a full-fledged programming language, such as one of the various *x*BASE dialects, it does have a very complete macro language for automating common tasks. Creating macros can be as simple as clicking your way through a couple of dialog boxes, and you can attach macros to on-screen buttons. Features added in version 2.0 allow you to assign macros to function keys, chain macros to unlimited depth, and create special macros that execute when a file is opened or closed. Approach also now supports variable fields, which act just like global variables in a regular programming language.

The designers have done an excellent job of improving the program's speed in several areas. Claimed improvements include the ability to sort 10 times faster than version 1.0 and save files 100 times faster. It also is said to be 100-percent faster in importing and exporting data. While an in-depth evaluation of these claims is beyond the scope of this review, my impression is that the speed improvements are substantial, though Approach itself still takes far too long to load. PicturePlus fields represent an improvement in its support for Windows' OLE capabilities, and system security is greatly enhanced by its support for read-only fields and many password options.

Still, despite these improvements, Approach has its share of faults. It supports only one level of undo, the unfortunate standard among Windows apps, and its icons' functions are not always obvious.

Plan to spend some time thumbing through the well-written manuals familiarizing yourself with them.

Upgrading from version 1.0 is easy. Approach can install itself over the older version, leaving all user files intact. When opening view files or using indexes created under version 1.0, Approach gives you the option of updating them so they can take advantage of the new features. Once they're updated, though, they won't be readable by version 1.0, so make a backup if you plan to run both versions.

With the recent release of several products and the promise of more to come, the Windows database market is heating up. But if you need a powerful relational database right now, Approach for Windows 2.0 has no equal. ❐

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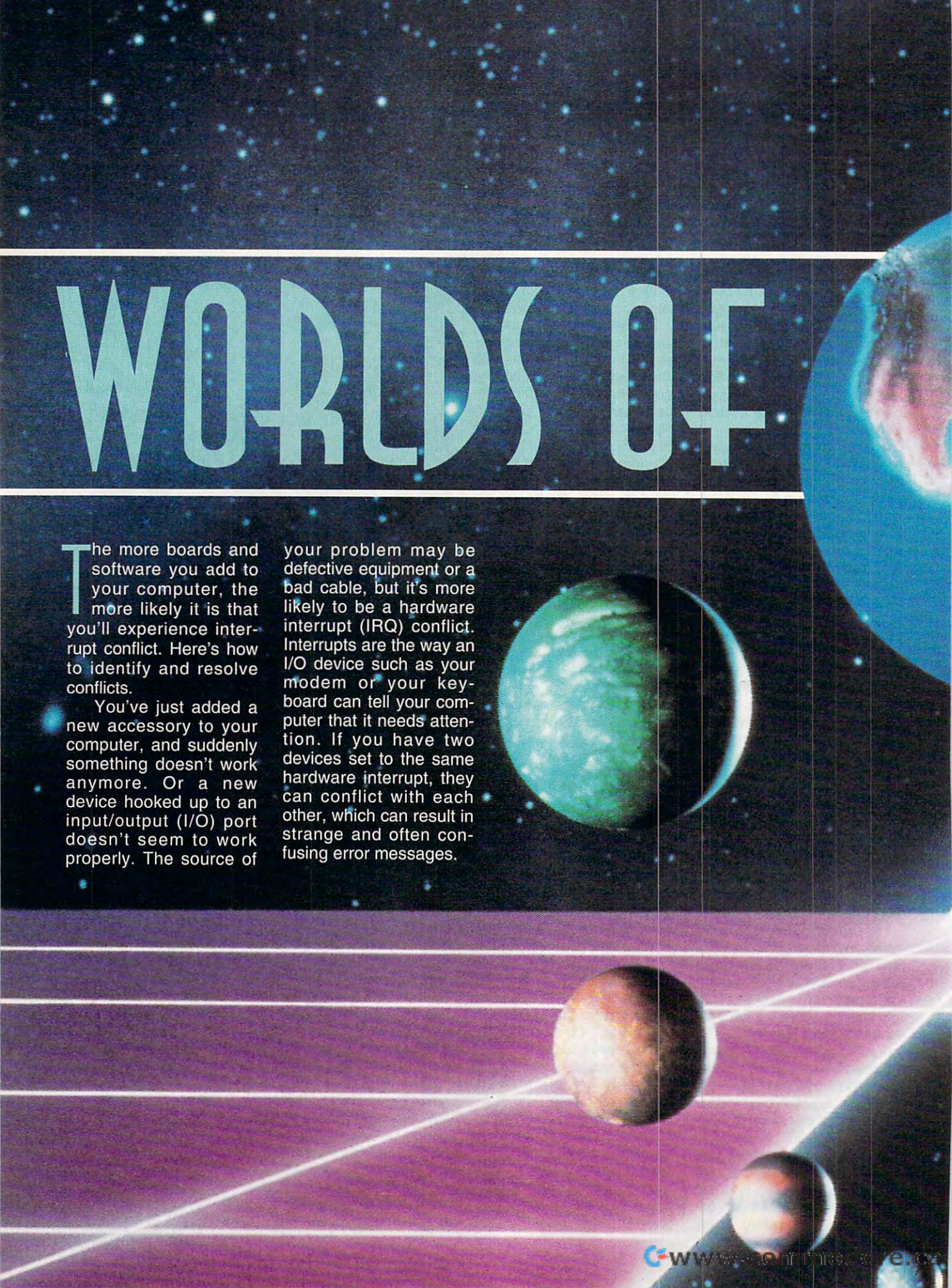

The more boards and software you add to your computer, the more likely it is that you'll experience interrupt conflict. Here's how to identify and resolve conflicts.

You've just added a new accessory to your computer, and suddenly something doesn't work anymore. Or a new device hooked up to an input/output (I/O) port doesn't seem to work properly. The source of your problem may be defective equipment or a bad cable, but it's more likely to be a hardware interrupt (IRQ) conflict. Interrupts are the way an I/O device such as your modem or your keyboard can tell your computer that it needs attention. If you have two devices set to the same hardware interrupt, they can conflict with each other, which can result in strange and often confusing error messages.

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CONFLICT

What's especially mystifying is that it's possible for an interrupt problem not to show up for a while. You can be using your computer for a long time without any problems, and then suddenly something strange happens, possibly because you're using a new program or an old program you haven't used for a while or because you've upgraded an existing program to a new version that uses interrupt-driven drivers.

The Polite Interrupt

While interrupts may be confusing, they're extremely useful tools for your computer, especially when it's communicating with the outside world. For example, a send/receive fax/modem generates an interrupt when its phone line rings. Your computer's processor recognizes the interrupt, temporarily stops the program it's running, runs the fax subpro-

BY PHILIP CHIEN

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Table 1: Standard Interrupts

IRQs marked with the word reserved are not used for standard I/O devices and can be assigned to user.

XT-class

IRQ	Purpose	IRQ	Purpose
0	timer	5	hard disk controller
1	keyboard		
2	reserved	6	floppy drive controller
3	COM2 serial port		
4	COM1 serial port	7	LPT1 parallel port

AT-class computers (including ATs and higher-performance

IRQ	Purpose	IRQ	Purpose
0	timer	8	realtime clock
1	keyboard	9	redirected IRQ2
2	slaved to IRQ9	10	reserved
3	COM2 serial port	11	reserved
4	COM1 serial port	12	reserved
5	LPT2 parallel port	13	coprocessor
6	floppy drive controller	14	hard drive controller
7	LPT1 parallel port	15	reserved

gram to receive the fax message, and then continues the main program from where it was temporarily stopped. The entire process takes less time than it takes to read about it, and normally you won't notice any reduced performance in your program.

On the other hand, if your fax/modem's interrupt is incorrectly set, the modem may not be able to recognize incoming faxes unless you're running a fax program that doesn't require interrupts (for example, a menu-driven program that constantly monitors the phone line to detect incoming calls). The first time you notice that the card is incorrectly configured may be when you upgrade to a new operating system—or when you get calls from customers wondering why your fax machine isn't working.

Besides interrupts, most hardware devices have their own assigned I/O ports: memory locations assigned to transfer data between the computer and hardware device. Some cards have DMA (Direct Memory Access) channels with the ability to read and write to your computer's memory directly. As with IRQs, you should make sure you don't have more than one card set up to use the same location.

Hard Versus Soft

Another confusing factor is that there are several different types of interrupts. Programs can generate their own software interrupts, and they often use interrupts to call operating system routines.

TSRs (Terminate and Stay Resident programs) are examples of routines that use both hardware and software interrupts. Hitting the proper combination of keys causes a hardware keyboard interrupt. The TSR software uses a software interrupt to temporarily stop your current program and allocate memory space for the TSR routine until it's completed.

An Isolationist Policy

The simplest way to solve hardware interrupt problems is to avoid them in the

"I'm afraid Mr. Ludlow, what you have is a terminal illness."

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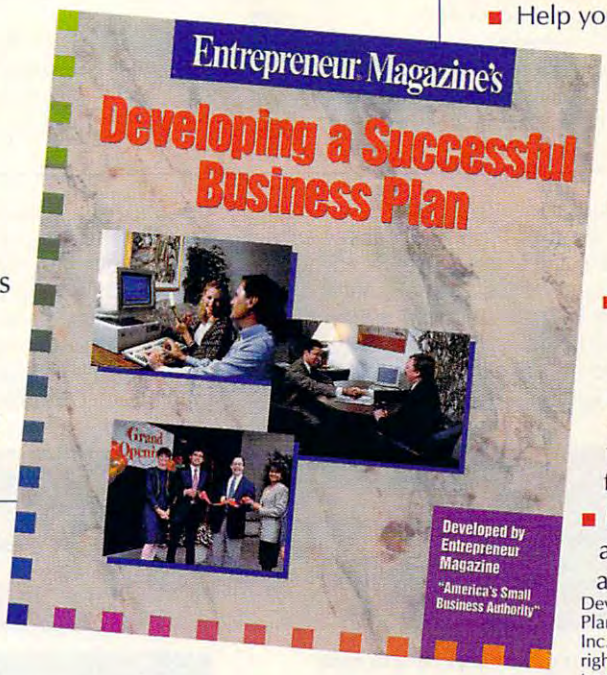

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Table 2: Typical Hardware IRQs in an AT-Class Machine

IRQ Status				
IRQ	Address	Description	Detected	Handled By
0	1C67:00AA	timer click	yes	system area
1	1C67:0124	keyboard	yes	system area
2	F000:FF53	second 8259A	yes	BIOS
3	1C67:02A1	COM2, COM4	no	system area
4	1C67:0329	COM1, COM3	yes, as COM1	system area
5	1C67:03B1	LPT2	no	system area
6	1C67:0439	floppy disk	yes	system area
7	0070:0756	LPT1	yes	system area
8	1C67:01A3	realtime clock	yes	system area
9	F000:C0F5	redirected IRQ2	yes	BIOS
10	1C67:04C1	reserved		system area
11	1C67:0549	reserved		system area
12	1C67:05D1	bus mouse	yes	system area
13	F000:C0E6	math coprocessor	yes	BIOS

first place. Whenever you install a new peripheral, write down the device's characteristics and configuration. As a general rule, I include a text file named WHO_AM_I.TXT on each computer I set up, documenting the computer's configuration and each of its peripherals and accessories. I tape a hardcopy of this documentation to the inside of the computer's case for future reference.

When installing a new device that uses an IRQ, you should check to see which IRQs are available. Table 1 shows the standard interrupt assignments for XT-class (8088) and AT-class (286, 386, and 486, machines. The device probably has a set of switches or jumpers to select different IRQs. You may also need to configure the device's software drivers to tell it which interrupt you've selected.

But what should you do if you unexpectedly encounter a hardware interrupt problem?

The first rule to remember is that interrupts have different priorities, with lower-numbered interrupts getting higher priorities. For example, if the keyboard (IRQ1) and primary printer (IRQ7) generate simultaneous interrupts, the keyboard gets priority. After it completes its routine, the printer interrupt can be processed. The second major point of confusion is the IRQ2 on an AT-class machine. There is no IRQ2 on an AT-class machine. Anything assigned to IRQ2 is automatically switched to IRQ9.

Internal modem and fax/modem cards are generally designed to emulate

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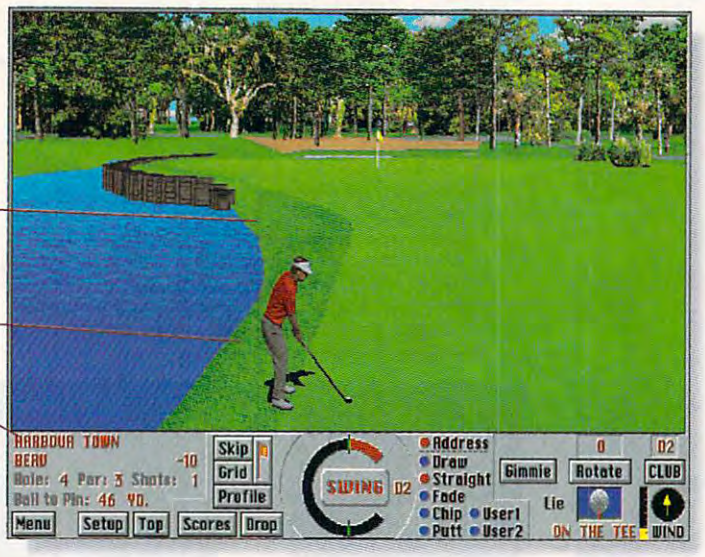

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a standard serial port attached to a modem. Since they look like serial ports to your computer, they're configured as COM ports. You should remember that they must be assigned to an unused port within your system. Higher-quality internal modem cards can be configured as COM3 or COM4 to avoid conflicting with the standard COM1 and COM2 ports which may already be installed in your computer.

If you suspect an IRQ conflict, you should run a diagnostic program that displays each of the hardware interrupts and its status (table 2). If the diagnostic program crashes (stops working and refuses to accept any keyboard input), then it's likely that you have two devices set to the same IRQ.

The most obvious source of your IRQ conflict is the most recent change you've made to your computer (that is, a new hardware peripheral, a new device hooked up to your computer, a new program or driver, and so on). This may be misleading, though. I had accidentally configured my mouse and COM1 serial port to the same IRQ. Both the mouse and a modem hooked up to the COM1 serial port worked normally until I disconnected the modem and hooked up a scanner to the COM1 port. My scanner's software package indicated that it couldn't find the scanner attached to the serial port (a message that was particularly irritating, since the scanner was sitting right there on the desk next to the computer).

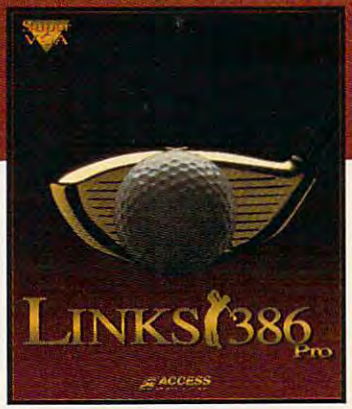
The solution didn't seem obvious until I checked the switch settings for the IRQs for the COM1 port and mouse and found that they were both set to IRQ4. Since IRQ4 is the standard location for the COM1 port (and also for the COM3 port, with IRQ3 being the standard location for the COM2 and COM4 ports), I reset the mouse card to another IRQ. My mouse card has a set of DIP switches to configure the card's address and IRQ, and fortunately, the card had enough documentation to permit easy reconfigurations. After the switch, the scanner software was able to find the serial port and scanner, and everything worked perfectly.

You may have to open up your computer to examine how its ports are configured. If you've never opened up your computer, you should have an expert help you. A small flashlight can be extremely useful for examining switch settings. In general, any ports built into your computer have their setting jumpers or switches on the motherboard, and peripherals have jumpers on their boards in the expansion bus. In some rare cases, settings are extremely difficult to establish and may require a knife or soldering iron, but almost all peripheral cards use standard switches and jumpers. Some cards include enough documentation printed directly on the board to indicate how the switches or jumpers should be set; others include cryptic labels like J5, and you have to refer to the documentation to determine how to set up the card properly.

Don't Give Up the Chip

Look for interrupt conflicts when you install new peripherals and software and whenever you have a degradation in performance for no obvious reason. Interrupt conflicts are far more common than other sources of computer problems, such as hardware failure or viruses, and are much more easily fixed. ❑

by the game itself.



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"...the ground texturing is dramatically realistic."

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ART WORKS

Robert Bixby

BITS AND PIECES

I appreciate the time and effort of all those who responded to what I now think of as "the ox column" (COMPUTE, October 1992). There are few issues more central to computing than desktop publishing and few issues of greater concern to desktop publishers than censorship. I think I gave a few readers the mistaken impression that I was speaking out in favor of pornography. In fact, the column made the case that pornography is an inevitable outgrowth of the same right to free speech that provides our culture with great literature, that you can't have one without the other, and that it is a small price to pay. There are plenty of places in the world where you can risk your life by publishing either great literature or pornography. I, for one, am proud and grateful to live in one of the few nations where tolerance is the law of the land.

As much as a painting or a sculpture, a book can be a real work of art.

On a completely unrelated matter, I received a letter from a woman in the Bahamas asking for more details regarding my wife's grandfather's book. Long-time readers of this column will recall that my wife and I undertook to typeset and publish a book of memoirs of John Russell Beal, her family patriarch (COMPUTE, May 1992). The letter writer intends to publish a book about the Church of England in the Bahamas and wanted to know what software I used and what book on desktop publishing I would recommend.

I used Ventura Publisher 2.0 to typeset the book. I have a special regard for Ventura over many other products because it leaves the text of your publication in a simple text file that can be edited with any word processor or text editor. Its tags are easily inserted from the word processor, allowing you to do all your chores in the lightning-quick environment of a DOS word processor, usually with a simple search and replace. PageMaker took a giant step forward when it incorporated a simple text editor in the program, but I can do much more with a word processor than with PageMaker's text editor. Sorry, Aldus; I still prefer venerable old Ventura.

Truthfully, though, since I finished work on the book, word processors have taken so many strides that I believe I'll simply use Ami Pro or Word for Windows to do my next major book project. I publish a small literary magazine partly because of a love of literature and partly to have an excuse to use all the desktop publishing hardware and software that comes my way. I pasted up the last two issues using only Word for Windows and ended up with a very short list of complaints. If all you're doing is a book made up primarily of text (really one of the simpler projects you could undertake), a word processor will probably fill all of your needs. Ami Pro even has an image editor that will let you adjust the brightness and contrast of gray-scale images.

The best book on desktop publishing—and on publishing in general—is *The Chicago Manual of Style*. It's the manual we use at COMPUTE and the one I use at home. It contains an exhaustive review of all those troubling questions that never arise unless you remember that your work will be in print for everyone to see. But even more important, it has a chapter on assembling a book, section by section.

There are a handful of excellent books on desktop publishing and design, including Roger C. Parker's best-selling *Looking Good in Print* (Ventana Press).

Another way to make sure you put your book together right is to find a book whose design you admire and emulate it. Most book designers get into the game because they admire the work they've seen on the shelf. As much as a painting or a sculpture, a book can be a real work of art.

Finally, almost as soon as my column on desktop typesetting went to bed (COMPUTE, January 1993), LaserMaster came out with yet another amazing product. Using the brand-new Hewlett-Packard LaserJet 4 as a platform, LaserMaster now produces plain paper typesetting at 1200 dpi. The WinJet 1200 is an add-on for the 600-dpi LaserJet 4 that includes 50 TrueType fonts, a PostScript interpreter, and a superfast video interface. Its price is $995 (plus the cost of the printer). Call (800) 365-4646 for more information. ❐

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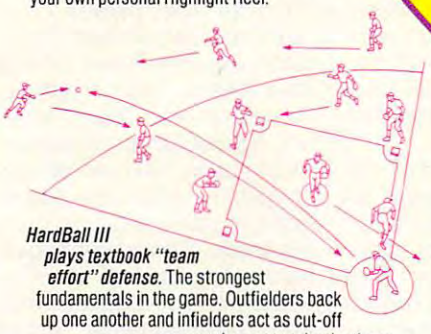

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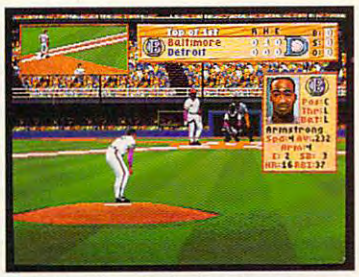

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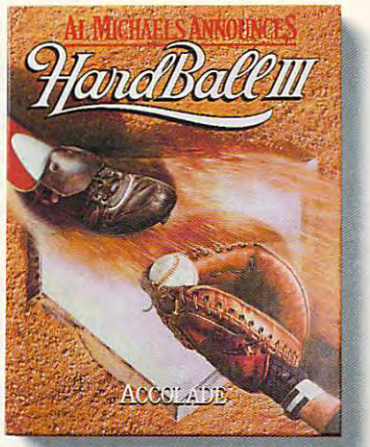

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DISCOVERY CHOICE

Here's the perfect electronic platform for kid-level storytelling.

David Sears

STORYBOOK WEAVER

Unleash your child's creative energies with Storybook Weaver. Thanks to the program's sumptuous graphics, legions of personalities, and suites of sound effects and music, your budding Nobel laureate will be encouraged to create imaginative tales to share with family and friends.

No one could doubt the value of the hands-on creative process; perhaps more significant is the appeal of creating something tangible to show friends, parents, and siblings that declares, "I'm smart," "I'm funny," or "Let me entertain you." Parents love to see children learning to spell as they grapple with language, stimulating their imaginations. MECC has made the experience even more appealing by making it digital, replacing ink and processed pulpwood with your child's new best friend and tutor, your PC.

Young authors have decisions to make right away as they create their title pages. Will they include gingerbread borders or have no borders at all? Using the mouse to point and click through these choices, kids are rewarded with instant pop-up graphics low in resolution but highly colorful.

Next, writers click on empty text blocks to name their stories, type their own names, and comment on their stories if they please. Already, kids have some idea of what direction their work will take—and they haven't even reached page 1 yet! To move forward, authors simply need to click on the page-turning arrows that are located at the bottom of the screen. But before making that step, they'll probably want to add some music—Storybook Weaver will play music at the beginning and the end of a story if the author commands it.

The program automatically adds pages as kids write, up to the program limit of 50. Each page consists of either text and graphics or only text. In the case of text-and-graphics pages, children select everything from the skyline to the foreground; an open block for words waits at the bottom of the page, ready for input at any time.

To select a background, kids just click on the appropriate image in the tool palette, in this case, Scenery. A new row of thumbnail pictures appears below the composition space; selections range from meadows to mountains, forests to ravines. Storybook Weaver even provides lighting effects: dusk, dawn, day, and night. If nothing seems appropriate for the story in mind, your child can choose from a range of colors to provide the desired background.

With a set stage, the plot can really begin to thicken. From the tool palette once more, aspiring scribes simply click wherever their hearts take them, from mythical beasts to everyday people and objects. Under the auspices of nature, kids will discover lightning bolts and beaver dams, blazing fires and gusting winds. Clover, cabbages, fields of corn, fruit trees—a whole world of special effects and environmental props stands ready to help tell a new story.

A search through the real-world people brings kids face to face with a cross-cultural melting pot: Asians, Native Americans, Nordic men in Alpine dress—all performing various activities such as climbing, walking, and sleeping. Boys and girls fill the ranks too; kids will have plenty of virtual friends to identify with here.

Where shall all these people live? How about a sinister castle or a gingerbread house? Maybe Baba Yaga would enjoy the move from a dancing hut on chicken legs to an ornate pagoda. Would that lighten her mood? Possi-

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bly, and if that thought occurs to your child, then Storybook Weaver does more than just act as palette; it interacts, provoking thought.

What's more, Storybook Weaver introduces children to Russian folklore and Native American mythology, among other, often previously unexplored, realms. And the fantastic creatures that MECC threw into the mix here will set young minds racing and perhaps a few future copy editors or history professors running to the encyclopedias to do some research.

Storybook Weaver allows as many as 50 objects on a single page—more than enough to obscure even the most lavish backgrounds. Giants, already towering over normal men, meet their match in babies that grow a dozen times over. Authors can manipulate object characteristics with ease from the tool palette. They need only click on an object to select it and then choose from shrink

Stories come to life onscreen.

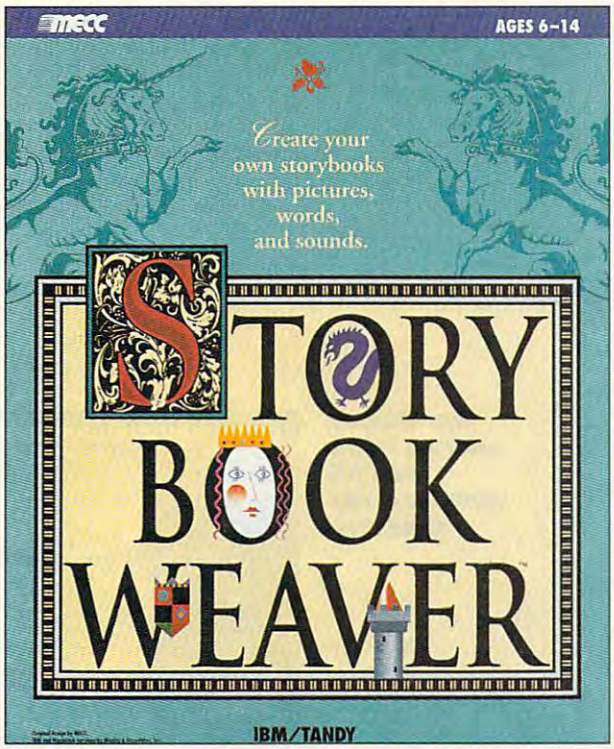
and expand options, flip (to flip the object horizontally), color (to change skin or clothing hues), and sounds (to add sound effects). Sound effects range from clangs to whistles, car horns and screeching tires to bird calls and footsteps. To move objects around the screen, the visual artist just clicks, holds, and drags.

Every computist encounters a menu bar at some point in life, and Storybook Weaver makes the experience simple for first-timers. Authors can click once to activate a menu and then click twice on an option to activate it. Here, they may alter the story text from plain to bold or italic; open, close, or save files; or request help on any aspect of the program.

Under the Goodies menu, kids find more ways to change object attributes (should an object the reader clicks on always cover other objects it touches?) and the way to insert and delete story pages. The choices that are available from the menu bar are neither numerous enough to intimidate a youthful novice nor in the least bit obscure: Everything works exactly as its label implies. Best of all, if your kids run into trouble spelling the name of an object, Storybook Weaver will actually drop the word's correct spelling into the text of the story. Budding writers can find everything they need to pull together perfect fictions in a single package.

And for those children who want to give their stories to grandparents and others, Storybook Weaver supports a gamut of printers. Output is understandably a bit hazy on standard, noncolor printouts; the best dithering remains only gray scale, after all. Thoughtfully provided markers make the difference though. And after completing a story, kids can print it and then bind it just as in the old days—with string and staples.

What has MECC left out here? Unless your friends own a copy of Storybook Weaver, your children can't swap stories on disk. Each



saved file requires only a few thousand bytes of hard drive space; the images and music files already reside on the drive so the actual story file can be quite brief. Also, kids might want to compose their own melodies or draw their own dragons. At present, the program limits them to the data on file—a prodigious amount of data, to be sure, but ultimately finite. Suggestions? Well, how about some inexpensive expansion sets?

In the meantime, your kids probably won't complain as they add wings to babies and put giraffes in pickup trucks. Every image complements every other image here, and even after spending weeks with Storybook Weaver, young writers will still mix and match with surprising results. ❐

Circle Reader Service Number 392

IBM PC or compatible; 640K RAM; MCGA or VGA; hard drive; supports Ad Lib, Sound Blaster, Covox Sound Master, Roland MT-32, and Tandy 3-voice; mouse recommended—$49.95

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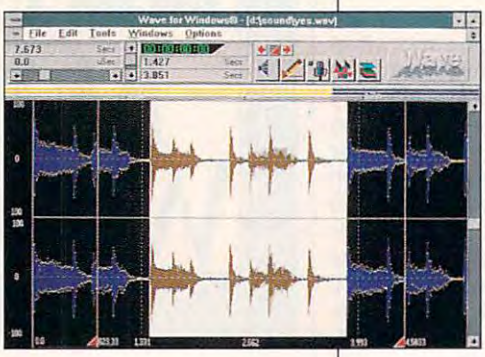
MULTIMEDIA PC

David English

THE SOUND AND THE FURY

Ever since Microsoft brought sound to Windows, there has been an explosion in Windows-based audio products. Sound cards are selling as fast as stores can get them in, and 16-bit sampling cards—the ones with CD-quality audio—are quickly becoming the standard.

Software companies are reacting just as Hollywood did following the success of *The Jazz Singer* in 1927—sound is being added to everything in sight, whether it needs it or not. You can buy talking icons, talking clocks, and even talking solitaire games.



New Windows programs let you take full advantage of your sound card.

One fast-growing category of audioware lets you attach sounds to your Windows system events. These events can include Windows open, Windows close, default beep, critical stop, application open, and control panel minimize. A good place to begin with this kind of software is with one of the SoundBits collections (Microsoft, One Microsoft Way, Redmond, Washington 98052; 206-882-8080; $39.95 each). The three current collections consist of Hanna-Barbera cartoon sounds (including the Flintstones, the Jetsons, and Yogi Bear), movies (including *The Wizard of Oz, The Maltese Falcon,* and *North by Northwest*), and musical instruments from around the world. You can buy five similar packages from Sound Source Unlimited (2985 East Hillcrest Drive, Suite A, Westlake Village, California 91362; 800-877-4778). Sound Source currently offers two "Star Trek" packages ($59.95 each), two "Star Trek: The Next Generation" packages ($69.95 each), and one *2001: A Space Odyssey* package ($69.95). Three packages of sounds from the Star Wars movies will be available soon.

In all these packages, you'll find sounds appropriate for specific Windows system events. For example, you could have Windows start each time with Captain Picard saying to you, "Welcome aboard," or have Windows exit with Cary Grant saying, "I've had enough stimulation for one day." I especially like the "Star Trek: The Next Generation" computer and communications sounds because they're less intrusive than the usual dialogue-based sounds.

Almost all sound cards come with software that lets you create your own sound files. But if you're interested in recording, editing, and manipulating sounds with professional-quality tools, you'll want to check out three new Windows sound programs. If you're looking for the best set of editing tools, your best bet is WAVE for Windows (Turtle Beach Systems, Cyber Center #33, 1600 Pennsylvania Avenue, York, Pennsylvania 17404; 717-843-6916; $149). WAVE includes a full undo, a fascinating 3-D visual analysis of your sound file, time compression and expansion, volume adjustment of all or any part of your sound file, and four-band digital equalization. Despite the elaborate tools, WAVE is easy to use. Turtle Beach has been selling a similar recording-and-editing system to professional musicians for years and clearly knows how to turn your PC into a powerful recording studio.

The other two programs are Sound Impressions (DigiVox, 991 Commercial Street, Palo Alto, California 94303; 415-494-6200; $149.00) and MCS Stereo (Animotion Development, 3720 Fourth Avenue South, Suite 205, Birmingham, Alabama 35222; 205-591-5715; $79.95). While they don't have the editing savvy of WAVE for Windows, they make up for it by offering a solid group of features for Windows audio, MIDI, and audio-CD. Both model themselves on a home component-stereo system. Both offer a WAVE-format recorder-and-playback system that looks like a cassette recorder, a CD-ROM playback system that looks like a standard audio-CD player, a MIDI playback system that looks like a digital recorder, and a mixing panel that lets you set the input and output levels for the other three components.

Both programs are well designed, though I would have to give the edge to Sound Impressions for its ease in loading individual files and its special editing features. MCS Stereo is a little easier to learn, but currently has conflicts with Adobe Type Manager and Squeegee.

Look for even more audioware throughout 1993 and for sound-card circuitry to be built into many PC motherboards. As Al Jolson said in *The Jazz Singer,* "You ain't heard nothin' yet!" ❐

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Alfred Giovetti

THEATRE OF WAR

Get ready to play a game like no other. One that demands such fast reflexes that it puts some arcade games to shame; one that requires the intense strategy and forethought of the most heated chess game. Get ready for Theatre of War, a game so unusual that it's difficult to understand unless you actually play it.

With Theatre of War, Three-Sixty pushes the envelope of computer strategy games, using the full capacity and power of the newer, faster computers equipped with hi-res 640 × 480 SVGA graphics and voice-capable sound cards.

It's a visual and aural feast. Its musical algorithm composes variations on a variety of preset jazz themes, synchronizing the music to the ebb and flow of the battling pieces. Accompanying the music is a high-quality, digitized vocal part that comments on and embellishes game functions. The pieces themselves—abstract ray-traced, 3-D forms rendered in bright, clear colors, using the full 256-color palette—spin and glide their way across the board like ballet dancers or ice skaters in free-form competition.

On the surface, Theatre of War is like chess. The ultimate goal parallels the chesslike kill-the-king idea. It has simple rules that can be learned quickly; but gameplay is complex, with the capacity to provide an infinite variety of subtle moves and countermoves. Strategy is based on the personality of the game player; players can be equally successful with an aggressive or a patient route. There are three playing sets; complex concepts are incorporated into the modern set's rules, while the medieval set has the simplest and most basic rules and strategies.

The stage is a cyberspace, represented by a matrix of squares that can be varied from the 8- × 8-square pattern of the familiar chessboard to a 50- × 50-square battlefield. The board can be displayed in overhead view, end-of-board oblique view, or as a series of checkered hills. The squares' colors and textures reveal terrain features that affect movement, endurance, and combat effectiveness.

Surrounding the board are various icon-based controls and display features. The 30 increasingly difficult scenarios provided will be supplemented by the future production of a scenario editor, new play sets, additional scenarios, and a network-play option.

Within the cyberspace, your 16 abstract, bright-blue shapes are poised on one side of a checkered battlefield. Facing them is an army of red shapes. Observing the battle from your control monitors, you must be a quick-acting general, sending your troops racing across the board, while the monitor speakers blare a continuous stream of jazz music. The tempo of the music increases as a line of red soldiers glides across the board in the direction of your blue line. As the reds near your line, your soldiers move out to meet them, executing your commands. The convincing sound of explosions punctuates the action, and various pieces speak, relating their status.

The game's three playing sets are medieval, Great War, and contemporary. Each set is composed of 16 pieces of six different types, with up to six separate functions per piece. Each set has a commanding kinglike piece with certain healing and authority-based powers. Other pieces serve the roles of infantry, artillery, cavalry, and fire support. Each set has its own strengths and weaknesses.

Both chess and Theatre of War are abstract strategy games that simulate warfare, but Theatre of War provides

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some advantages over the ancient board game. Combat is conducted in realtime (save in the two-player, one-computer mode, in which players take turns), and it presents a challenge in the placement and deployment of troops as well as in effectively using and conserving the troops' expendable resources. Therefore, the conflict addresses both strategy and tactics.

As the leader, you can give any number of commands to any number of pieces; you're limited only by the time it takes to point and click. The pieces do the rest, executing your commands automatically. The realtime play makes the game more realistic than the rounded (you take a turn, I take a turn) play. It also emphasizes fast action and quick reflexes.

Learning the names and functions of the pieces in the sets was an enjoyable experience on its own. The highly intuitive interface almost makes the well-written instruction manual and command cards superfluous. The sitting-duck scenarios provide an experimental battlefield that allows you to learn the pieces' functions without being blown up. After you've investigated with the mouse, the functions of each piece and command tile are revealed. Before you know it, you're playing the game with ease.

Theatre of War allows three modes of play: one-man show, human versus computer, or two-player. You can use human-to-human combat on a single computer or in realtime over a null or phone modem.

The different methods of play involve different strategies. The rounded play of two-player, one-computer mode gives the player with the first move an initial advantage. Modem and one-player play are in true realtime; your strategy will require you to choose between the advantages and disadvantages of the various modes of piece display and board display, and piece status will also be important.

The pieces were designed in 3-D; then they were ray-traced, using 3-D software. The images were compressed to fit more easily on the disks. Three to six animations were prepared per piece for Fighting, Moving, Dying, Special fighting, In-trouble, and Protected modes. Traditional paper-and-pencil animation drawings enhance the ray-traced animations. The transparencies and reflections of ray-tracing combine with the flat animations to create a smooth flow of texture and form. The bright, transparent, primary colors of red and blue are set off by the ray-traced, veined marble of the board and the icon-based controls.

Digitized speech and music have the dual effect of both setting and following the tempo of the game. Humor has been interjected into the largely somber mood of the game to remind you that Theatre of War is, at its heart, just a game. The script gives the pieces personality as they say, "I am too tired" or "I am dead." The voice replaces the need for a text-based warning window and enhances the play significantly for those whose hearing is not impaired.

Theatre of War's games are designed to be completed in one sitting, obviating the need for a save-game feature; however, you can pause the game in the single-player mode or in the two-player, one-computer mode. The developers expect modem play to be the most satisfactory, in spite of early indications that solitaire play seems to be the most popular.

The designers have taken the war-game expertise that made Harpoon such a hit and have created an abstract game of strategy and tactics that not only challenges the intellect in three different eras of military history but also is a feast for the eyes and ears. The bright, crisp colors, detailed 3-D graphics, online composition of synthesized jazz, digital voice, and intuitive, interactive interface leave little to be desired. Theatre of War is a well-thought-out abstraction of war—a game that may rival chess's power to entertain. ❐

Circle Reader Service Number 393

IBM PC or compatible (80286 compatible required, 80386 compatible or faster recommended); 640K RAM for 256-color VGA, 2MB RAM for SVGA with 256K on the video card; hard drive; DOS 5.0 and mouse highly recommended; supports Ad Lib, Sound Blaster, and Sound Blaster Pro—$49.95

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GAMEPLAY

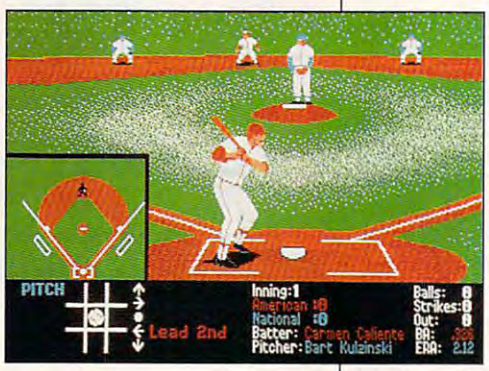
Paul C. Schuytema

THE LONG MARCH

The only way to tell whether a game designer is working on a classic is to check the gameplay. All the graphics in the world won't make up for leaden play.

What makes a computer game a classic? Is it longevity? Originality? Mass appeal? It could be any or all of these things, but one thing is certain in the world of computer entertainment: A classic is not a classic because it has remained stagnant.

Take The Oregon Trail by MECC. The game has been around forever (in terms of PCs, that means since the Apple II in 1979), and it's still here. The task is simple (or so it first seems): to guide a wagon from Independence, Missouri, to the Willamette Valley in Oregon during the 1840s. It's a logistical game: You have to know what supplies are important from the start, and you have to keep your people fed and healthy. What the game accomplishes beyond just great gameplay is to make you think about the millions of variables and unknowns the settlers had to face during that trek of 2000+ miles. You learn along the way, by listening to complaints and hopes and histories, just what it might have been like. The Oregon Trail is not the same game it was. It has just moved to 256-color VGA and full mouse support, and during its evolution, The Oregon Trail has become a better game. Now, when you hunt, you must actually aim your weapon, lead the prey, and shoot carefully (you brought along only so many bullets, remember?). If and when you get to the Columbia River, you must navigate it yourself, avoiding rocks and swirling eddies.



Accolade's sports game from the mid 1980s, Hardball, is another game that has stood the test of time. The baseball simulator began with CGA graphics and a simple premise: to simulate the feel of full-diamond baseball, from play to management. The current incarnation is Hardball III, which is announced by a digital Al Michaels and features woodgrain scoreboards, customizable players, rosters, and zoomed-in shots of key plays. Accolade has also just released the MLBPA Players Disk, which allows you to play real teams in Hardball III.

One category of games that faded from view during the graphic revolution is the text adventure. Beginning with the original Adventure at MIT, the genre grew into interactive fiction. In 1982, Zork I, Infocom's first interactive story set in the Great Underground Empire, was the top-selling computer game. Infocom tackled nearly all genres, from the hard-boiled detective story in Witness to cryogenic science fiction in Suspended to tropical diving adventures in Cutthroats—all without a single screen of graphics.

Not many games have yet come up to the storytelling depth of Infocom's adventures. So Activision has rereleased a two-volume set containing Infocom's 31 classic stories of interactive fiction. There are enough games in those two heavy boxes to keep even the most expert player challenged for years.

Back in the early days of computerized entertainment, games like Adventure and Zork were the first to take us to other worlds: fantasy worlds. There is a tradition of fantasy role-playing that is every bit as long as computer gaming itself, and one of the most stunningly evolved and dynamic series is Origin's Ultima. The first trilogy still sells well, and it should: The adventures are addictively playable.

The first Ultima adventure was released in 1980, utilizing tile graphics: It was a bird's-eye view of the lay of the land with the hero at the center. The Ultima trilogy (Ultima I, II, and III) takes place in the kingdom of Sosaria, ruled by the benevolent Lord British. Sosaria is a world full of castles and dungeons and creatures of every flavor, and exploring is the name of the game.

Currently, the series takes place in Britannia and has progressed into Ultima VII, Ultima VII Part Two (Serpent Isle), and Ultima Underworld: the Stygian Abyss. The graphics have pushed the technology to the edge (Ultima I requires a PC with 256K RAM and EGA, while the Stygian Abyss needs a 386 with 2MB of RAM and VGA), but the story is still the thing. And Ultima delivers.

Perhaps the acid test for a classic (no matter how old) is this: Do you still ponder the game after you shut off the computer and walk away? ❐

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