SETTING THE STANDARDS
15
YEARS

End-User Programming: Powerful Tools, Quick Solutions PAGE 208

BYTE

AUGUST 1990

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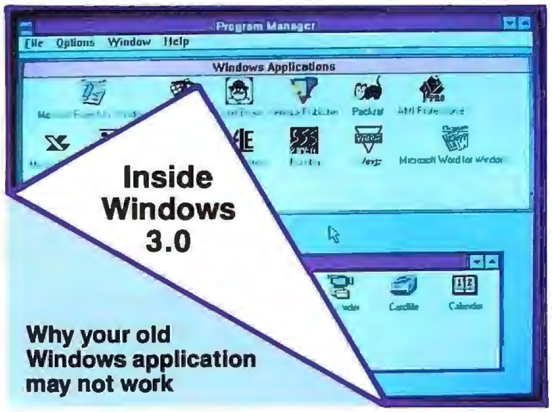

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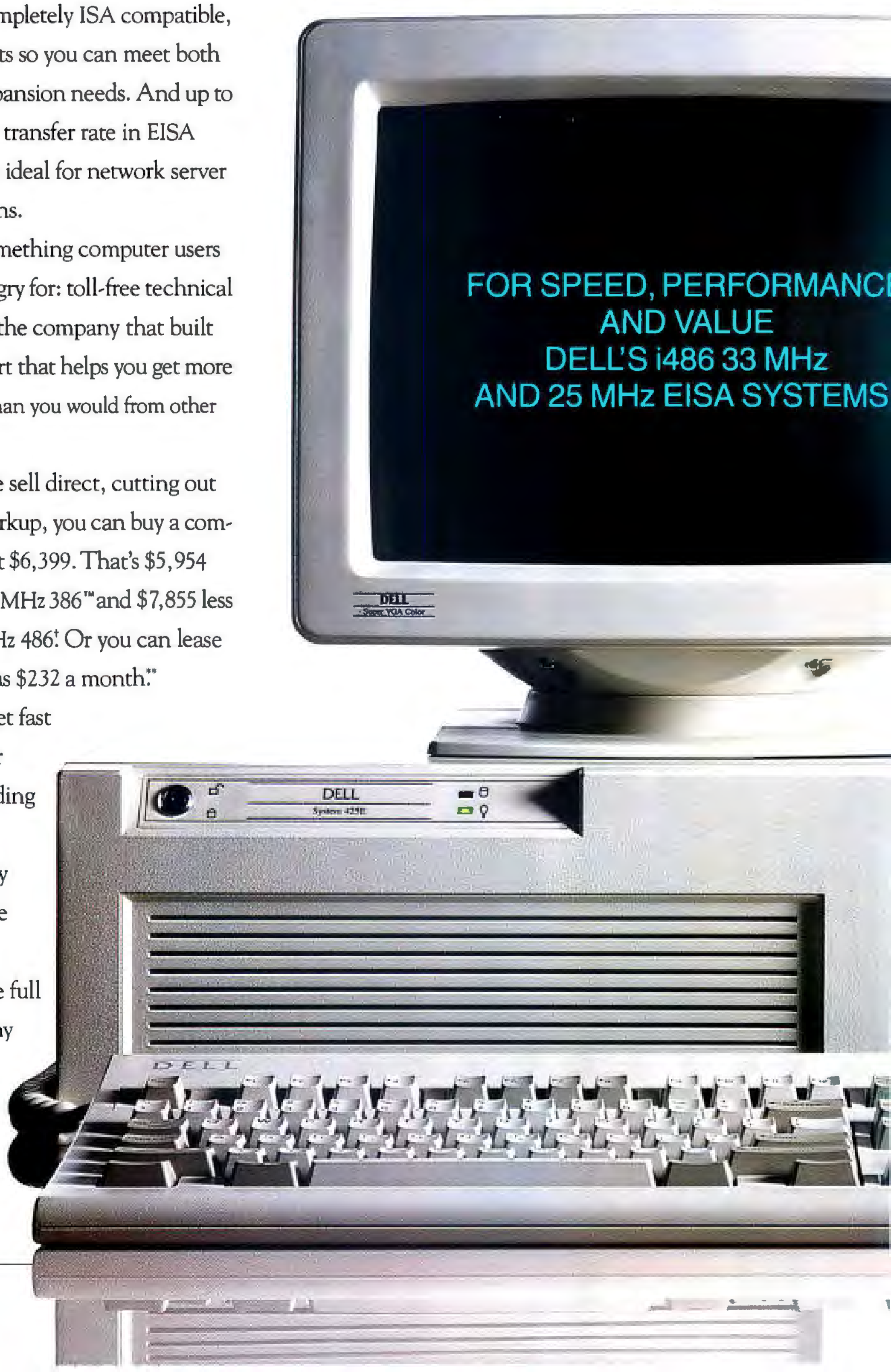

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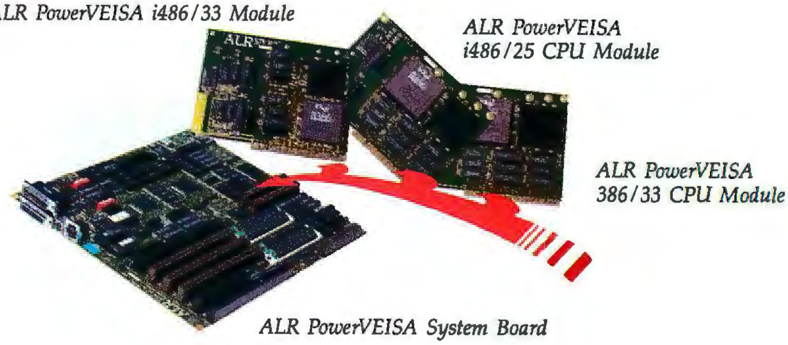

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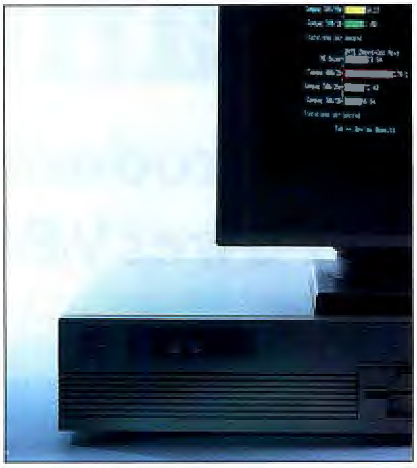

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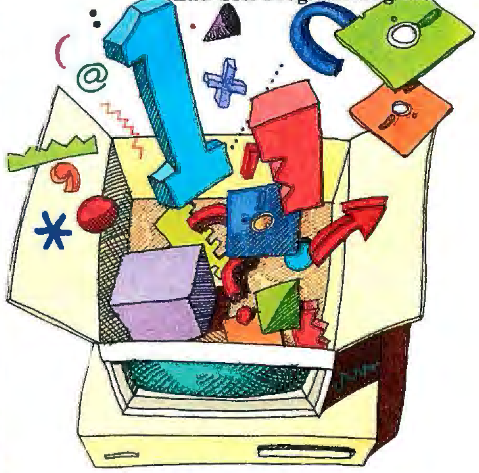

COVER STORY

PRODUCT FOCUS

386SX PCs: Heirs to the Low End

386SX systems bring 386 applications to the desktop without emptying your wallet.

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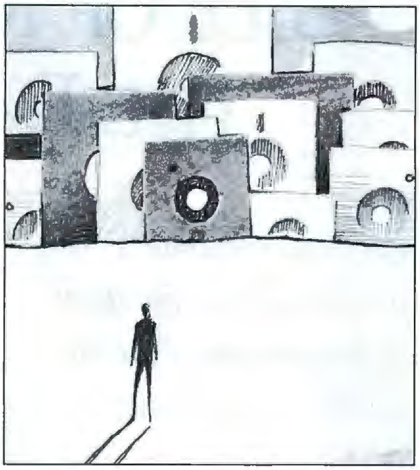

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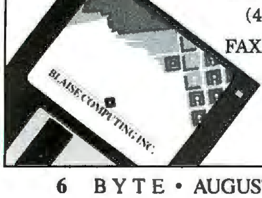

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AN ELECTRONIC BILL OF RIGHTS FOR THE DISABLED

Personal computers have become a passport to independence for the disabled—including authors of articles in computer magazines

Joe Lazzaro was an 18-year-old college student majoring in physics when he realized that he was going blind—victim of a retinal disorder that was gradually worsening. How, he wondered, could he possibly pursue a career in physics when he wouldn't be able to see?

Then Joe began hearing about microcomputers and special adapters that let blind people use them. With help from his girlfriend and his father, Joe purchased an Apple IIe and a speech synthesis card that let him hear what he was typing. And although he couldn't, at first, find a "talking" word processor, he was highly motivated to find his way around any obstacles; he was so anxious to communicate with others via his new tool, he began composing letters electronically, line by line, as BASIC programs!

Joe's persistence and drive paid off. As he became more proficient at using computers and peripheral devices to interact with the nondisabled world, other blind people began calling on him for assistance.

Adaptive Technology

Joe began writing articles about adaptive technology—systems that adapt computers for use by people with visual, hearing, or motor impairments. Among these articles was a review of five speech synthesizer boards for the *Guide to Apple PCs* that accompanied the December 1984 issue of BYTE. Joe received dozens of calls in response to the article, which bolstered his credentials as an authority and consultant in the field of adaptive technology.

In 1984, Joe applied for a position with the Massachusetts Commission for the Blind as an engineer/assistant and was hired as a part-time consultant. In 1988, he was offered the full-time position as director of the Commission's adaptive technology program.

When Joe approached our features editor via BIX with an idea for an article about adaptive technology, the editor—unfamiliar with Joe's earlier work for BYTE—had no idea that he was blind. And interestingly—marvelously—it did not seem to matter at all.

A Successful Collaboration

Working with a blind author was quite a learning experience for technical editor Janet J. Barron. Our editors and authors work cooperatively on articles, often viewing a manuscript simultaneously on their individual computer screens as they make changes. How do you do that when one of the participants is blind? How do you create graphics to accompany the article? How do you check the accuracy of those graphics?

Joe and Janet got the job done; thanks to a mixture of persistence, good humor, and hours spent on the phone. As part of the process, Janet traveled to Joe's office to see firsthand the many ways he (and other disabled people) use personal computers to function in the professional world.

We're proud of our lead feature this month, "Opening Doors for the Disabled," on page 258. We hope that it will encourage people with disabilities to discover—as Joe Lazzaro has—that an adapted personal computer can be an electronic bill of rights, providing a new life of independence, creativity, and productivity. ■

—Kenneth M. Sheldon

New FoxPro

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- FoxPro is so easy to learn and use, even beginners can become productive immediately; yet it's powerful and sophisticated enough to satisfy the needs of the most demanding developers and power-users.
- FoxPro gives you choices instead of limits: use a mouse or a keyboard; type commands or use the object-oriented interface; run in one window, or hundreds.
- FoxPro is so efficient, it runs in a 512K PC-XT, yet it's able to take advantage of the speed, expanded memory and extended video modes of the most advanced machines available. You don't even need a graphics card or special windowing software.

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We've taken everything we know about software engineering, databases and interface design, and focused it into one remarkable product—FoxPro.

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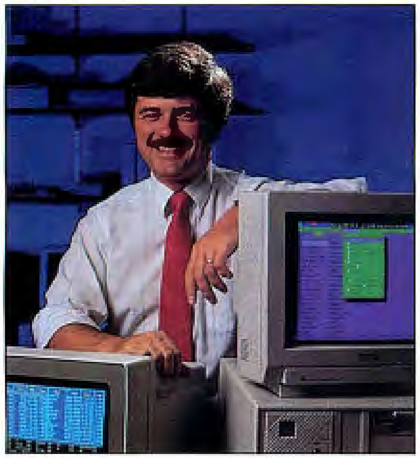

BYTE'S NEW BENCHMARKS

We introduce a new and improved suite of MS-DOS system benchmarks

Editor's note: *At this writing, BYTE editor in chief Fred Langa is in Moscow at the first postglasnost International Computer Club meeting. Filling in as this month's editorial writer is BYTE Lab managing editor Michael Nadeau.*

Benchmarking is a delicate science. The tests you create must produce repeatable results, have relevance to real-world tasks, and work on all the variations in a given product category. They must be accurate, bug-free, and easy to use, as well.

This month, we proudly introduce BYTE's new MS-DOS system benchmarks, version 2.0, with our Product Focus on 386SX PCs ("386SX PCs: Heirs to the Low End" on page 152). This new suite addresses a major modern-day benchmarking problem and includes more application categories.

Better, and Better Looking

The fastest 386 and 486 machines are outrunning low-level benchmark suites. A low-level test operates at the component level (e.g., our CPU test measures the raw processing power of the CPU). Some tasks execute so quickly that the benchmark code cannot accurately measure their duration, often returning zero as a result. This inflates some scores.

Rather than measure the duration of a specific task, our new code repeatedly runs that task for a set amount of time and then counts the number of iterations. The result is an accurate and repeatable measure of performance.

The most obvious change in our low-level benchmarks is the user interface. A colorful display with a menu and help window greets you. Run a test, and a bar graph indicates its progress; when it's finished, the software generates another bar graph showing performance relative to several other systems. Using version 2.0 is both easy and fun.

More Application Tests

To better reflect how high-end PCs are being used today, we've broadened the scope of our application test suite, which indicates real-world performance. We've taken the desktop publishing tests from the word processing suite and the CAD tests from the scientific/engineering suite and given them their own indexes. The revised scientific/engineering category now measures a system's performance running statistical and mathematical software.

We have also updated to the latest versions of the commercial applications software we use in the application suite. Added to the database suite is Borland's Paradox 3.0 for the database category; to the scientific suite, we've added The MathWorks' PC-Matlab 3.5.

Because we've taken a fundamentally different approach on the low-level suite and have added categories and new software to the application-level suite, it is impossible to compare version 2.0 indexes to previous version indexes. We have run the new benchmarks on several milestone PCs and the baseline IBM AT so that you'll have points of reference.

The real plus for PC users is that the new BYTE MS-DOS benchmarks will be valid for the foreseeable future. New versions of the i486 CPU, which could soon reach speeds of 50 MHz, should present no problem for version 2.0. We expect that they will run fine on even the next-generation Intel CPU, the i586.

The Rest of the Story

Benchmark indexes are wonderful tools for evaluating PCs. But an odd paradox has arisen as systems reach ever-greater speed: The faster the average PC becomes, the less of a purchasing factor speed is for an average PC buyer.

Many common applications require only a modest amount of system horsepower. Someone shopping for a system can simply choose a processor and clock speed, say, a 16-MHz 386SX, knowing it to be adequate for the intended task. Comparing features, support, reputation for reliability, and price would then be the main criteria for selecting a brand.

This does not diminish the value of benchmarking. It is still important to know relative performance between 286 and 386 systems, between 20- and 25-MHz 386s, and so on. And system performance is still a critical factor for applications in engineering, financial, and desktop publishing environments, to name a few.

BYTE has always been on the leading edge of system benchmarking and evaluation. To lead, however, it is not enough to publish the test results and let them speak for themselves. We must put them into perspective along with all other relevant factors.

To further focus our system reviews, we've redesigned our benchmark tables and graphs. They are smaller, and we've dropped the raw times in favor of the index scores. (The timings are available; see the Product Focus.) The new graphs present the most significant benchmarking data in a more accessible manner.

Finally, the new benchmark code was developed at BYTE by the BYTE staff, most significantly by BYTE Lab testing editors/engineers Steve Apiki and Stanford Diehl and technical director Rick Grehan. We got intimate with the inner workings of the state-of-the-art, high-end PC. The knowledge we gained was put to good use in the BYTE benchmarks. You'll see it in our system evaluations, too, and that's to your benefit.

—Michael Nadeau
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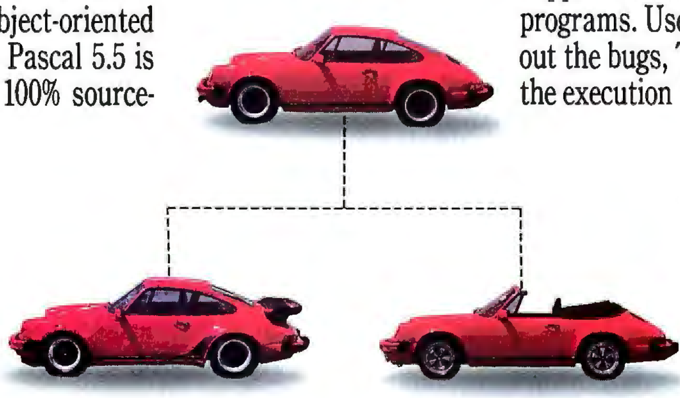

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If you're a current 1-2-3 user, you'll be happy to know that all data and macros created in existing versions of 1-2-3 can be retrieved directly into 1-2-3/G. So a move to OS/2 will only serve to enhance any investment you may have already made in 1-2-3.

IBM

But how does OS/2 make 1-2-3 better? Well, besides introducing 1-2-3 to a graphical environment, OS/2 works harder and faster, so 1-2-3 can work harder and faster for you.

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With OS/2, 1-2-3/G can give you Dynamic Data Exchange. DDE provides live links to other Presentation Manager™ applications for true application integration.

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OS/2 1.2 is better than ever. And before long, no one will be without it. It's more than just a graphical environment for the PC. Or an operating system for a handful of power users. It's a high performance, easy to use operating system that provides increased memory addressability and true multitasking.

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If you're worried that a move to OS/2 will mean sacrificing the investment you've made in DOS-based applications, this should put your mind at rest: The DOS compatibility mode in OS/2 allows you to run most of the existing DOS-based programs you already own. Which means the transition to OS/2 involves great gain, with no pain.

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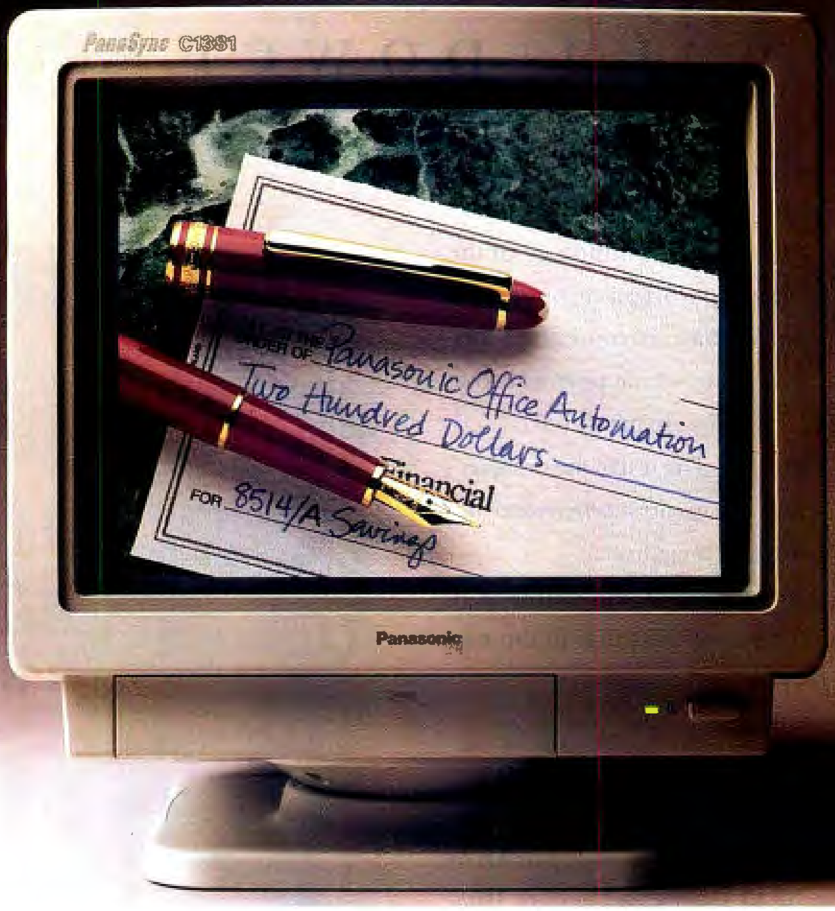

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The test of the designer's art, though, is to wring the greatest *performance* out of available megabytes and megahertz.

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2 *Surface Mount Technology. Used only by the most advanced manufacturers, SMT techniques protect the structural integrity of the board, which increases overall reliability.*

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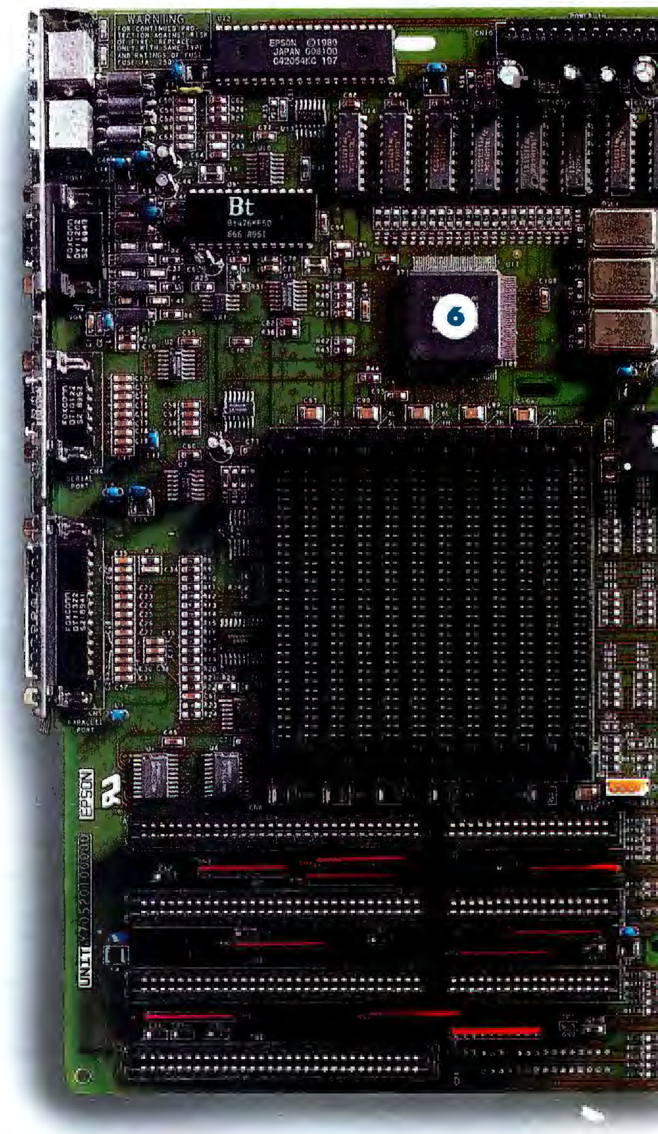

Epson's 386SX motherboard displays the elegant architecture necessary for optimal performance.

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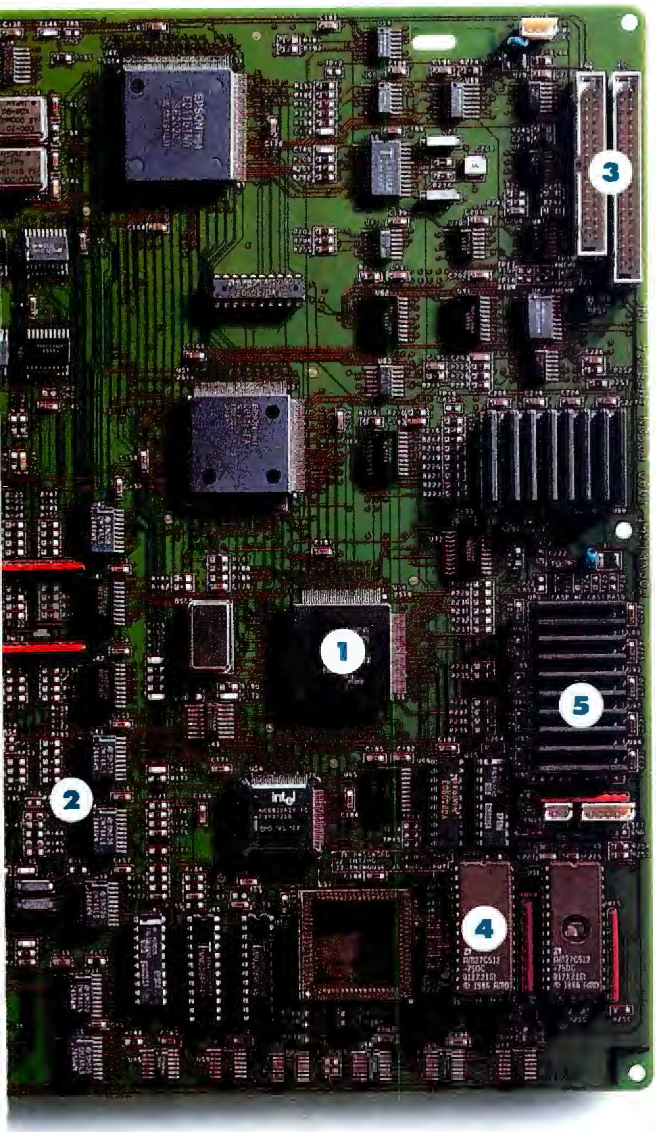

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Circle 96 on Reader Service Card

Research news and industry developments shaping the world of desktop computing
Edited by D. Barker

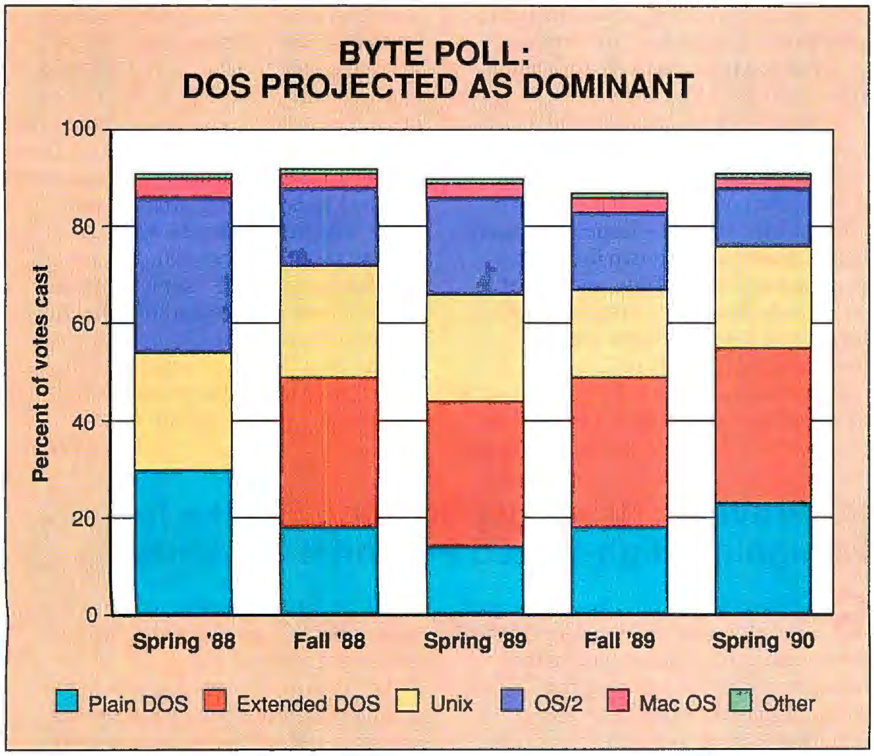
Next DOS to be "Configurable, More 386-Aware"

On a mission to develop the next version of MS-DOS, Microsoft's chief architect of systems software, Gordon Letwin, sent out a call for input from the "power user" community, including developers and users on the BYTE Information Exchange. The consensus from developers participating in BIX's microsoft/new.dos conference is that the new operating system should use less conventional RAM and run faster. Letwin, one of the wizards behind OS/2, confirmed this as a design goal, even for 8088-based machines.

The new operating system will support the DOS Protected Mode Interface, Letwin said. DPMI is the technique that allows Windows 3.0 to access memory beyond 640K bytes and offers a standard for DOS extenders. Even though the new operating system will let you run programs that conform to the Virtual Control Program Interface (developed by Quarterdeck and Phar Lap in 1987), Letwin said he prefers DPMI for 386 memory management. "Phar Lap and Quarterdeck very definitely have not done their homework," Letwin said; he thinks VCPI won't be adequate for the advanced computers and operating systems of the future, "machines that will be running literally hundreds of subsystems. These machines will never be reliable, protected, or trustworthy because they support VCPI, which runs the applications at Ring 0—in other words, in system mode."

DOS will become "more 386-aware

continued



Results from the BYTE poll taken at Comdex Spring show 55 percent of the respondents expecting DOS with extensions and a prettier face—Windows or DESQview, for example—to be the dominant microcomputer operating system through 1995. Perception of OS/2's fortunes, at least among Comdex-goers, has changed most significantly; note its standing two years ago. Extended DOS was not included in the Spring '88 poll.

NANOBYTES

Big Blue light: Scientists at the **IBM** Almaden Research Center (San Jose, CA) say they've succeeded in developing a laser that produces blue light from infrared light, thereby doubling the frequency. High-frequency blue light is anticipated as a means of dramatically raising the capacities of optical storage devices. Because of its shorter wavelength, blue light can be more tightly focused; in an optical disk system, it could make marks (which hold data) as small as 0.4 micron in diameter, half the size of marks made by current devices. The IBM blue laser works only at very low temperatures, but the scientists say they can overcome that.

A **NeXT** Computer based on the Motorola **68040** processor will be available in the fourth quarter, Steve Jobs said at a recent press conference. NeXT will make available a $1495 board upgrade for current cube owners. Other than the upgrade cost, Jobs declined to reveal pricing for the new 68040 system or whether NeXT would continue to sell the 68030 version. One likely possibility is that NeXT will sell the 68040 model for close to the same price as the current machine and drop the price on the 68030 model. Jobs said that NeXT is "working very hard" on a system that supports "compressed color video." The rumor line says Motorola's new 96002 DSP will be used in the next NeXT.

"All **future modular Macs** will have **sound I/O**," Apple CEO John Sculley said at Apple's latest developers conference. Some developers interpreted that to mean an electronic microphone, similar to Farallon's MacRecorder. The Apple chief also made a brief reference to the existence of **QuickTime**, a standard interface to control timing similar to QuickDraw's interface for drawing on a Mac's screen. Observers said QuickTime shows Apple's commitment to solving multimedia interface problems.

NANOBYTES

Intel (Santa Clara, CA) says that its new **287XL math coprocessor** for 286-based machines offers as much as double the performance of its current 80287. A resource-pounding program like AutoCAD will regenerate drawings 15 percent faster with the 287XL than with the old 80287, Intel says. The company also has a version designed for laptop and notebook computers. The suggested retail price is $370.

We're starting to see good **price cuts on i486-based computers. AST Research** (Irvine, CA) has taken as much as $1800 off its Premium 486s, which come in 25- and 33-MHz models, some with the Extended Industry Standard Architecture bus and some with the ISA bus; prices now start at $9795. **Dell Computer** (Austin, TX) trimmed the prices of its EISA-based 425E; a system with a 330-MB hard disk drive, 4 MB of RAM, a Super VGA color monitor, and a floppy disk drive is now $9599, or $8299 with an 80-MB hard disk drive.

Sun Microsystems intends to make **CD-ROM** the "standard software distribution medium" for its operating systems and application programs by 1991. To encourage the use of CD-ROM, Sun cut the price of its SunCD drive by 30 percent to $995 and is offering a free copy of SunOS 4.1 to SunCD buyers until August 31. Sun is also offering aggressively priced deals to developers.

Hardware and software manufacturers are cooperating on developing a **new standard for displaying stereo images** on microcomputers. Participating companies include Vermont Microsystems, Artist Graphics, Nth Graphics, Matrox, Pixelworks, StereoGraphics, Tektronix, Autodesk, Cadkey, and Ithaca Software. The standard will provide a uniform method for software developers to specify stereo information so that they need not rewrite the stereo portion of code for use with different display systems. It will give display system manufacturers a standard method of receiving stereographic information. The final part is a standard signal for stereographic hardware.

to reduce its memory burden in the 640K," Letwin said. "DOS is more constrained [than OS/2 2.0] in that we need to support Windows/386, Phar Lap [386|DOS-Extender], etc., which also muck with this hardware. The chip doesn't support 'virtual machines,' so two guys playing with the 386 hardware get into a fight."

The next version of DOS will be "highly configurable," Letwin said, "so there will be features available only to folks with extended memory, and/or only to folks with 386s, and likewise perhaps only to folks with hard disks. All these configuration-sensitive features will be performance and size issues; there won't be any functional difference. DPMI is the only functional difference that I can think of right now; it won't run on an 8088."

"We're going to greatly improve Backup," he said. "I agree that the current product is really bad; I'm horrified to discover that we didn't even provide forward compatibility."

Although Microsoft won't abandon EDLIN, the next DOS will incorporate "a very easy-to-use screen editor," Letwin said. "It won't be a powerful programmer's editor"; it will instead be easy to use, geared toward "nonprogrammers who want to create a batch file or edit CONFIG.SYS."

"We're looking at supporting Unix-like wild-card handling. OS/2 version 1.2 does this today. The problem isn't writing the code; it's in handling the compatibility issues—issues with users' habits, commands shown in books, commands in batch files, and use of wild cards directly by programs. We hope to be able to resolve these problems and get this in."

Some often-requested features—such as an "edit window" or a communications service with internal buffering and support for protocols—can't be incorporated into the next DOS because they would require a new application programming interface, Letwin said. "Basically, new APIs require that a program be written specifically to use them. The problem with that is that few software manufacturers" are willing to develop a program that runs under the new DOS but not on "the 30 million or so DOS 2, DOS 3, and DOS 4 systems out there," he said.

As for extending the command-line size limit beyond 128 bytes, "The problem with lengthening the command line is that it's stored in a fixed 128-byte area in the PSP [program segment prefix]. All programs get the line out of there to parse it. We don't see how we can extend the length of the command line without breaking all existing programs," Letwin explained.

There could be an attribute bit in each binary that says, "I understand the new long command-line convention," but then the user has to remember which programs will allow it and which won't. "The user might be working with compliant programs and might create a path which is very long, then discover later that he can't use those files with noncompliant programs because they make the path too long," Letwin said.

How many of the suggestions from outside developers will make it into the next DOS is anyone's guess, but Letwin said he found it "particularly valuable to see the kinds of things that 'power users' and programmers want. Although programmers make up a small percentage" of DOS users, "those are the folks who create the stuff that the rest of the world uses."

The next DOS will probably ship later this year, although Microsoft is not inclined to say that definitively.

—Martin Heller

S3 Provides New Bus, Building Blocks for Designing High-Speed Personal Systems

S3 (Santa Clara, CA) has developed a new bus and architecture that will give personal computer makers the pieces to build multiprocessing, workstation-like systems. A young company started by two founders of Chips & Technologies, S3 is offering a system-level chip set architecture that features a high-speed 32-bit bus called the Advanced Chip Interconnect. The ACI bus is an open, published specification and can be used by other designers and manufacturers without licensing or royalty costs, according to Ron Yara, S3 cofounder and vice president of marketing.

Using the concept of modular and scalable building blocks, ACI gives designers flexibility in mixing parts such as buses, CPUs, and subsystems. A company could build anything from a standard 386 or 486 computer with a single CPU and bus to a multiprocessing system with multiple CPUs and buses by adding chip modules and

continued

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address lines to the ACI. The ACI supports cache coherency, distributed interrupts, and interprocess communications, S3 says. Depending on the bandwidth of the address lines to the ACI bus (16, 32, or 64 bytes) and the clock speed of the host system (25 or 33 MHz), data transfer rates ranging from 60 to 120 MBps can be achieved, according to S3 officials.

While S3's approach might not appeal to manufacturers who can fabricate their own chips and circuits, like IBM or Hewlett-Packard, many clone makers will be able to compete at the high-performance end using off-the-shelf components based on the ACI architecture.

Advanced Micro Devices, National Semiconductor, Integrated Device Technology, and Cirrus Logic have all said that they support the S3 Silicon Subsystems architecture and plan to supply peripheral controllers that can connect to the ACI bus. These devices will include graphics accelerators, Ethernet and SCSI controllers, cache memory controllers, and Fiber Distributed Data Interface and ISDN controllers. The Santa Cruz Operation has endorsed ACI and is working with S3 to develop a multiprocessor version of Unix for the ACI bus. Software and BIOS vendors Microsoft, Corollary, Phoenix Technologies, and American Megatrends say they'll support ACI. Several manufacturers said they'll build systems based on the ACI bus, including Altos, Arche Technologies, HCL America, Mitac Group, Mylex, and TriGem Computer.

—Nick Baran

NANOBYTES

Now that Windows 3.0 has made vast amounts of memory available, **Hewlett-Packard**'s innovative **NewWave** operating environment, which sits on top of Windows, should be able to perform some of the tasks it was meant to. The two main attractions of NewWave are its easy integration of information from diverse applications and its use of "Agents." An Agent functions as a smart macro facility, allowing you to automate routine tasks. The Agent is intelligent: It records not just keystrokes but actions in the underlying applications, and it can handle error conditions. New to NewWave 3, scheduled to be available this month for $195, are facilities for incorporating data from different applications into various network servers.

The **U.S. government** is facing a **"major national catastrophe"** because federal agencies have failed to protect their computer systems from infiltration, two U.S. congressmen have charged. Robert Torricelli (D–NJ) and Dan Glickman (D–KS) said they are seeking sanctions against the delinquent agencies. Their response followed a report from the General Accounting Office that says few government security measures are actually being implemented. By not complying with the law, federal agencies are demonstrating "unabashed arrogance and insensitivity to critical computer and network security issues," Glickman said. The GAO report said that federal agencies implemented just 55 of 145 planned security controls and that the Computer Security Act failed to improve security for 22 vital information systems in 10 agencies, including the FAA and the IRS.

Visix Software (Reston, VA), whose Looking Glass puts a graphical interface on Unix, has formed the Visix Software Partnership to promote development of applications that support Looking Glass. Visix has landed some important partners, including Adobe Systems, Frame Technology, Oracle, and Ingres. Looking Glass has been praised by some software developers as the most advanced graphical interface supporting the X Window System.

Adobe Writes a New PostScript

In spite of the countless clones and the alliance of Apple and Microsoft to bring out a competing font standard, Adobe Systems' PostScript remains the dominant language for defining fonts and graphics on the printed page, particularly in desktop publishing applications. PostScript is also gaining acceptance as a language for defining text and graphics on screen displays. IBM, Digital Equipment, and NeXT have introduced machines that use Display PostScript to put text and graphics on the screen, thus unifying the screen and printer imaging model and giving true WYSIWYG display.

Nevertheless, PostScript has needed improvements for several years. The language has limited color support. It uses a segmented memory model, causing printers to run out of memory in very large or complex print jobs. The language, which is interpreted rather than compiled, performs acceptably at printing text but has been criticized for being too slow for heavy-duty graphics applications. And developing device drivers for PostScript output devices has traditionally been a complex and time-consuming endeavor, requiring intensive technical support from Adobe.

Adobe's PostScript Level 2 aims to correct the deficiencies in the current implementation and add features that make it more suitable for use in professional printing facilities—in particular, improved support for color printing. Level 2 consolidates extensions that have been added to Level 1 over the years, including integrating the extensions in Display PostScript into Level 2 so that the same code can be used in either display or printer applications.

Major data compression algorithms can now be included in PostScript programs. Basically, Adobe has added an operator to the language that can accept one of several compression algorithms as its argument. Level 2 supports the JPEG and LZW data compression algorithms (Joint Photographic Experts Group and Lempel-Ziv-Welch, respectively), as well as the CCITT and various ASCII-based data compression algorithms. The addition of compression algorithms will allow PostScript text and graphics files to be transmitted much more quickly and take up less storage space, resulting in performance improvements at the printer and also on networks and other communications systems that are transmitting PostScript files. Graphics data compression algorithms such as the JPEG's can squeeze printed images as much as 25 to 1 without a noticeable loss in quality.

Level 2's language interpreter can handle binary encodings rather than ASCII digits like the Level 1 interpreter. The binary encoding system will improve the execution speed of PostScript code; nevertheless, Level 2 will still use interpreted rather than compiled code.

Other new features include improved clipping algorithms for formatting graphics on the page. In addition, Level

continued

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Bruce Eckel, Micro Cornucopia, pp. 8-17, March 1990

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Scott Robert Ladd, Dr. Dobbs Journal, pp. 64-73, January 1990

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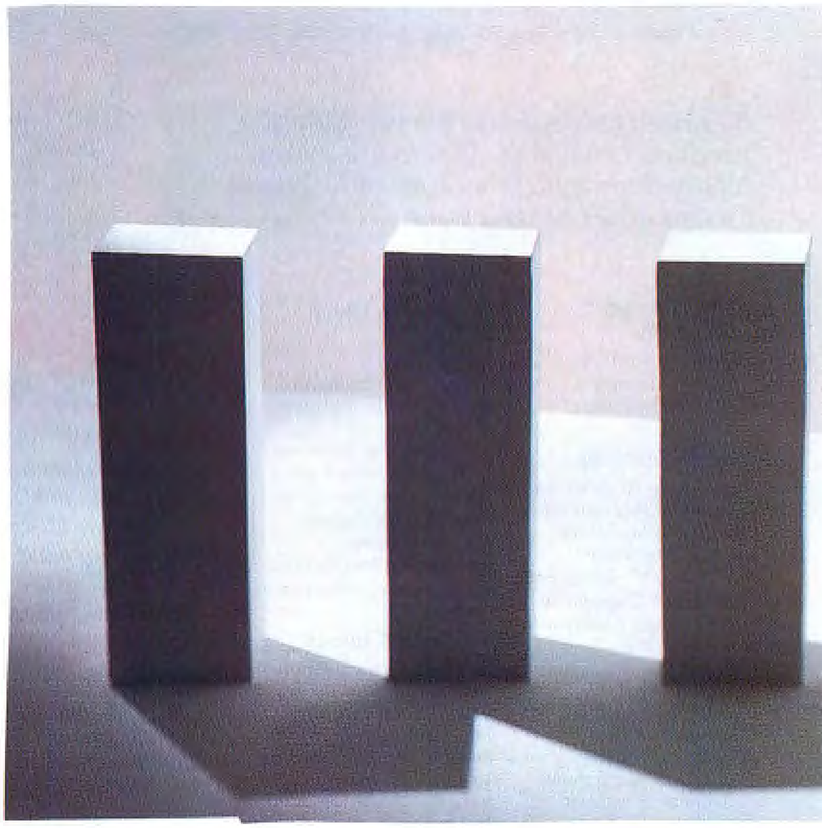

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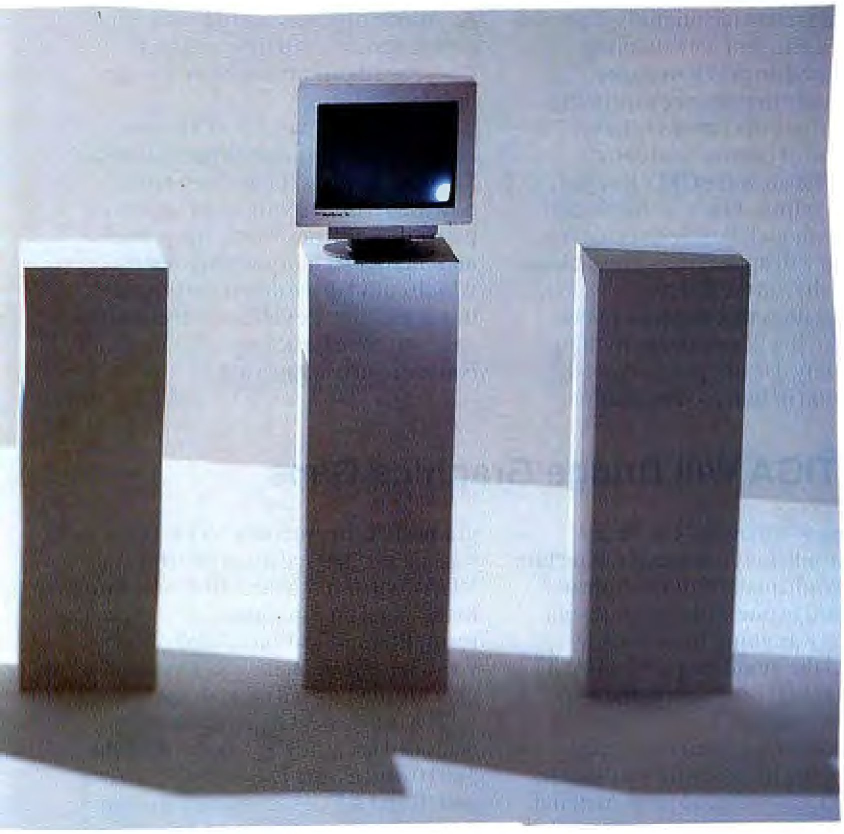

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NANOBYTES

North American **retail sales of software increased** to an estimated $993 million for the first quarter of this year, according to figures released by the **Software Publishers Association** (Washington, DC). That represents an increase of 25 percent over the same period in 1989, the SPA says. Sales of Macintosh software were up 37 percent, while MS-DOS software sales increased 24 percent, according to SPA figures. Word processors were the largest and fastest growing category for the period, showing 88 percent growth. "This quarter's results, with an overall growth rate of 33 percent for domestic and international sales, are in marked contrast to last year, which had a growth rate of about 12 percent," said SPA research director Ann Stephens. "Since the largest growth is in the 'bread and butter' category of word processing, this seems to indicate a healthy software market that we think will continue."

Hoteliers, take heed: As on-the-road computing becomes more commonplace, business travelers are looking for rooms that accommodate their communications needs. They want to be able to just plug in their modems and not have to fiddle with the phone wiring. Nearly 90 percent of the companies polled by the **Electronic Mail Association** said that "pre-knowledge of in-room computer communications" would be an important factor in picking a hotel, the EMA says. "Many business people simply won't accept a room with a hard-wired telephone and no access jack," said Peggy Pisani, head of the EMA's committee on the subject of hotel/motel computer-aided communications.

The **Video Electronics Standards Association** (San Jose, CA) has adopted a **standard refresh rate** of 72 Hz for displays with 800- by 600-pixel resolution. This refresh rate is higher than that of most current monitors and will result in a steadier display with less flicker, which should reduce eye stress in users. Members of VESA include Panacea, Western Digital, Everex, HP, Intel, ATI Technologies, Headland, Chips & Technologies, Mitsubishi, Genoa, Tandy, NEC, and Willow.

2 uses the character-rendering techniques developed for Adobe Type Manager, allowing a two- to threefold improvement in text rendering speed and better-looking small text.

Level 2's memory management system features a single "memory pool" for storing fonts and PostScript routines as well as working memory for storing the generated image. In Level 1, memory was segmented into separate areas for font storage, code storage, and working memory. This was not an efficient way to use memory, and often very large or complex images would cause memory overflow errors in Level 1. Level 2 resolves this. In addition, the new management technique is supposed to be more efficient in reclaiming memory used on previous pages.

Of primary importance to printing and publishing operations is Level 2's full support of commercial color standards, such as the CMYK (cyan, magenta, yellow, black) color model. Using this model, PostScript color on the screen will appear the same, at least theoretically, on the printer.

So what does this all mean to the user? First, it will not mean anything immediately. Developers just got the new version in June, so applications won't show up until early 1991. Second, Level 2 applications will not run on Level 1 printers, which means that there will be little hardware support for Level 2 until printer and other output device manufacturers upgrade their machines to use ROMs that support Level 2. Printers and other devices that have removable ROMs (e.g., the LaserWriter IINTX) will be able to easily upgrade to Level 2.

Adobe says it will make much of the information about Level 2 public. This leads to an obvious question: Can someone use this information to create a clone that would effectively duplicate the features in Level 2? Probably not. As Adobe officials are fond of saying, giving someone all the parts to a Corvette doesn't mean he or she can build a Corvette.

PostScript Level 2 won't have a major impact on desktop publishing for a couple of years. In the long term, however, Level 2 will mean improved performance from PostScript printers and smaller memory requirements, which could drive down the prices of those printers. Level 2 will also make it easier to have PostScript files printed at commercial printing shops.

—Nick Baran

New TIGA Will Bridge Graphics Gaps

The new version of the Texas Instruments Graphics Architecture (TIGA) could make moving from a VGA board to one with higher resolution as easy as going from EGA to VGA. All the muddle over 8514/A, TI's 340x0 graphics processors, and Super VGA won't matter.

TIGA provides a standard application programming interface for software to address TI's 340x0 processors without having to use custom drivers for each graphics board. TIGA operates independently of resolution, color depth, or pixel size, and it can be extended through user-developed primitives that are downloaded to the graphics processor at run time.

TIGA 2.0, which is scheduled to be available in the third quarter, will show improvements in performance and capabilities, but the most significant change will be support for VGA, for lower-resolution graphics modes, and for IBM's 8514/A Application Interface. TI-based graphics boards running under TIGA will be able to emulate VGA or 8514/A graphics boards. The user will still be able to run old programs that support only VGA; the signals are "passed through" from the VGA controller to the 340x0 and output to the same monitor used for higher-resolution applications. Applications written to work on the 8514/A can execute unchanged on a 340x0.

TI has a new VGA interface chip designed specifically to work with the 34010 processor. The TI 34092 links a 34010 and a VGA controller on a single board (the same thing has typically been done until now using discrete logic) so that it can run in TIGA, 8514/A, and VGA (or lower) modes. Having an off-the-shelf chip perform this interface will make it easier for graphics board designers to incorporate both VGA and 34010 on their cards. A VGA interface chip for the 34020 is supposed to be ready later this year.

Combining a TI graphics processor and a standard VGA chip set means some of the hardware is redundant. One of TI's European units is developing a board-level product, currently called Cessane, as a more efficient alternative. Cessane is designed to go on graphics

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NANOBYTES

Dariana Technology Group (Buena Park, CA) is readying **Windows 3.0 and Macintosh versions of System Sleuth**, its DOS program for analyzing and diagnosing a computer configuration. System WinSleuth, which the company hopes to ship this month, will ferret out information about hardware and software configurations, attached peripherals, and memory. Developer David Seifert said he is putting everything from the DOS program into WinSleuth, except where the use of protected mode will interfere. WinSleuth might not be able to find out as much information about areas like interrupts as System Sleuth does. MacSleuth, still in the preliminary stage, will provide information about AppleTalk and the devices connected to a Mac via AppleTalk and identify the type of system, desk accessories, INITs, SCSI devices, slots, cdevs, and drivers. Both new Sleuths will cost $149.

Less filling: **CMS Enhancements** (Tustin, CA) has a new 20-MB hard disk drive that weighs only **10 ounces**. The 2-inch LiteDrive has an access time of 28 ms and draws less than 3 watts of power, the company says. Versions for the NEC MultiSpeed HD and the Tandy 1400 FD sell for $999.

IBM has signed a deal to send thousands of **PS/2s to the U.S.S.R.** The computer maker announced that it will deliver "more than 13,000" PS/2 systems for use in Soviet schools, from "secondary schools on up." Plans call for IBM to ship "a variety of different" 286-based PS/2 computers with "a variety of peripherals," said a spokesperson.

How'd you like to spend hundreds of thousands of dollars courting a prospective partner, only to change your mind right before moving in together? That's what happened to **Novell**. The company's second-quarter financial statement notes that Novell incurred expenses of $400,000 relating to its "attempted merger" with **Lotus**. Novell nixed the deal at the last minute after its directors decided they couldn't accept the corporate board arrangement proposed by Lotus.

cards and motherboards to provide both TIGA and VGA with minimum overlap. It employs a special VGA chip set that uses a TI graphics processor to perform some functions normally built into the VGA chips.

"VGA is what everyone's using today," said Scott Huckaby, marketing program manager for TI's computer video products group (Houston, TX). "We had to offer it."

The company has also enhanced TIGA with support for high-speed video RAM and the TI 34082 FPU. TIGA 2.0 will take full advantage of the 34020 instruction set. And, for the first time, it will work with DOS extenders, including the DOS Protected Mode Interface used in Microsoft Windows 3.0 and other products.

TIGA 2.0 promises to make moot much of the discussion over 8514/A, TIGA, and Super VGA. If TIGA 2.0 does what it promises, it may no longer matter which graphics board you have in your system: The graphics interface will be smart enough to adapt itself to your hardware, and you'll be able to run practically any application at the highest resolution that it can handle, all through a single graphics board.

—Andy Reinhardt and Rick Cook

National Semiconductor's New Chips Will Bring Multipurpose Imaging Devices

National Semiconductor (Santa Clara, CA) has launched a range of new 32-bit microprocessors tailored to controlling imaging peripherals. The new embedded processors are designed to make it easy for manufacturers to integrate printers, scanners, fax machines, terminals, and even voice mail into a single system. A company official said new products that incorporate the chips will probably start shipping late this year.

The NS32FX16 Imaging/Signal Processor is a flexible chip designed for use in all Group 3 fax machines, as well as in page printers and combined imaging devices. It has a built-in digital signal processor module and can be programmed to perform all the functions of a fax machine, laser/fax, PostScript printer, and data modem or fax modem, as well as other similar peripherals. It can also be programmed for digital voice recording and used as the basis of an office voice-mail system. The chip can perform other functions like image enhancement, error correction, and data encryption.

The new NS32CG160 Integrated System Processor is optimized for use in peripherals such as monochrome and color page printers, graphics terminals, and scanners. It's an extension of the current NS32CG16 chip, adding a fast 16- by 16-bit multiplier, a two-channel DMA controller, three programmable timers, and a BitBlt unit (for manipulating bit-map images).

The third new chip, the NS32GX320 High Performance Integrated System Processor, is in some ways similar to the NS32FX16 but can perform all the same functions concurrently. It is capable of acting as a Printer Command Language or PostScript printer, scanner, fax machine, modem, and voice digitizer simultaneously. National Semiconductor sees the NS32GX320 being used for very fast imaging page printers, intelligent terminals, solid-state voice mail, phone answering, and faxing, as well as for integrating a number of these functions into a single unit. National Semiconductor says that a laser printer controlled with this chip will operate from six to 10 times faster than Apple's LaserWriter IINTX.

National Semiconductor officials say that a PC board, about half-slot size, built using the NS32GX320 could deliver PostScript hard copy, PostScript visual display, graphical output, data transfer, and voice recording.

The new chips are scheduled to be available in the fourth quarter.

—Owen Linderholm

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PC MAGAZINE EDITORS' CHOICE 3-13-90

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AD CODE 11EH0

Circle 68 on Reader Service Card

LETTERS

and Ask BYTE

More Assembly Flirts

I enjoyed reading Hugh Kenner's piece on the use of assembly language in that "critical 5 percent" of code to produce a dramatic improvement ("Flirting with Assembly," April). There is no question that machine language (especially in-line code, as supported by Turbo and other compilers) can produce a dramatic speedup when the code produced by the compiler is redundant or inefficient. Often a compiler generates subroutine calls and uses complex addressing; in such cases, in-line code tailored to the specific problem speeds things up impressively.

The downside of this methodology is that the resulting program becomes unreadable and unmodifiable except by the original programmer (and then only for a month or so, until he or she forgets the details of the clever stunts required to make things work). It is better for all concerned to treat assembly language programming as a last resort.

I have never published anything as widely read and highly regarded as *The Mythical Man-Month*, but I estimate that replacing from 1 percent to 5 percent of the high-level language code with smarter algorithms is, in fact, the best fix for any speed problem. Only after the algorithms are shown analytically to be nearly optimal should one resort to assembly language.

Obviously, the optimality of any particular piece of code is an important consideration only if it is, in fact, a bottleneck in the execution of the software considered as a whole. For example, I/O operations often dictate the minimum running time, and they frequently resist speedup. Strictly compute-bound operations may proceed one or two orders of magnitude faster than I/O, and speeding them up may well prove to be a waste of effort.

Donald Girod
Buffalo, NY

Concerning Hugh Kenner's "Flirting with Assembly," it is true that by replacing all the

```
CMP ES:BYTE PTR [DI],XXX
   ;"XXX" stands for anything
```

statements with

PRINT QUEUE

Hugh Kenner

Advise and Compute

A lawyer looks at computers, copyrights, and "look and feel" lawsuits

```
MOV CH,ES:BYTE PTR [DI]
```

before doing the comparisons with

```
CMP CH,'0'
JB SPP          ; SPP is used as
                ; address instead of
CMP CH, '9'  ; SP, since SP is
                ; the stack pointer
                ; register
```

will make the coding smaller and faster without using any more registers. Replacing the register CH with AL will improve it, as will the use of the LOOP instruction.

However, the real point to be made is that Kenner did not have to hand-code it. DEBUG.COM, which comes free with every DOS, has a simple assembler that could have calculated the jumps and generated everything in hexadecimal. If Kenner had just redirected the output to a file, he wouldn't have even had to type the hexadecimals.

I commend Kenner's efforts, but can't you editors at BYTE find someone who is more experienced at explaining assembly? BYTE is not a computer magazine for novices, so the marginal quality of presentations in this article does not do justice to the otherwise fine articles in your magazine. I can explain assembly better, or even edit it better. And that's not boasting.

Dr. Masaaki Sawada
Montreal, Quebec, Canada

Donald Girod is quite correct about the feasibility of speeding things up via better data structures. But I don't understand what he means by "unreadable and unmodifiable except by the original programmer." As I see it, I've now got fast self-contained assembly language DECAP, DEPUNCT, and MATCH routines for reuse in all manner of other projects; but a data structure revision would be confined to the program it revised. And Dr. Sawada errs in supposing that I was trying to explain assembly language. I was showing how, by borrowing from published code, you can sometimes co-opt more than you understand.

—Hugh Kenner

"Look and Feel" Author Responds

I enjoyed Hugh Kenner's review of my book—or, more correctly, his ruminations after reading my book—in the April Print Queue, but I would like to offer a few responsive comments.

While programmers create artificial realities every day, they live in the real world, and in the real world people's rights and obligations vis-à-vis one another must occasionally be sorted out. Rarely is that sorting-out process governed by black-and-white ground rules. The programming community should not expect the respective rights and obligations of the software innovator and the software clone to be any more clearly stated than they are for playwrights.

The good news, however, is that the programming community can expect the rights and obligations of software innovators to be as clearly stated as they are

continued

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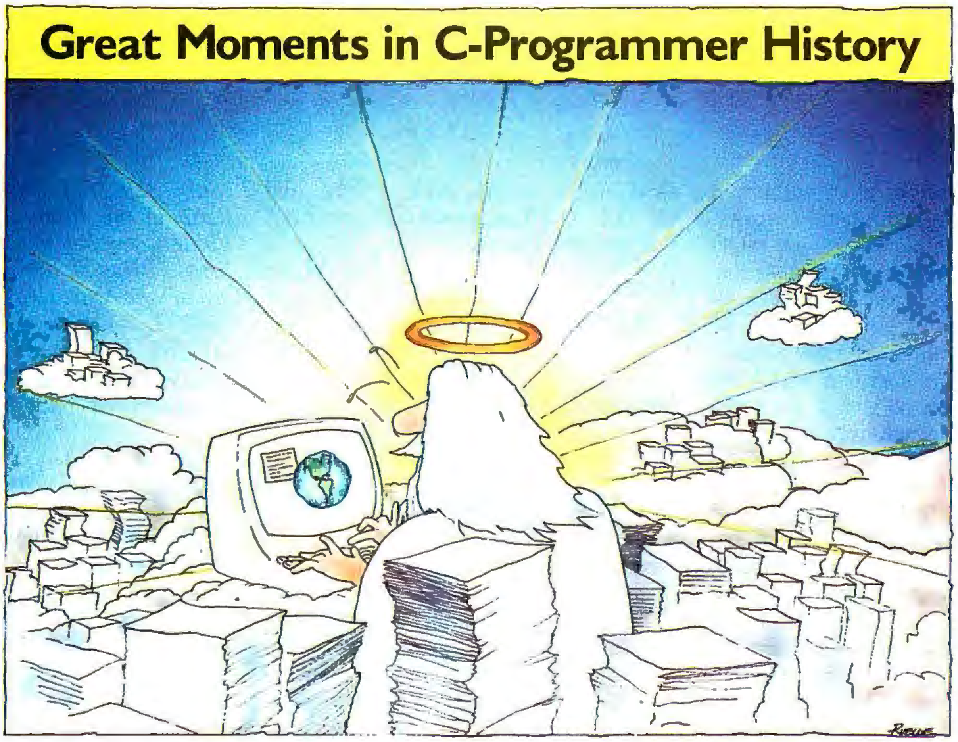

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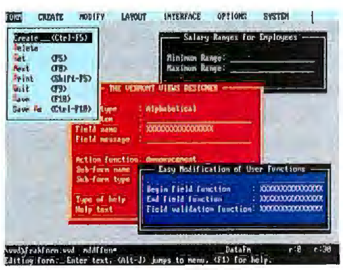

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for playwrights and for other authors of traditional copyright-protected works. Indeed, the great benefit of copyright protection for computer programs is that it subjects the rights and obligations of program authors to being sorted out under a framework that is a well-understood part of the society in which we live. That framework is not yet well-understood by many programmers, perhaps, but then that's why I wrote *Software, Copyright, and Competition*.

In one respect, Kenner's piece is part of the problem. Drawing an analogy between user interfaces and gear-shift patterns and dashboards throws the "look and feel" issue into a hardware context, where it does not belong. User interfaces are not like gear-shift patterns and dashboards. They are more like the conversation between Hamlet and his two friends, alluded to by Kenner: a predetermined dialogue, written in advance to be played out anywhere, at any time, but only according to the prescribed script. That users want to learn that script only once is no more surprising than that actors do not want their lines to change with each performance. It is certainly not an argument, though, for freezing the technology at today's levels by allowing unrestrained duplication. One universal truth about user interfaces is that they are not as good as they should be, and we should be encouraging innovation, not a form of expropriation.

Anthony L. Clapes
White Plains, NY

Hardware (the gearbox) is what you can handle; software (the H-pattern) is what you think your way into. So user interfaces are *like gear-shift patterns: They're what you get used to, never mind what hunks of iron are doing down under the floor. For you, "encouraging innovation" would force every car manufacturer to establish a different pattern, lest the inventor of the H-pattern sue him for pursuing "a form of expropriation."*
—Hugh Kenner

C Browser for 6.0

I read Jon Udell's Short Take on Microsoft C 6.0 (March) with great interest. However, I would like to point out that Sbrowse, our fully interactive source code browser, has been available since last year and does not have the major defect that Udell complained of; it works on compiled, uncompiled, or even uncompilable code, as well as on proqram fragments and complete programs. It works not only with C, but also with C++, Lex, and YACC. It works under DOS, Unix, Xenix, AIX, Ultrix, and HP-UX. And it integrates with any editor you're fond of using.

Ann Winter
Marketing Manager
Paul Siegel Computer Enterprises, Inc.
Port Jefferson, NY

Benchmark Silliness

The art of benchmarking marches on! Apropos of your groundbreaking BYTE On-Going Utility in Space (BOGUS) test suite (Stop Bit, April), I would like to inform you and the BYTE readership of a benchmark suite that I have just completed.

My extensive research has determined that the usual Whetstones, Dhrystones, and Rhealstones are simply not suitable metrics in many situations. My new suite is designed to test embedded microprocessors in automotive applications, and it generates statistics called Rhollingstones. The suite is currently optimized for vehicles with steel wheels. Other versions will be available "real soon now."

Barry Cohen
Brooklyn, NY

Attention, VGA Shoppers

Regarding the excellent article by Stanford Diehl and Howard Eglowstein ("A VGA on Every Desk," March), I have only this to say: Come on, fellows, give us a break.

I have been wanting to buy a monitor, so, armed with your recommendations, I began looking for the best place to make the purchase. Based on my search, I concluded that the best monitors are not even sold in this country.

To find the Mitsubishi XC1429CH and the Tatung CM-1296, I checked every advertisement in BYTE and other computer magazines without success. Several mail-order firms sold Mitsubishi monitors, but not that model. None sold Tatung monitors. I even tried phoning the toll-free number you listed for Tatung, but it had been disconnected. Where can I buy the two best monitors?

Frank M. Loos
Libertyville, IL

Mitsubishi's customer-support staff will provide names and telephone numbers of dealers selling the XC1429CH in your area. Dial the main number, listed in the Product Focus, or reach customer support directly by dialing (213) 217-5732. Mitsubishi does not have a toll-free number.

The toll-free number that we listed for Tatung has indeed been disconnected, but readers can locate dealers by calling (800) 829-2850 or the main number listed in the Product Focus. A call to Laser Computer at the number that we listed will put readers in touch with an operator who can locate dealers of the Laser 6448. Laser Computer does not have a toll-free number, but, fortunately for you, you and Laser Computer are within the same area code.—Stanford Diehl

I enjoyed "A VGA on Every Desk" immensely. It could not have come at a more perfect time. I was in the market to buy my first VGA monitor. The BYTE Lab's preciseness regarding detail is what computer engineers like me are looking for. With the never-ending flow of VGA monitors, we need all the information we can get. This is almost an impossible task, because most of us cannot afford a lab with all the test equipment required to analyze monitors.

There appears to be a conflict in figure 1 of the review, however. Diehl and Eglowstein state that the Quimax DM-3114 and the AST ASTCVGA posted the best convergence, but the figure shows that the Quimax and the CTX CVG-5432 have the best convergence. Which is correct?

Gerald L. Penhollow
Largo, FL

Unfortunately, the caption incorrectly identified the leaders in convergence precision. The CTX CVG-5432 was, in fact, second only to the Quimax DM-3114, as shown in the bar graph.—Stanford Diehl

The authors of "A VGA on Every Desk" seem to have confused pixels with phosphor dots. The article also suffers from confusion between the monitor and the display adapter, and between the format of the adapter and the resolution of the monitor.

The electron beams in a CRT are directed by the deflection yoke coils, which are driven by the horizontal and vertical oscillators. These oscillators are controlled by the synchronization signals from the display adapter. The electron beam draws lines across the face of the tube. It is only the modulation of the video signals by the display adapter that divides this line into pixels.

The article states, "If a monitor has fewer than 640 groups of RGB dots, a pixel will span more than one physical group, giving a grainy appearance. Generally, the closer together the phosphor dots are, the better the display."

These two sentences contradict each other. The smaller the dot pitch, the

continued

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—ROBERT KENDALL
PC MAGAZINE 12-26-89

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Circle 60 on Reader Service Card (RESELLERS: 61)

more RGB groups a pixel will span. If the pixel spans less than one group, the color resolution will be less than the pixel format, and small details and characters will vary in color. The phosphor dots are, by definition, the grain. The smaller the dot pitch, the less grainy the appearance. To be technical, the dot pitch is the distance between the centers of the dots.

Misconvergence is the failure of the red, green, and blue images to be in perfect registration (just like the color pictures in a magazine). The dots are arranged in hex packing, as follows:

```
R G B R G B R G B R G B R G B R G
 B R G B R G B R G B R G B R G B
R G B R G B R G B R G B R G B R G
 B R G B R G B R G B R G B R G B
```

As a result, it is impossible for the round beam to hit just three dots. For the same reason, there are no "adjacent groups." Note that the in-line tubes use exactly the same pattern and that the beam is still round in the in-line tube.

There are no dots that correspond to a pixel. If the electron beam fails to hit the intended RGB dots properly, the tube is defective, and convergence adjustments will not help. Convergence is the alignment of the red, green, and blue images; it has nothing to do with the phosphor dots on the screen.

Where did the 34-MHz figure come from? The IBM specifications list a pixel time of 39.72 nanoseconds (25.18 MHz) for the 640- by 480-pixel format. Since the horizontal line resolution is one-half the pixel rate, this corresponds to a frequency of 12.59 MHz. (This bandwidth would not be sufficient for the sharp display of characters.) Actually, the 720- by 400-pixel format has a higher frequency: 35.31 ns, 28.32 MHz, and 14.61 MHz, respectively. That's because this format runs at 70 frames per second.

As stated in the footnote to the chart on page 128, the scan rate of the VGA standard is 31.5 kHz. VGA monitors do not need to change their scan rates. CGA display modes are simulated by doubling the number of lines to 400. A resolution of 640 by 400 pixels uses the same pixel frequency as that of 640 by 480, but the frame rate increases from 60 to 70 Hz.

The VGA standard has only two, not three, vertical sync rates. However, there are three different vertical formats: 350, 400, and 480 lines.

James Tyrer
Green Valley, AZ

You're right. In this case, more is less. The sentence that you cited should read, "If a monitor has fewer than 640 groups of RGB dots, a pixel will span less than one physical group." Change that one word, and our next point follows logically: The closer together the phosphor dots, the better the display.

When we explained convergence, we used a reference figure of a single group of RGB dots for simplification. The actual number of phosphor dots that the beam illuminates depends on the monitor's dot-pitch specification. In any case, if the beam does not hit the proper dots precisely, you should retain the services of a qualified technician. A technician can make a number of adjustments to correct the problem. If anything, we oversimplified by grouping a set of possible alignment problems under the term "misconvergence."

The pixel terminology is debatable. We referred to a pixel as one of the 640 discrete points across the monitor. This division is a function of the adapter card, specified by the VGA standard to be 640. Therefore, it is significant to note how many phosphor dots reside within 1/640th of the horizontal line. After all, that is the size that the pixel will be once the adapter card divides the line. So, in the end, the number of dots within 1/640th of the line is the number of dots within each pixel. By calling the area a pixel before the adapter card makes the actual division, we may have jumped the gun a bit, if you'll pardon the pun.

—Stanford Diehl

ASK BYTE

A Temperamental Computer

I hope "The Heart and Soul of a PC Compatible" (April) was not an April Fool joke. I purchased a DTK PEM 2500 Cache 386-25 motherboard with 5 megabytes of 80-nanosecond RAM and a 64K-byte cache. My system also uses a WD1006V-MM2 hard/floppy disk drive controller, a Trident VGA1000 video board with 512K bytes, an NEC 3-D MultiSync monitor, 1.44-MB and 1.2-MB Teac floppy disk drives, and a Seagate 20-MB MFM hard disk drive. No printer or other peripherals are attached.

It will almost never run in the 25-MHz setting. It is configured to switch speeds with the software mode, but it usually hangs when in the 25-MHz setting. When I can get it to run in this setting, it is really a screamer, but it will usually only run in the simplest of tasks. I have tried two DOS versions with no change. When I switch to the hardware method of changing speeds, it's even worse, and it will not even boot in this mode most of the time.

A call to DTK's technical support in Miami was of no help. The technicians suggested that I change jumper W13 from 1-2 to 2-3, which slows the DMA and I/O clock, but this didn't help. The staff could offer no other suggestions. I suppose this is one of the penalties of setting up one's own machine, but this is my fifth one over the past several years, and the first real stumper.

T. L. Morgan
Land O' Lakes, FL

When you use the phrases "almost never run" and "usually only run," it makes me suspect that you have an intermittent hardware problem. I suggest that you completely disassemble your system and take a close look at the motherboard. Check the position of all the jumpers. Specifically, look at the jumper that selects whether you are using 256K-byte or 1-MB RAM chips. Then make sure that all the chips, the RAM single in-line packages, BIOS DIPs, and so on, are firmly seated in their sockets. Move every jumper slightly to ensure that they are making good electrical contact. If possible, test your RAM chips in another machine.

When you reassemble your system, take special care to prevent the board from shorting out to the case. Use nonmetallic washers or other insulating material at all the mounting points. Make sure that the connectors for the front panel (e.g., reset and turbo switches, turbo and hard disk drive LEDs) are connected properly.

If the trouble continues, it's probably a bad chip on the motherboard. I would continue to seek help from DTK technical support. There is a DTK BBS at (818) 333-6548; you can see if other owners have solved problems similar to yours.

—S. W.

A Slot Machine

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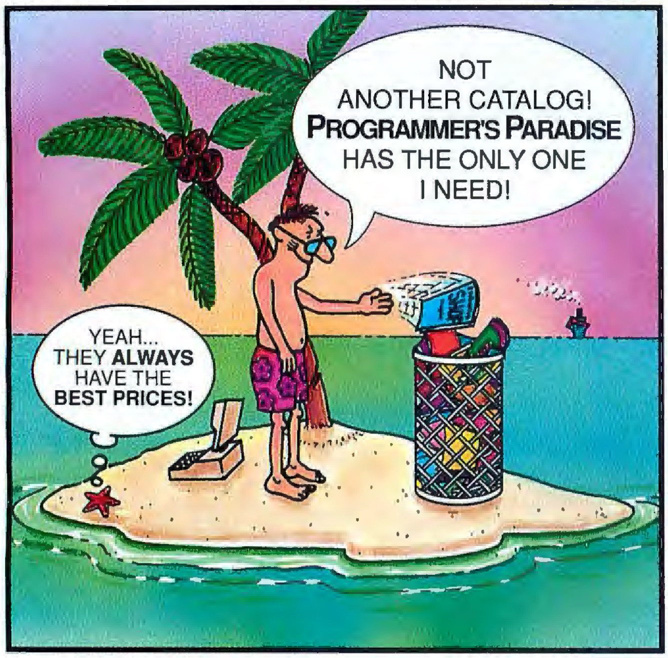

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disk drive (SyQuest Technology's SQ555, when it comes on the market in IBM-compatible form), a second video monitor for desktop publishing, perhaps a CD-ROM drive, and an external 3½-inch floppy disk drive. Since no manufacturer likes to use the first slot anyway—the one nearest to the power source (I wonder why?)—I'm fast running out of available slots.

I inquired about an exterior expansion chassis, but people tell me that there "ain't no such animal." Delving back into my old magazines, I found an ad from PC Horizons in Santa Ana, California, for just such a chassis for $450, and I distinctly remember another ad concerning the Butler expansion chassis, but I can't find that one anymore.

I suppose that a lot of other people have the same problem I do. Why doesn't anyone mention an external expansion chassis as a possible solution, or doesn't it work properly? If it does, where can I get a good one? It would help if you would mention more fax numbers for correspondence with your different services from other countries.

Paul Verbinnen
Winksele, Belgium

You appear to be bucking the trend toward smaller-footprint computers. There are indeed expansion chassis available for your AT. One source is Industrial Computer Source (4837 Mercury St., San Diego, CA 92111, (619) 279-0084, fax (619) 541-1138). The company offers a wide variety of chassis and computers suitable for industrial or heavy-duty use. Its 7600 Series of expansion chassis have both 12- and 15-slot XT/AT passive backplane buses, interface cards, and their own power supplies. This should give you enough slots to go wild.—S. W.

Proper Ground

What is the proper ground for a personal computer and its peripheral equipment? Should the electrical circuit for the computer equipment be grounded separately from the rest of the building's electrical system?

On farms, electrical systems often have a poor ground, and arc welders, electric fence chargers, and large motors share the same transformer with office equipment. What effect would that have?

Bruce Roorda
Craig, MO

The type of equipment that you mention could cause a host of problems for microcomputers hooked into the same line. Arc welders and motors, especially, are likely to generate potentially hazardous electrical noise.

You need to electrically separate the computer equipment from the heavy machinery at your site. An isolation transformer placed between the supply line and your computers is the proper device for this task. The transformer offers two benefits: It eliminates common-mode (neutral to ground) noise and cuts off high-frequency normal-mode (line to neutral) noise.

Isolation transformers are included in power-line conditioners, which also contain filter capacitors and metal-oxide varistors for additional normal-mode protection. You may want to shop around for a line conditioner to keep your equipment and data secure. For additional information, see "PC Power, Part 1: Power Protection" (October 1988 BYTE).—S. A.

Library in Your Pocket

Is there a directory of low-cost CD-ROMs? How can I obtain a list of possible applications for use at an elementary school?

Bob Kammer
Ledyard, CT

Contact the Bureau of Electronic Publishing (P.O. Box 43131, Upper Montclair, NJ 07043, (201) 746-3031) and request its latest catalog of CD-ROM titles. The list is quite extensive, and the cost of a given CD-ROM depends on the information it carries. Some of the CD-ROMs of public domain applications and data cost only $99.—R. G.

IBM-Compatible Security

In regard to the security software Empower I and II for the Macintosh (What's New Regional, April), does the same company offer similar software for the PC? Do any other companies offer such security software for PCs? My goals are to keep anyone from accessing my hard disk, to keep anyone from bypassing or terminating a batch file in operation, and to keep people from accessing hard disk files even if they boot from drive A (the floppy disk).

Amadeo M. Leira
Mamaroneck, NY

Magna Corp. does not make a PC version of Empower. Two products come to mind that would probably meet your requirements: PC Watchman (Harcom Security Systems Corp., 130 William St., New York, NY 10038, (212) 766-1802) and PC/DACS (Pyramid Development Corp., 20 Hurlbut St., West Hartford, CT 06110, (203) 953-9832). Both install directly on the hard disk drive, and after you enter your user name and password, the system grants you access to specific applications and subdirectories.

You or a system administrator decides who can access what information. Floppy disk drive boot protection comes from the software's cleverly modifying the standard partition table so as to fool a bootable DOS disk into thinking that you no longer have a hard disk drive.—H. E.

Around the World

I would like to know more about Tymnet and how to access the network in Europe. Could you print an address, fax number, or telex number so that I can get in touch with Tymnet myself? Also, could you please tell me more about BIX?

D. Lockey
Ugchelen, The Netherlands

You should be able to find out what sort of direct support Tymnet provides in The Netherlands by contacting BT Tymnet's Benelux Support Center in The Hague; the phone number is (31) 703-820-044.

If that route doesn't work, you could access Tymnet via Datanet-1, run by PTT-Telecom-BV. It can be reached through Telematics Systems and Services (P.O. Box 30150, 2500 GD's Gravenhage, The Netherlands).

Finally, if you want to know more about BIX, you'll find what you're looking for in any recent issue of BYTE. Just check the reader service box for the BIX listings in the table of contents.—R. G.

FIXES

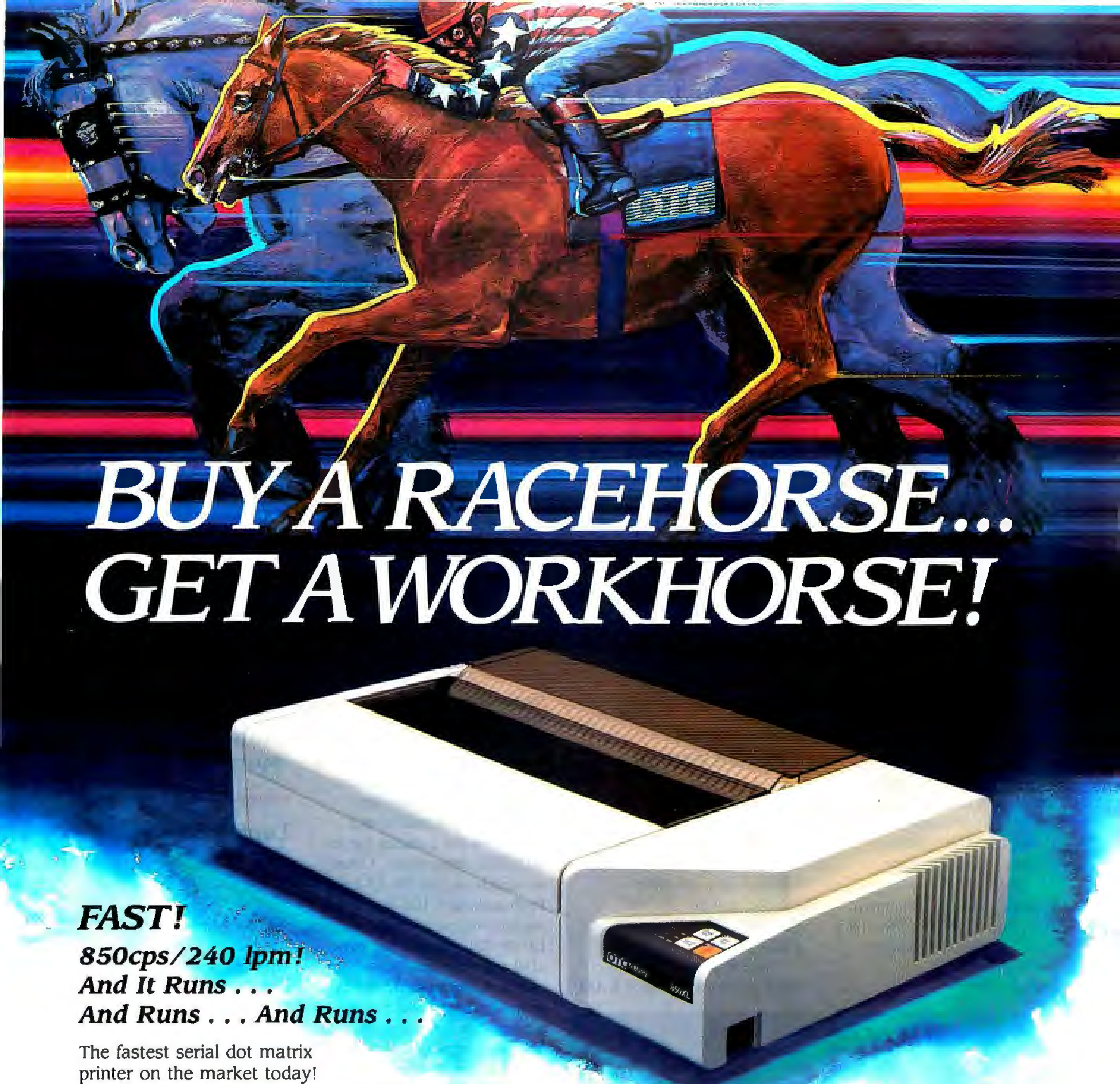
• The correct prices for the Amiga 3000 ("Commodore Sets Course for Multimedia," May) are $3299 for the 16-MHz version and $3999 for the 25-MHz version. Both models come with a 40-MB hard disk drive.

• The AST Premium 386/33 that was covered in "The Fast Keep Getting Faster" (May) had a 300-MB hard disk drive.

• The cumulative Unix benchmark index for the Personal Iris Turbo workstation ("Personal Iris: The Dream Maker," July) should be 14.2.

• HanZon Data, whose PostScript controller BYTE reviewed in the June issue ("Fast Fonts: PostScript Gets Turbocharged") has gone out of business.

• In the article "Consortia: High-Tech Co-ops" (June), photos 1 and 3 were inadvertently switched. ■



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486 Portable Packs a Powerful Punch

The 486 Super Portable from Bitwise weighs 22 pounds and runs at 25 MHz or, optionally, at 33 MHz. It includes 4 MB of RAM (expandable to 16 MB), a 64K-byte cache, VGA graphics (including a 10-inch monochrome gas-plasma monitor), and a 3½-inch internal 212-MB hard disk drive with its own Intelligent Drive Electronics controller. The system measures 16 by 9½ by 8 inches.

Also standard are your choice of a 5¼- or 3½-inch high-capacity floppy disk drive (only one will fit), and a 200-W power supply.

Price: 25-MHz system, $9995; 33-MHz system, $11,995.

Contact: Bitwise Designs, Inc., 701 River St., Troy, NY 12180, (800) 367-5906 or (518) 274-0755.

Inquiry 1120.

The Bitwise 486 Super Portable features VGA graphics, enough RAM for Unix, and more hard disk storage than some file servers.

Fora Shows Line of Laptops

A new company called Fora has introduced a line of low-priced laptops that includes the LP-386SX, a full-featured 16-MHz 386SX, and the LP-286L, a 12-MHz 286 with backlit CGA graphics.

The LP-386SX features VGA graphics, 1 MB of RAM (expandable to 4 MB with a proprietary add-in card), a 3½-inch 1.44-MB floppy disk drive, and either a 40- or a 100-MB internal 28-ms hard disk drive. For expansion, there's an open half-length 16-bit slot and a socket for an 80387SX coprocessor. Other standards include the 85-key keyboard and a 100-W power supply. For peripherals, the LP-386SX includes one parallel and two serial ports, one external display port, one external keyboard connector, and a connector for an external 5¼-inch floppy disk drive. The LP-386SX weighs 15⅗ pounds and measures 14⅘ by 13½ by 3⁷⁄₁₀ inches.

The LP-286L comes with a 10¾-inch display, a high-capacity 3½-inch floppy disk drive, your choice of internal hard disk drives, and room for two half-length cards, one 8-bit and one 16-bit. Other standards include 1 MB of RAM (expandable to 5 MB with a proprietary card), an 82-key keyboard, an AC adapter, a 2½-hour internal battery, and a carrying case. You can add peripherals through one parallel and two serial ports, the external display port, and an external keyboard port. The LP-286L measures 12¾ by 16¹⁄₁₀ by 3¹⁄₁₀ inches and weighs 14 pounds.

MS-DOS 4.01 and GW-BASIC are standard on both systems.

Price: LP-386SX: with 40-MB hard disk drive, $4695; with 100-MB hard disk drive, $5055; LP-286L: with 20-MB hard disk drive, $3495; with 40-MB hard disk drive, $3595.

Contact: Fora, Inc., 3081 North First St., San Jose, CA 95134, (800) 367-3672 or (408) 944-0393.

Inquiry 1123.

Fora's LP-386SX laptop features VGA graphics, floppy and hard disk drives, and a half-length expansion slot.

Laptop SX Features Backlit VGA and Two Disk Drives

The Altima NSX is a 9³⁄₁₀-pound 386SX computer with an internal 20-MB hard disk drive, an internal 3½-inch 1.44-MB floppy disk drive, and a 10⅗-inch backlit VGA display.

The basic system comes with 2 MB of RAM (expandable to 8 MB), one parallel port, two serial ports, a 2400-bps internal modem with send-fax capabilities at up to 4800 bps, an 83-key keyboard, and an external keyboard port. Access time on the 2½-inch hard disk drive is 28 ms. The internal battery will last 1½ hours. System dimensions are 14⅕ by 11 by 2⁷⁄₁₀ inches. DOS 4.01 and GW-BASIC are included.

Price: $4999.

Contact: Altima Systems, Inc., 1390 Willow Pass Rd., Suite 1050, Concord, CA 94520, (800) 356-9990 or (415) 356-5600.

Inquiry 1122.

A Laptop-Size Removable Hard Disk Drive

The RHD 20 is a 20-MB 23-ms hard disk drive for your laptop, portable, or desktop system in a package about the size of a deck of cards. Despite its size (3⅕ by 5 by ⅗ inches), the RHD 20 has its own controller circuitry that connects to a laptop's internal Intelligent Drive Electronics port. Power consumption is rated at less than a watt, and a sleep mode reduces it to about 50 mW, Disk Technologies says.

A key feature is the RHD 20's optional docking bracket that lets you use the 7-ounce drive in another laptop or in your desktop system. Or you can simply remove the drive from your system and lock it up for security. Data transfer is rated at 5 Mbps.

Price: Drive, $595; docking bracket, $50 to $100.
Contact: Disk Technologies Corp., P.O. Box 1750, Winter Park, FL 32789, (407) 645-0001.
Inquiry 1125.

Disk Technologies' RHD 20 is a 20-MB removable hard disk drive that's fast and uses little power.

Pioneer Claims First Rewritable WORM

Pioneer says that its new optical drive supports both WORM (write once, read many times) and rewritable (magneto-optical) standards in a single package.

The DE-S7001 (external) and the DE-U7001 (internal full-height 5¼-inch) use an International Standards Organization standard called sampled servo, which is slightly different from the more popular ISO continuous composite servo format, Pioneer says. Continuous composite servo format has tracks imprinted on the disk; sampled servo writes tracks itself.

Both SCSI drives work with Pioneer's currently available WORM disks and its 5¼-inch magneto-optical erasable media. Interface kits are included for your choice of XT, AT, Micro Channel, and Macintosh systems.

Price: DE-U7001, $4495; DE-S7001, $4695; magneto-optical disk, $250; WORM disk, $145.
Contact: Pioneer Communications of America, Inc., Optical Memory Products Division, Sherbrooke Plaza, 600 East Crescent Ave., Upper Saddle River, NJ 07458, (201) 327-6400.
Inquiry 1127.

High-Performance LED Printer Upgrades Easily

The OkiLaser 800 is a low-priced 8-ppm parallel or serially connected LED printer that comes with 26 resident fonts in four typefaces. And you can upgrade it to use an Adobe PostScript interpreter.

Standard emulations include Hewlett-Packard LaserJet II, Diablo 630 ECS, and IBM Proprinter. Font slots let you add (optionally) from Okidata's type library. Memory is standard at 512K bytes and is expandable to 4.5 MB.

Optional equipment includes a second 200-sheet paper tray and serial and parallel multiport adapters (only one will work at a time) that can each serve up to three PCs. The OkiLaser 800 measures 8½ by 17⁷⁄₁₀ by 17⁷⁄₁₀ inches and weighs 37 pounds.

Price: $1795.
Contact: Okidata, 532 Fellowship Rd., Mount Laurel, NJ 08054, (800) 654-3282 or (609) 235-2600.
Inquiry 1129.

Small Backup System Stores 300 MB on a QIC

The CoreTape Light is a QIC-80 tape drive that fits in your 3½-inch disk drive bay and lets you back up 300 MB of data in about 1¼ hours. You can extend the standard 80-MB tape capacity to 120 MB by buying longer tapes (and a proprietary data compression algorithm lets you extend the 120 MB to 300 MB).

You connect CoreTape Light to a standard floppy disk drive controller. Included software lets you initiate disk drive backup in just two keystrokes. Other software features include file management and scheduled unattended backup.

Price: $545; pack of five 80-MB cartridges, $225; five 120-MB cartridges, $269.
Contact: Core International, 7171 North Federal Hwy., Boca Raton, FL 33487, (407) 997-6055.
Inquiry 1128.

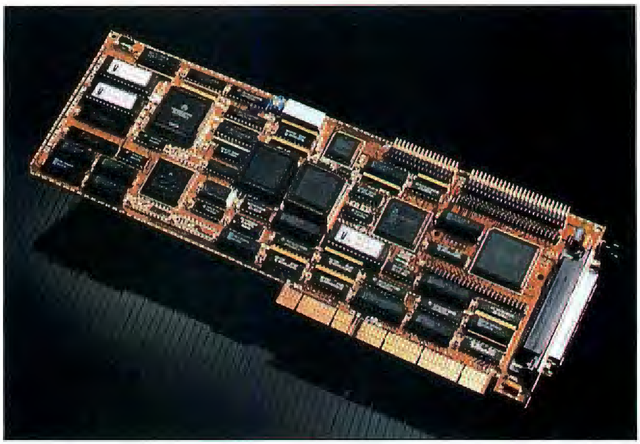
SPREAD THE WORD

Your new product is important to us. Please address information to New Products Editors, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Better yet, use your modem and mail new product information to the microbytes.hw or microbytes.sw conferences on BIX. Please send the product description, price, ship date, and an address and telephone number where readers can get more information.

continued

More Non-Macs Join the SCSI Bandwagon

New SCSI controllers from Distributed Processing Technology and Ciprico offer multiplatform support and high performance for disk-intensive applications.



DPT's SCSI controllers are ready for DOS, OS/2, and Unix.

DPT's SmartConnex/ISA and SmartConnex/EISA both feature low-cost SCSI support for DOS, OS/2, and Unix without special software drivers or BIOS ROMs. Additional drivers are available for these operating systems to support tape drives and optical drives. The 16-bit and 32-bit boards can run disk drives without drivers because of an on-board WD1003 interface that makes any SCSI drive appear to be a standard disk drive, DPT says.

Each SmartConnex/ISA features a 68000 CPU for data transfer at up to 4 MBps. The SmartConnex/EISA, which also has a 68000 CPU, features data transfers typically at 16.5 MBps and in burst mode at up to 33 MBps.

Optional equipment on each board is a connector for a floppy disk drive.

Price: ISA, $330; ISA with floppy disk drive connector, $365; EISA, $655; EISA with floppy disk drive connector, $715.

Contact: Distributed Processing Technology, 132 Candace Dr., Maitland, FL 32751, (407) 830-5522.

Inquiry 1131.

Ciprico's Rimfire 5500 is a 16-bit high-performance SCSI adapter that's ideal for Unix and NetWare 286 file server applications, the manufacturer claims.

It comes with an 80186 microprocessor, an NCR 53C94 SCSI controller chip, and dual-ported static RAM (for SCSI commands and scatter/gather tables). Included software provides optional algorithms for sorting, combining, and reordering commands.

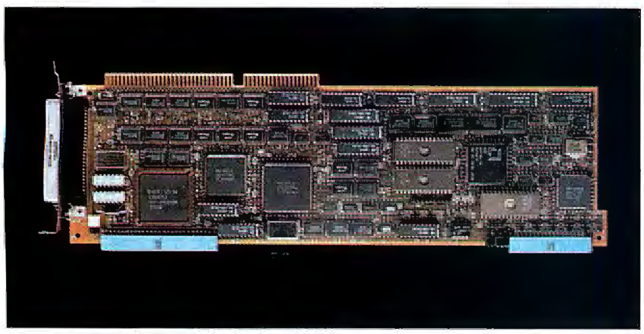
On Unix systems, sequential data transfers can be sustained at over 900K bytes per second with some drives, Ciprico says. The Rimfire 5500 generally supports bus-master DMA at up to 10 MBps and slave DMA at 1 MBps. Multithreading and multitasking allow simultaneous processing of multiple requests. In target mode and with additional applications software, Ciprico claims that the Rimfire 5500 supports host-to-host data transfers at up to 5 MBps over the SCSI bus. Asynchronous SCSI transfers are rated at up to 2 MBps, and synchronous transfers are rated at up to 5 MBps.

EEPROM and a software configuration utility eliminate the need for the Rimfire 5500 to have jumpers. A BIOS EPROM lets you boot DOS off the SCSI disk drive. An on-board floppy disk drive port and included cable let you use Rimfire as a controller for one floppy disk drive.

Price: $795; host-to-host software, under $400.

Contact: Ciprico, Inc., 2955 Xenium Lane, Plymouth, MN 55441, (612) 559-2034.

Inquiry 1132.



Ciprico's Rimfire 5500 is optimized for Unix and NetWare.

Capture Color Video for Computer Display

ComputerEyes is a two-thirds-length low-priced video digitizer that offers 640- by 480-pixel image capture from any Super-VHS or Hi-8 camcorder or VCR at up to 24-bit (16-million-color) palette depth. Then you can display the images on CGA, EGA, VGA, or Super VGA graphics systems.

Full 24-bit color is available in TIFF and Targa format; ComputerEyes also supports PCX, IFF, Targa TGA, ColorRix, and Windows. Or you can digitize 8-bit gray scale from up to 256 gray levels.

Other features include simultaneous capture and display; a live-image preview mode to frame, focus, and adjust color and intensity balance before capturing; and menu-driven software. The minimum system configuration is an XT with 640K bytes of RAM, a 5¼-inch floppy disk drive, and DOS 2.1.

Price: $449.95.

Contact: Digital Vision, Inc., 270 Bridge St., Dedham, MA 02026, (617) 329-5400.

Inquiry 1133.

High-Performance Control with RISC System/6000

To help you make the most of your new IBM RISC System/6000, National Instruments offers the GPIB-6000, an IEEE-488 and general-purpose interface bus interface kit. It consists of the Micro Channel architecture board and a software driver.

Features include a Talker/Listener/Controller capability with the NEC μPD7210 GPIB chip, FIFO buffers for high-speed DMA transfers, 1-MBps GPIB reads, 700K-byte-per-second GPIB writes, and circuitry for selecting I/O address (interrupt level) and DMA channel (without hardware jumpers or switches).

Price: $1295.

Contact: National Instruments, 6504 Bridge Point Pkwy., Austin, TX 78730, (800) 433-3488 or (512) 794-0100.

Inquiry 1134.

continued

DBMS Case Study:

Security for the Goodwill Games™*

The Problem

The 1990 Goodwill Games: 2500 athletes in 22 events at 15 locations, drawing hundreds of thousands to watch them perform. A show-place for international good-will. A potential target for terrorists. A challenge for security agencies.

With only 3,000 off-duty officers to fill 30,000 assignments, there's no room for confusion in scheduling. And scheduling must respond to last minute changes, as event times slip, as dignitaries arrive on short notice, or as threats arise. Hand-scheduling can't meet the challenge. But the Games' Integrated Police Planning Group (IPPG) found that no automated system had ever been developed for securing such events.

The Application

Automated Manpower On-line Scheduling (AMOS) matches personnel to scheduling requirements, taking into account special training, language skills, and other factors. AMOS prepares an assignment sheet for each individual, explaining the assignment, when and where to report, how to get there – even where to park.

AMOS responds to changes quickly. The database is large and complex, yet thanks to the innovative combined technology of the underlying db_VISTA database engine, search, match, and update times are negligible. Data integrity is assured by avoiding data redundancy. That means the information is reliable.

Command center personnel can adjust schedules without delay or confusion, thanks to db_VISTA III's ability to handle large volumes of data with speed and accuracy.

The Solution

AMOS was created by Raima's services subsidiary, Vista Development Corp., using the db_VISTA III DBMS. "We looked for months for a database that was fast, flexible, and could handle a huge volume of data while still maintaining speed," said Sgt. Alan Bernstein of the IPPG. "We also wanted to find a company that could not only furnish the product, but provide the development services." They discovered Raima and db_VISTA III.

Your end users may not be fighting terrorists, but they still need fast, reliable information to get their jobs done. If you develop applications for MS-DOS, MS Windows, UNIX, QNX, OS/2, VMS, Macintosh, and other environments, db_VISTA III is the solution.

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Build a Smart Home with the Solus Computer

If you're not a programmer yet want to manage your home's temperature and humidity and also set up sensors and an alarm to alert you to intruders, the Solus Control Computer may be the help you need. You manage it with DOS-compatible software through your XT's serial port, and it can control a large number of sensors and instruments in a single home.

The Solus Control Computer has a 16-bit 6-MHz 64180 processor (Z80-compatible) system, its own power (12-V DC and AC adapters), memory, and clock, and a plethora of I/O ports: 14 analog inputs, eight digital inputs, four pulse counters, one accumulator counter, eight digital outputs, and an X-10 power-line interface.

The X-10 interface lets you automate control of as many as 256 lights and appliances. In the Solus Control Computer kit, you get a cable, one X-10 transceiver (which transmits high-frequency signals over AC wiring), and a receiver module to control one appliance.

Pull-down menus and icons from about 200K bytes of DOS-compatible software let you "write" programs. The Solus Control Computer also includes a second serial port to link Control Computers, even over a wide area with modems. You can theoretically join 256 Control Computers, each monitoring a variety of conditions.

System standards include an 87-Hz 10-bit A/D converter subsystem, EPROM firmware, a real-time clock, and 32K bytes of static memory, 24K bytes of which is available to store collected data. The 10-bit A/D subsystem offers 1-in-1024 step resolution for input signals and a minimum resolvable signal size of 1 mV. In the initial release, the maximum sampling rate (chosen through the software) is 87 samples per second, per channel.
Price: $1795.
Contact: Solus Systems, Inc., 4000 Kruse Way Place, Building 2-285, Lake Oswego, OR 97035, (800) 247-5712 or (503) 635-3966.
Inquiry 1137.

The Solus Control Computer and an XT can control your home's temperature and security systems, plus a whole lot more.

Analyze Substances with a PC

The RTI-870 is an 8-bit add-in board that transforms your PC into a high-resolution chromatography workstation for your laboratory. You use it to identify elements within materials.

In its basic form, you can use the RTI-870 to simultaneously record data from up to four chromatographs. Its 22-bit (0.25 parts per million) A/D converter automatically samples signals at up to 20 times per second, with a maximum integral nonlinearity of 0.5 ppm and 2 μV of noise. Software-programmable gain, from Laboratory Technologies' data acquisition software, allows input scaling from $\pm$5 V to $\pm$100 mV, selectable each time a reading is taken.

Options include Laboratory Technologies' Chrom software for manipulating raw laboratory data, a screw terminator for analog input channels or TTL-compatible digital I/O lines, and a relay backplane for increasing input capabilities to 16 channels.
Price: $1795; Chrom software, $495; screw terminator, $295; backplane, $139.
Contact: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062, (800) 426-2564 or (617) 461-3375.
Inquiry 1139.

Print Four Times Faster

The TigerCub laser printer controller, with TigerJet software, can speed printing by as much as 400 percent, the manufacturer claims.

The controller is an 8-bit card that is said to work with most laser printers, including those made by Hewlett-Packard and Canon. TigerJet software includes printer drivers for Windows, GEM, Ventura Publisher, and HP Printer Control Language applications. System requirements are DOS 2.0 or higher and at least 640K bytes of RAM and 2 MB of EMS memory.
Price: $595.
Contact: Advanced Vision Research, Inc., 2201 Qume Dr., San Jose, CA 95131, (408) 434-1115.
Inquiry 1138.

Speak Computer Commands Instead of Typing

The Micro IntroVoice hand-held voice-recognition system is designed for applications that require—or could be helped by—hands-free computer input and text-to-speech voice output. It's compatible with most operating systems by way of its serial interface.

This voice-recognition device includes an 8-MHz V25 microprocessor, 128K bytes of RAM, and system software that automatically recognizes 21 voice commands.
Price: $995.
Contact: Voice Connexion, 17835 Skypark Cir., Suite C, Irvine, CA 92714, (714) 261-2366.
Inquiry 1140.

continued

INSTANT MAINFRAME. JUST ADD SCO.

Not too long ago, a few dozen people sharing the same programs, resources, and information on a single computer at the same time meant only one thing—a mainframe.

Powerful, big, expensive, and proprietary.

More recently, the same people could be found doing exactly the same things—simultaneously sharing programs, resources, and information—on a minicomputer.

A lot cheaper, a lot smaller, yet powerful enough to do the same jobs. And just as proprietary.

Then along came the latest generation of personal computers. And now, the same people are more and more likely to be found doing exactly the same things—simultaneously sharing programs, resources, and information—on a PC.

And not a whole officeful of PCs networked together, either, but *a single PC powering the whole office at once.*

A *lot* cheaper, a *lot* smaller, yet still easily powerful enough to do the same jobs. Built to non-proprietary, open system standards that allow complete freedom of choice in hardware and software.

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The Santa Cruz Operation, Ltd., Croxley Centre, Hatters Lane, Watford WD1 8YN, United Kingdom, +44 (0)923 816344, FAX: +44 (0)923 817781, TELEX: 917372 SCOLON G

Today, SCO UNIX System solutions are installed on more than one in ten of all leading 386 computers in operation worldwide.

Running thousands of off-the-shelf XENIX® and UNIX System-based applications on powerful standard business systems supporting 32 or even more workstations—at an unbelievably low cost per user. And with such blazing performance that individual users believe they have the whole system to themselves.

Running electronic mail across the office—or around the world—in seconds.

Running multiuser PC communications to minis and mainframes through TCP/IP and SNA networks.

And doing some things that no mainframe—or even DOS- or OS/2™-based PC—ever thought about, such as running multiple DOS applications. Or networking DOS, OS/2, XENIX and UNIX Systems together. Or running UNIX System versions and workalikes of popular DOS applications such as Microsoft® Word, 1-2-3®, and dBASE III PLUS.®

Or even letting users integrate full-featured multiuser productivity packages *of their choice* under a standard, friendly menu interface.

Today's personal computer isn't just a "PC" anymore, and you can unleash its incredible mainframe-plus power for yourself—today.

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Circle 237 on Reader Service Card

Diskless and Not-So-Diskless LAN Workstations

Compaq, Emerald, and Unisys have recently introduced space-saving LAN workstations that feature VGA graphics and 286 CPUs.

Compaq says that its Deskpro 286n and 386n (which have 12-MHz 286 and 16-MHz 386SX CPUs, respectively) are designed to coexist with the company's LAN servers (and other servers) and double as stand-alone PCs.

The Deskpro 386n comes diskless with 1 MB of RAM (expandable to 16 MB), an embedded VGA controller, a graphics accelerator, a keyboard, and room for three one-third-height disk drives, a proprietary memory card, and two full-length 16-bit cards. The diskless Deskpro 286n has the same features except that its RAM limit is 13 MB.

Options include floppy disk drives, 40-MB hard disk drives, a 2400-bps modem, a 14-inch monochrome or color VGA monitor, and MS-DOS 3.3 or 4.01 or OS/2 1.2. The 15- by $3\frac{9}{10}$- by $14\frac{9}{10}$-inch chassis encloses a 90-W power supply and a dual-speed fan.
Price: 286n, $1699; 386n, $2299.
Contact: Compaq Computer Corp., 20555 FM 149, Houston, TX 77070, (800) 231-0900.
Inquiry 1143.

Emerald's LANstation II is a diskless workstation for your ARCnet, Ethernet, or Token Ring LAN that features a 12.5-MHz or, optionally, a 16-MHz 286 microprocessor, and 1 MB of RAM (upgradable to 4 MB).

The 12- by 12- by 2-inch chassis supports the motherboard with one half-length add-in slot to hold a networking card. Ports include two serial, one parallel, one for VGA graphics (a monitor is optional), and one for the included 101-key keyboard. The chassis also supports one 3½-inch floppy disk drive and one 40-MB hard disk drive (both are optional).
Price: ARCnet, $995; Ethernet, $1095; Token Ring, $1295; add $200 for 16-MHz; floppy disk drive, $100; hard disk drive, $500.
Contact: Emerald Computers, Inc., 7324 Southwest Durham Rd., Portland, OR 97224, (800) 321-5711 or (503) 620-6094.
Inquiry 1144.

The Unisys PW^2 LAN workstation fits on the back of its accompanying monitor, out of your way.

Unisys designed its PW^2 LAN workstation, a diskless 10-MHz 286, to hang off the back of its 14-inch monochrome VGA monitor like a 1-inch-thick package of letter-size (8½- by 11-inch) paper.

Its standard configuration includes a 101-key keyboard, 1 MB of RAM (upgradable to 5 MB), a Microsoft Mouse, a NetWare 286 driver, DOS 4.01, Windows/286, a serial port, a parallel port, and an Ethernet adapter card for thick and thin coaxial cabling.
Price: $2395.
Contact: Unisys Corp., P.O. Box 500, Blue Bell, PA 19424, (800) 448-1424.
Inquiry 1145.

Microcom Offers Low-Priced Cellular Modem

Microcom provides a power inverter in its MNP cellular modem to give you data communications from your car's cellular phone at rates as high as 12 Kbps. All you need to add is a $500 data port for the phone.

Two models are available: the C-96 for the central site (typically the receiving end) and the M-96 for automobiles. The high data rates are achieved with a modified 2400-bps (V.22bis) modem that packs 5 instead of 4 bits per baud for 4-Kbps rates, Microcom says. Microcom adds its seventh Networking Protocol (MNP 7), a compression algorithm, which typically triples the 4-Kbps transfer rate.

The company also provides its MNP 10 protocol, which drops data rates as lines get noisier and raises them again when the line noise disappears.
Price: C-96, $899; M-96, $999.
Contact: Microcom Systems, Inc., 500 River Ridge Dr., Norwood, MA 02062, (800) 822-8224 or (617) 551-1000.
Inquiry 1142.

Low-Priced LAN Administration

LAN Command is LAN management software that combines database management with low-level network analysis. It occupies about 350K bytes on the server plus 512K bytes per LAN node. You must load NetBIOS on all the workstations, or you can use NetWare's IPX protocol.

The relational database system tracks node data (including user name, location, phone number, address, and node name) and more than 50 additional fields. Portions of the database are populated automatically by the network monitoring commands to build a traffic history for every node.

A report generator provides standard and custom reports using Boolean operators on any field in the record. For example, the administrator might request a custom report for every Ethernet node on the fourth floor that uses the server named Accounting and has rebooted more than five times in the last week.

Other monitoring features include packet activity, collisions, ring faults, bridge failures, router failures, bandwidth use, traffic errors, and data loss. And you can monitor single stations, sets of stations, or the entire network across bridges and routers from any single DOS or OS/2 workstation.

A TSR program called Snooper lets you perform remote administration of the client computer.
Price: $395 per administrator.
Contact: Dolphin Software, Inc., 6050 Peachtree Pkwy., Suite 340-208, Norcross, GA 30092, (404) 339-7877.
Inquiry 1146.

continued

We've got a new 2MB W.O.R.M.

Now we're fishing for ideas from you.

Introducing the Optical Card, the remarkable new personal data storage and retrieval medium from Canon. An IBM AT-compatible RW-10 Reader/Writer uses a laser to read and write up to two Megabytes of digitized text, graphics or sound on the Optical Card (shown here actual size). Data can be added, but not erased, and isn't susceptible to magnetic or electrostatic fields.

The Optical Card and RW-10 combine speed, high reliability and convenience that just cry out for the development of entirely new systems applications. And that's where you come in.

Don't let this "big one" get away. Find out more about the Optical Card by calling Bruno Dosso at Canon at 516-488-6700.

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Canon

Circle 47 on Reader Service Card

CONNECTIVITY

Brainstorm Gets LAN Users Talking

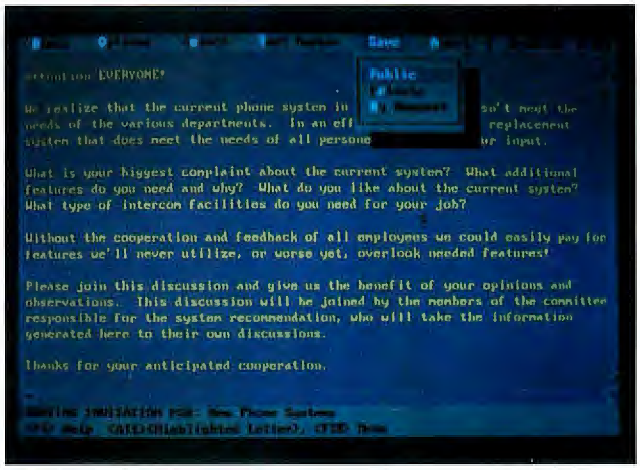
Brainstorm 2.0 is a LAN program designed to encourage group discussions. It lets you respond to any number of defined topics in an organized manner, as if you were sitting at a round-table discussion.

An opening message invites everyone to join a topic discussion. Once you've selected a topic, you're shown all the messages in that topic in order of their entry. You add to the conversation by replying to any message in the topic. Brainstorm incorporates a "quoted reply" feature that lets you move phrases from the original message into the reply, allowing you to follow the thoughts of the other topic members.

The program supports public and private discussions, plus a third type of topic that lets a topic author share an invitation message with everyone but allow only selected users to join the discussion. An interested user reads the invitation and requests permission from the author to access the private topic. You can also send private messages to each other in the traditional E-mail fashion.

An Application Menu choice on the main menu allows the LAN administrator to attach other application programs and list them on the menu for direct selection. This lets you access applications directly from the Application Menu and return to Brainstorm when finished.

Brainstorm runs on the IBM PC with 448K bytes of RAM. You can load it as a pop-up TSR program, and it occupies only 6K bytes. Network compatibility includes Novell, Banyan Vines, 3Com, and any network that supports NetBIOS or DOS 3.x file and record locking via share command.



Brainstorm 2.0 promotes round-table discussions on your LAN.

Price: 25-user version, $349; unlimited-user version, $699.
Contact: Mustang Software, Inc., P.O. Box 2264, Bakersfield, CA 93303, (800) 999-9619 or (805) 395-0223.
Inquiry 1148.

A Low-Cost Alternative to Link Computers

TransFarNet is an external unit that connects up to six personal computers at data rates of up to 115,000 bps and at distances of up to 500 feet. You use a free serial port on each computer and cables with RJ-11 connectors to plug into TransFarNet.

The basic package, which is designed only for simple file transfer, comes with four 50-foot lengths of unshielded twisted-pair cabling. TransFarNet is compatible with LapLink, LapLink Mac, DeskLink, Hot Wire, Brooklyn Bridge, and FastLynx.
Price: $395.
Contact: Western Telematic, Inc., 5 Sterling, Irvine, CA 92718, (800) 854-7226 or (714) 586-9950.
Inquiry 1150.

Protect Your Memory Within NetWare 386

NLM-Check and NetCheck are software utilities for application developers and NetWare 386 users, respectively, who are concerned about applications crashing workstations, servers, or each other.

Both are essentially NetWare 386 versions of Bounds-Checker, a programmers' utility for checking DOS-application memory accesses. While Bounds-Checker automatically diagnoses out-of-bounds memory accesses by DOS—memory that's not legally within the limits set by DOS for that application—NLM-Check automatically detects out-of-bounds memory accesses by NetWare 386 applications.

NetCheck 1.0 write-protects all executable code on the NetWare 386 server. If a server task or driver corrupts this code, NetCheck displays a warning message on the system's console.

NetCheck also contains a performance-monitoring NLM that you can access to display statistics on each NLM's use of the processor; it provides data on the longest time slice and the average time slice of each NLM.

Price: NLM-Check, $499; NetCheck, $299.
Contact: Nu-Mega Technologies, P.O. Box 7607, Nashua, NH 03060, (603) 888-2386.
Inquiry 1149.

NCR Card, OS/2 Software Turn PC into ISDN Station

The NCR ISDN Workstation includes a PC Terminal Adapter, or PCTA (the digital equivalent of a modem), OS/2 1.1, and an OS/2 Presentation Manager voice-mail application.

This 16-MHz 386SX machine is designed for the evolving digital telephone system called ISDN, which features simultaneous voice and data communications over a 144,000-bps line (with three digital channels limited to 64,000, 64,000, and 16,000 bps) rather than today's more common analog telephone line, which is limited to voice-only or data-only communications at a maximum rate of 9600 bps (without compression).

Standard versions of NCR's ISDN Workstation include 5 MB of RAM, a 40-MB hard disk drive, a VGA controller and monitor, and a mouse.

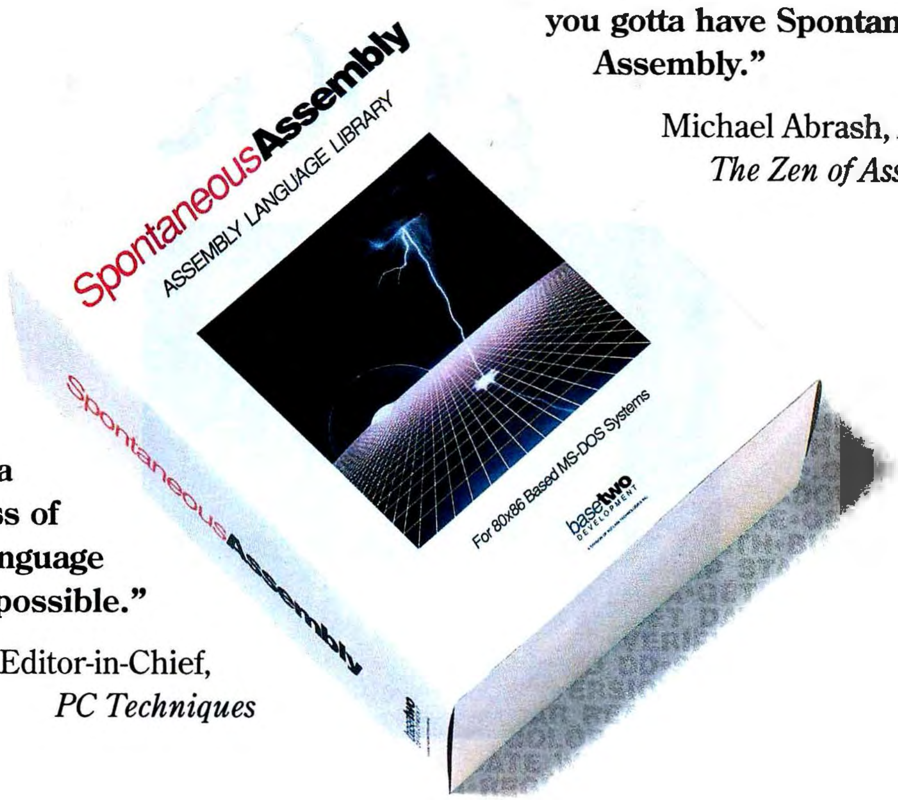
Basic to the system is the PCTA, a full-length 16-bit add-in board with an 80188 microprocessor.

Voice-mail software called Voice Data Manager includes a dialing directory for outgoing voice/data calls and a digital answering machine.
Price: ISDN Workstation, $7795; PCTA, $1695; Voice Data Manager, $195.
Contact: NCR Corp., Customer Service, P.O. Box 2989, Norcross, GA 30091, (800) 544-3333.
Inquiry 1151.

continued

"If you program in assembly language, you gotta have Spontaneous Assembly."

Michael Abrash, Author of *The Zen of Assembly*



"Spontaneous Assembly makes a whole new class of assembly language applications possible."

Jeff Duntemann, Editor-in-Chief, *PC Techniques*

Serious Assembly.

Nobody really takes assembly language seriously. Nobody, that is, except Lotus, WordPerfect, Novell, and everyone else who needs the tightest, fastest code possible.

But assembly is tough...unless you have plenty of ready-to-use assembly language routines at your fingertips. That's why industry leaders spend a lot of time and money creating their own, proprietary assembly language libraries.

You could spend your valuable development time building a library; or you can use **Spontaneous Assembly**, the complete **assembly language library** specifically designed for serious assembly language development.

Over 700 functions and macros.
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Tight, fast code. Fast.
Every routine is hand-coded and hand-optimized (in assembly, of course). And a consistent, register-oriented parameter-passing convention makes these routines remarkably easy to use. With Spontaneous Assembly, coding in assembly is as fast as coding in a high-level language—without the overhead.

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Spontaneous Assembly unleashes the full power of memory models in assembly language. It supports all Microsoft/Borland standard memory models as well as custom models and mixed-model programming. And it gives you complete control over segment/group names and attributes.

Complete documentation.
A 750 page reference manual describes every function, macro, and variable in detail. Step-by-step instructions and technical notes explain memory models, library customization, integration with C, and much more.

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basetwo DEVELOPMENT

For 80x86-based systems running DOS 2.0 or later. MASM 5.1 or TASM recommended.
Base Two Development • A Division of Acclaim Technologies, Inc. • 11 East 200 North • Orem, Utah 84057 • (801) 222-9500
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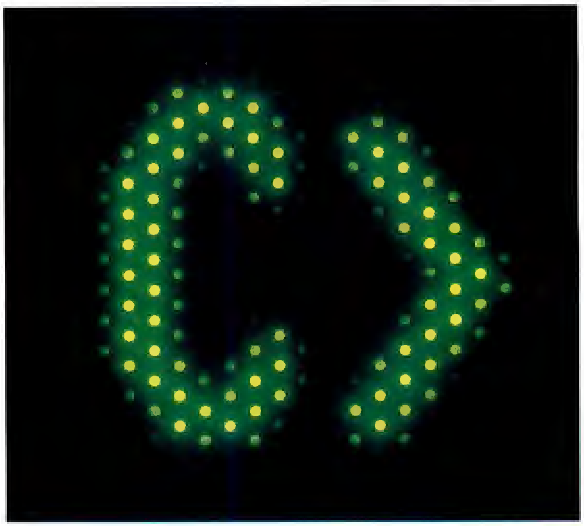
Kiss it goodbye.



Introducing new Windows 3.0.

The graphical user interface (GUI) environment on an MS-DOS® PC, and subsequent demise of the "C" prompt, is a reality today. Sure, you say.

Microsoft realizes you may have heard this one before. And we agree that you have every reason to be skeptical.

Well, all of this was before new Microsoft® Windows™ version 3.0. A GUI environment that will forever transform the way you use your PC.

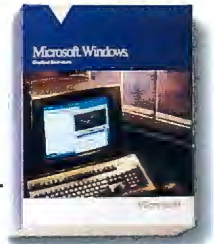
Now, before you wonder what to do with all of your existing DOS applications (to say nothing about your existing DOS experience), the Windows environment works within your MS-DOS system. This is not a traumatic thing.

As a matter of fact, once you see the environment created by Windows 3.0, you'll think quite the contrary.

The first time you see it, you won't believe it. Archaic characters, mundane instructions, and even entire command sequences, have been replaced by a program manager full of clear, friendly icons. You're immediately comfortable.

When you work on more than one thing at a time, you'll quickly reap the benefits. Because the program manager welcomes on-screen multitasking of large Windows applications. Of course, without ever visiting the "C" prompt.

Through something with the complicated name of Dynamic Data Exchange (DDE), you can simplify your life. For example, with DDE, you can change information in a Microsoft Excel spreadsheet, and have those changes automatically show up in a "linked" table in a word processing document. Or vice versa.



You can also easily access a network from within Windows. So, no matter how big the rivalry between research and accounting is on the softball field, everybody's on speaking terms in the office.

Even the setup program is graphical, only needing a few easy steps.

At this point, you probably think your machine will slow to a crawl the first time you try any of this.

We thought about that, too. So new Windows 3.0 breaks the 640K memory barrier that saddles other DOS programs. Giving you access to all the memory and power your 286 or 386 PC can muster.

It all sounds incredible. Which it is. And, it's taking place in an intuitive, consistent graphical environment.

For more information or to learn about upgrading your current Windows version, call (800) 323-3577, Dept. L83.

Graphics-based software is how people will run their PCs in the 1990s.

And there's no better way to get yourself acquainted than Windows 3.0.

Microsoft
Making it all make sense™

Microsoft Windows 3.0 is optimized for 1-2MB 286 and 386 personal computers. 640K RAM required. Customers inside the 50 United States, call (800) 323-3577, Dept. L83. In Canada, call (416) 673-7638. Outside the U.S. and Canada, call (206) 882-8661.
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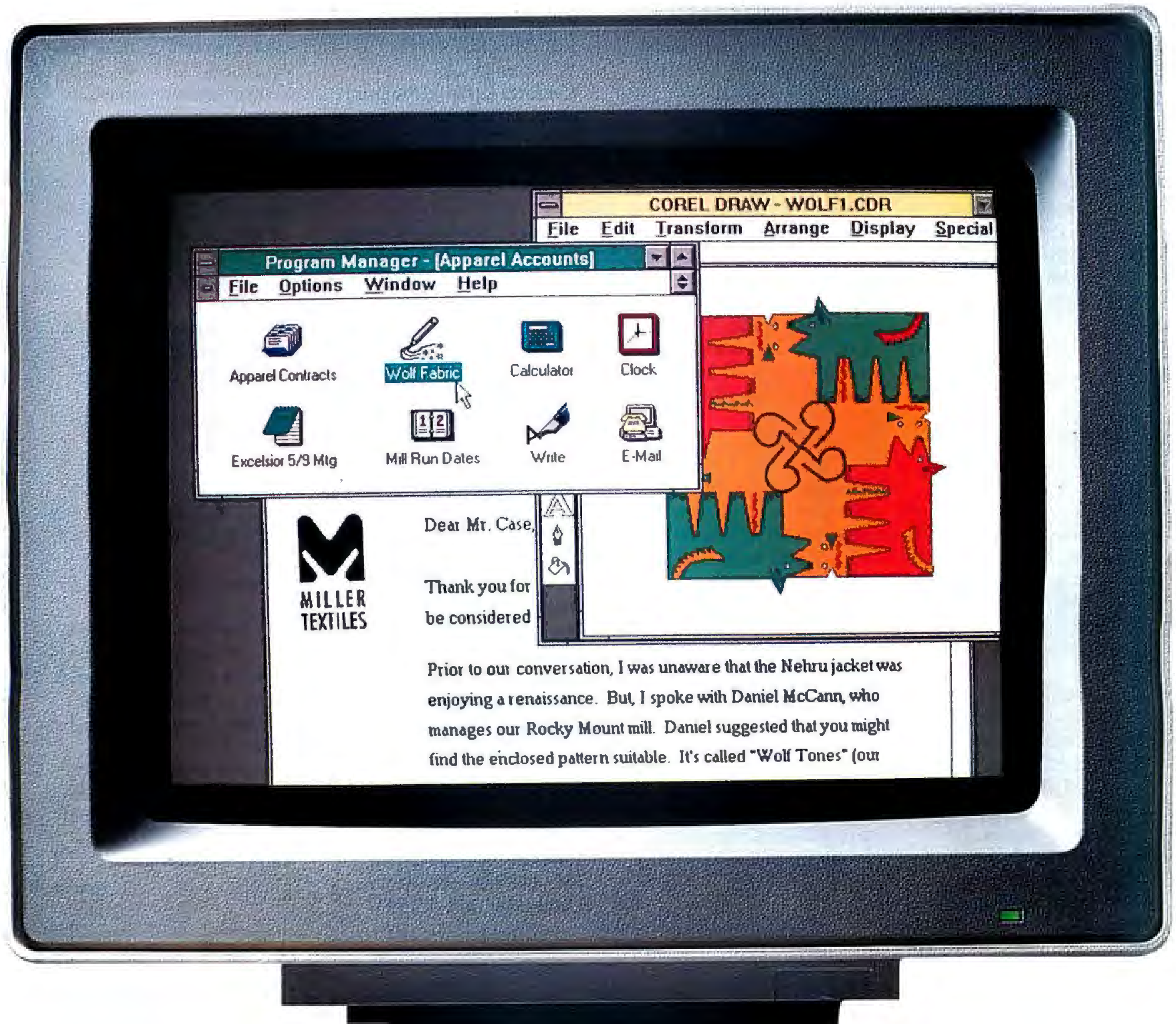
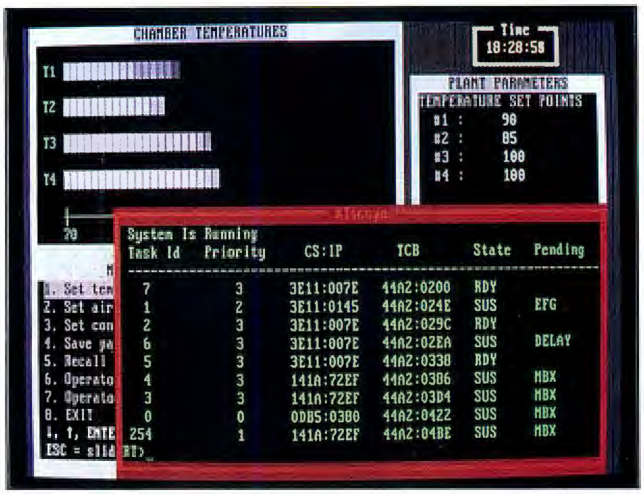


Develop Real-Time Embedded Systems on the PC

Ready Systems, a real-time software development company, now has a new version of its VRTX32 operating system that takes advantage of the 386 processor to run real-time multitasking operations in protected mode. VRTX-PC/386 handles task management, intertask communication and synchronization, memory allocation, real-time clock control, character I/O support, interrupt servicing, and other facilities.

You can program the operating system using standard DOS development tools. VRTX-PC/386 lets you launch VRTX applications from DOS, run VRTX, and exit to DOS without having to reboot.

Price: $9880.
Contact: Ready Systems, M/S VPC1191, 470 Potrero Ave., Sunnyvale, CA 94086, (408) 736-2600.
Inquiry 1152.



The real-time, multitasking VRTX-PC/386 lets you work with and monitor several tasks at once.

Add-on Tools Improve Microsoft C 6.0

With its new compilers, CodeView, Browse tool, and integrated Programmer's Workbench, Microsoft C 6.0 offers a programming system for DOS, Windows, and OS/2. The following add-ins can make C 6.0 even better.

CTools Plus/6.0 is a library of compiled C functions that give you routines for menus and windows, pop-up help screens, and a multiline editor for gathering user responses.

C Asynch Manager/3.0 now includes modem control routines for letting programs talk to several modems simultaneously.

Price: C Tools Plus/6.0, $149; C Asynch Manager/3.0, $189.
Contact: Blaise Computing, Inc., 2560 Ninth St., Suite 316, Berkeley, CA 94710, (415) 540-5441.
Inquiry 1153.

The **Chatterbox User Interface Library** has routines for adding pull-down menus and dialog boxes, and customizing menus with graphics, icons, and other features.
Price: Chatterbox, $189; with source code, $399.
Contact: Courseware Applications, Inc., 481 Devonshire, Champaign, IL 61820, (217) 359-1878.
Inquiry 1154.

The **Glockenspiel C++ 2.0** compiler includes an interface to Microsoft's CodeView debugger for source-level debugging.
Price: $499.
Contact: ImageSoft, Inc., 2 Haven Ave., Port Washington, NY 11050, (516) 767-2233.
Inquiry 1155.

The **Vitamin C** user-interface library for DOS and OS/2 includes source code and functions for adding overlapping windows, data-entry forms, menus, and context-sensitive help. After you've designed the screen, VCScreen generates source code.
Price: Vitamin C for DOS, $225; for OS/2, $345; VCScreen, $149.
Contact: Creative Programming, P.O. Box 112097, Carrollton, TX 75011, (214) 416-6447.
Inquiry 1156.

Soft-ICE, Nu-Mega's debugger, now supports symbols from Microsoft 6.0 .EXE files, in addition to supporting symbols from Microsoft .MAP files. Bounds-Checker identifies code that causes out-of-bounds memory access.
Price: Soft-ICE, $386; Bounds-Checker, $249.
Contact: Nu-Mega Technologies, P.O. Box 7607, Nashua, NH 03060, (603) 888-2386.
Inquiry 1157.

C-scape Interface Management System 3.2 provides a library of C routines for creating user interfaces, helping you prototype and generate code for data-entry, menu, help, and text screens when used with the Look & Feel screen designer.
Price: $499, including source code; C-scape without Look & Feel, $399.
Contact: Oakland Group, Inc., 675 Massachusetts Ave., Cambridge, MA 02139, (800) 233-3733 or (617) 491-7311.
Inquiry 1158.

C6toPROM lets you take your Microsoft C 6.0 .EXE files and produce code that you place into ROM or PROM and download to most in-circuit emulators for source-level debugging.
Price: $149.
Contact: Systems & Software, Inc., 18012 Cowan, Suite 100, Irvine, CA 92714, (714) 833-1700.
Inquiry 1159.

Locate, for 8086-compatible embedded systems, includes subsets of Microsoft C 6.0 run-time libraries that you can place in ROM, and you can download code to in-circuit emulators.

The **Inside!** profiler lets you analyze your C code.
Price: Locate, $295; Inside!, $125.
Contact: Paradigm Systems, Inc., P.O. Box 152, Milford, MA 01757, (800) 537-5043 or (508) 478-0499.
Inquiry 1160.

The **Polytron Version Control System** lets a team of developers track changes to files.
Price: for DOS, $495; for OS/2, $595.
Contact: Sage Software, Inc., 1700 Northwest 167th Place, Beaverton, OR 97068, (800) 547-4000 or (301) 230-3307.
Inquiry 1163.

The **Vermont Views 2.0** library of more than 550 functions for creating data-entry forms includes a designer for defining forms and menus.
Price: $495.
Contact: Vermont Creative Software, Pinnacle Meadows, Richford, VT 05476, (802) 848-7731.
Inquiry 1164.

continued

Look familiar?

Then this $50 upgrade will look great.

If this looks like your current version of Windows, you can upgrade for just $50.

You may have received Microsoft Windows with your hardware. If you did, you can save $99 with this upgrade offer.

Check out your software because if it works within a Windows environment, you're in luck.

If you are using Microsoft® Windows™ the best thing about this offer, besides the special upgrade price, is that you'll now have access to all the memory in your PC. Not to mention that you can keep using your existing MS-DOS® applications, multitask with other Windows applications, and network more easily.

All the popular Windows applications have already been updated to utilize Windows 3.0's powerful capabilities. And most are offering low-cost or free updates. So if you have any version of Windows—including runtime Windows—give us a call. We'll upgrade your copy of Windows, help you update your applications, and answer any questions you may have.

But make sure and call for your $50* Windows upgrade before September 15, 1990. You'll save $99 off the suggested retail price of $149. And you'll be using Windows 3.0. Which will make you look great.

To get your Windows upgrade for just $50, call (800) 323-3577, Dept. L53.

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Making it all make sense™

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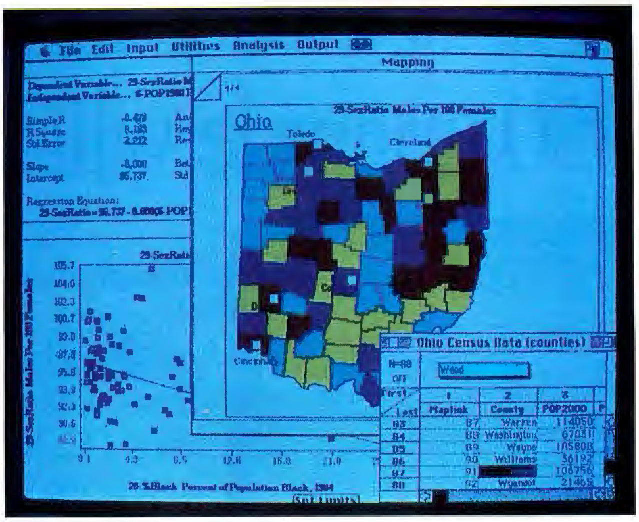
SOFTWARE • BUSINESS

Link Data to Maps on the Mac

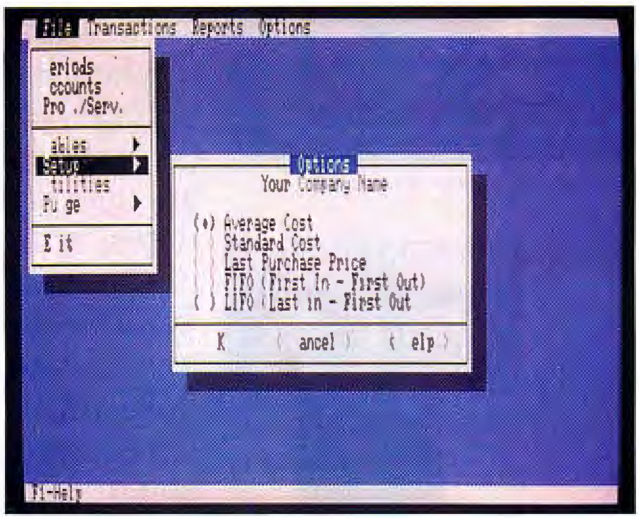
Flo•Stat, which PSRC Software describes as an entry-level statistical analysis, mapping, and graphics package, includes a map-link feature for linking rows in a statistical worksheet with objects, letting you visualize statistical data.

You can link data to maps or pictures created in MacDraw, SuperPaint, Canvas, or any application that supports the Macintosh Clipboard, the company says. The program can create numerous types of charts and graphs from data, including worksheets from Excel and tab-delimited ASCII.

Price: $99.
Contact: PSRC Software, Bowling Green, OH 43403, (419) 372-8648 or (419) 372-7126.
Inquiry 1165.



After you've identified objects in a Flo•Stat map, the program numbers them so that objects correspond with columns.



Pacioli 2000 supports five types of costing systems, including last purchase price, average cost, and standard cost.

Network Accounting for Under $50

The designer of the Dac-Easy Accounting series has formed a new company that now sells an eight-module, NetBIOS-compatible network accounting package.

According to M-USA Business Systems, Pacioli 2000, which can also run as a single-user system, lets you keep up to 36 monthly periods open. You can browse through accounting files and create new records on the fly. Multicompany support lets you keep up to 999 companies online. The system's auditing module lets you place temporary or permanent check marks next to transactions during account reconciliation.

For a single-user system, you need DOS 2.1 or higher with 640K bytes of RAM.

Price: $49.95.
Contact: M-USA Business Systems, Inc., 17440 North Dallas Pkwy., Suite 207, Dallas, TX 75287, (214) 931-0024.
Inquiry 1167.

Manage It All with Biz*Base

With Biz*Base Gold, you can control your business word processing, mass mailings, database, and contacts in one application. The program's dBASE-compatible database, which is integrated with the word processor, lets you take advantage of bulk mailing rates when producing mass mailings. The program can print letters by ZIP code and carrier route order.

Lookup tables make data entry fast and accurate, the company says. The program lets you store as many data responses as you need, keeping typing to a minimum.

A slimmed-down version of the program, Biz*Base Silver, can run off one 360K-byte floppy disk.

Price: Biz*Base Gold, $175; four-station network version, $600; each additional network station, $100; Biz*Base Silver, $59.
Contact: Creagh Computer Systems, 674 Via de la Valle, Suite 204, Solana Beach, CA 92075, (800) 833-8892 or (619) 792-1367.
Inquiry 1168.

continued

Accounting and 1-2-3 Integrated for Small Business

Lotus Development and Great American Software have collaborated on a package called Financial Manager that combines 1-2-3 release 2.2 and Great American's One-Write Plus small-business accounting program with @Accounting. Based partly on Circle Systems' RoundTrip program, which creates 1-2-3 worksheets from dBASE reports data, @Accounting lets you combine accounting and database capabilities with the analysis power of a spreadsheet. Great American Software says that you can use Financial Manager to do what-if analyses and create presentation graphics on your accounting data without knowing much about 1-2-3 release 2.2.

Price: $795.
Contact: Great American Software, Inc., 615 Amherst St., P.O. Box 2066, Nashua, NH 03063, (603) 889-5400.
Inquiry 1169.

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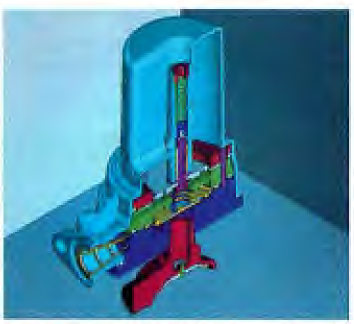

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6000™ family.

will seem downright primitive.

cations from more than a dozen vendors.

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So if you're tired of paddling upstream with yesterday's performance, call your IBM marketing representative or Business Partner to find out more about the RISC System/6000 family. For literature, call 1 800 IBM-6676, ext. 991.

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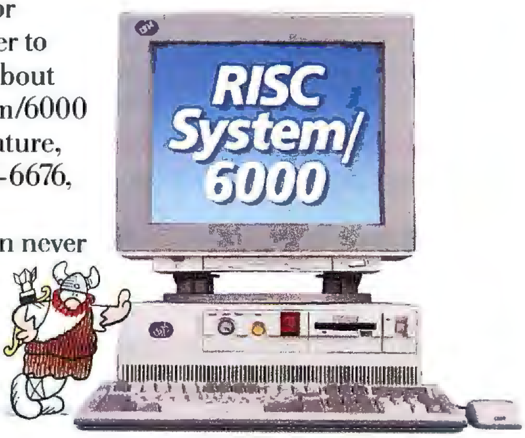

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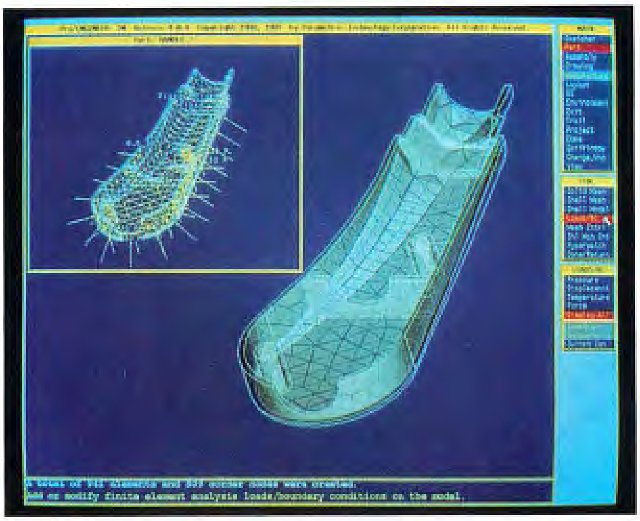
Ansys Meshes with Mechanical Design Program

With a new interface between Swanson Analysis Systems' Ansys element modeling program and Parametric Technology's Pro/Engineer family of meshing products for Unix workstations, you can perform design optimization on a mechanical design by passing Pro/Engineer's mesh output into Ansys. The two Parametric applications include Pro/Shellmesh, for shell elements, and Pro/Tetmesh, for tetrahedral meshing.
Price: Pro/Engineer, $9500; Pro/Shell, $3000 and up; Pro/Tetmesh, $4000 and up. For information on Ansys, contact the company.
Contact: Swanson Analysis Systems, Inc., Johnson Rd., P.O. Box 65, Houston, PA 15342, (412) 746-3304; Parametric Technology Corp., 128 Technology Dr., Waltham, MA 02154, (617) 894-7111.
Inquiry 1172.



Pro/Shellmesh meshed this handle that was modeled by the Pro/Engineer solid-modeling capability. The engineer defined the loads and created an Ansys preprocessing input file to analyze the handle using the Ansys finite-element program.

Estimate Construction Costs

Elite's Esticalc program, available in modules for general construction, mechanical, and electrical engineers, uses take-off methods, industry databases, and custom reports to help you quickly and accurately prepare construction estimates.

With Esticalc, you press a key to pick a specific item from a category of materials lists and count the number of those items using a digitizer or counter probe.

The company provides customizable materials databases for each trade. The program also supports automatic price updating from Trade Services, the National Price Service, and other industry pricing services.

The program supports more than 2 million items per materials database, with as many as 10,000 groups and 40 types per group. Each assembly can contain up to 100 items; the program supports up to 100,000 items per job.

Esticalc requires 512K bytes of RAM and a hard disk drive on the IBM PC.
Price: $595.
Contact: Elite Software Development, Inc., P.O. Drawer 1194, Bryan, TX 77806, (409) 846-2340.
Inquiry 1173.

Add Technical Graphing to Your Applications

Advanced Micro Solutions' run-time version of SEGS 2.1, a two-dimensional graphics package for engineering, lets you add technical graphing capabilities to an application such as a database with just a few lines of code, the company says. With the run-time version, you can plot data from an application that's written in C, dBASE, Pascal, and FORTRAN.

The run-time version has all the capabilities of SEGS itself, including support for linear, date, and logarithmic axes, up to four *y* axes, and up to 10 curves with 16,000 points each per graph. Other capabilities include curve fitting and extrapolation.
Price: SEGS-RT 2.1, $95; unlimited distribution version, $495; SEGS 2.1, $195.
Contact: Advanced Micro Solutions, Inc., 3817 Windover Dr., Edmond, OK 73013, (800) 284-3381 or (405) 842-0558.
Inquiry 1174.

MathCAD Now Runs on the Sun

MathCAD, the mathematical-analysis program for formatting equations and calculating and graphing their results, is now available for the Sun-3, Sun-4, and SPARCstation workstations. The new Unix version lets you access and work with MathCAD files created on other platforms, the company says.

Like the version for the IBM PC, Unix MathCAD is based on a live document interface that lets you use the computer as a scratch pad, defining variables and entering text anywhere on the screen. The program can handle matrices of up to 1 million elements. On a SPARCstation, the average speed of a Unix MathCAD calculation is two times faster than on a 16-MHz 386 system with a coprocessor, the company says.
Price: $695.
Contact: MathSoft, Inc., 201 Broadway, Cambridge, MA 02139, (617) 577-1017.
Inquiry 1175.

Scientific Word Processor Supports WYSIWYG

The new version of EXP, a WYSIWYG word processor for scientists and engineers, now supports more than 450 technical and foreign expressions and can import PCX and TIFF format graphics, Brooks/Cole Publishing says.

EXP 2.0 supports the automatic formatting of mathematical expressions, including sizing, centering, and spacing of expressions and italicizing of variables. A 100,000-word spelling checker gives you the option of U.S. or U.K. spellings.

EXP 2.0 runs on the IBM PC with 384K bytes of RAM.
Price: $295.
Contact: Brooks/Cole Publishing Company, 10 Davis Dr., Belmont, CA 94002, (800) 831-6996, (800) 367-1977, or (415) 595-2350.
Inquiry 1171.

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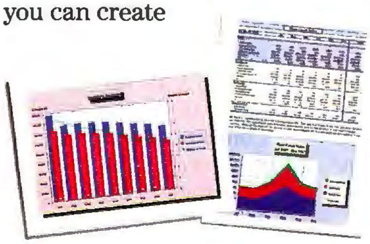

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Circle 110 on Reader Service Card

Facilities Management in AutoCAD

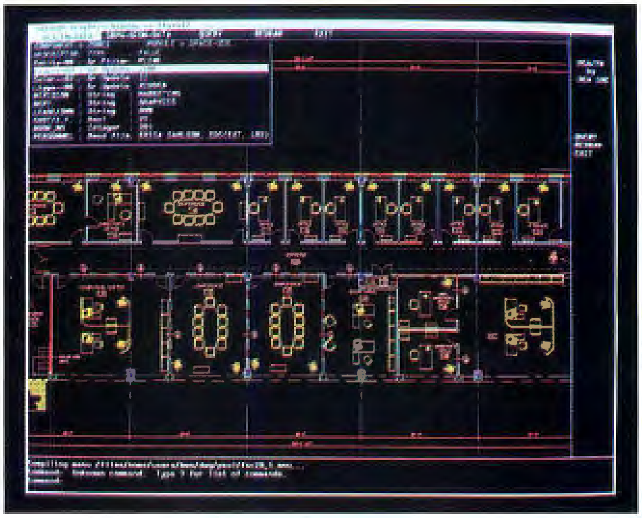
By using AutoCAD entity handles, the DCA Facilities management add-in for AutoCAD on the IBM PC and Sun systems lets you link graphical information that represents your facilities with the information related to those symbols without increasing drawing overhead, D.C.A. says.

With the program, you can establish links to dBASE-compatible databases or your own binary file structure and read externally stored database information on an entity from within the program.

Price: $1495.

Contact: D.C.A. Engineering Software, Inc., 7 Liberty Hill Rd., Henniker, NH 03242, (603) 428-3199.

Inquiry 1180.



DCA Facilities lets you store information such as repair costs, rental agreements, zone areas, and other information pertaining to a facility and its equipment.

Manage CAD Drawings on Your Network

Cyco, famous for its AutoManager utility that lets you view AutoCAD drawings up to 10 times faster than with AutoCAD itself, now has a graphical database called AutoBase that lets you manage AutoCAD drawings on DOS and OS/2 networks.

To provide a way to manage your old AutoCAD drawings, AutoBase lets you pull in information based on data such as paths and user names that are inherently stored in a drawing's filename. After that, you can search for a drawing by project, drafter, revision date, budgeted time, or any other information determined by the system manager.

A version of AutoBase for Sun workstations is scheduled for release in the fourth quarter.

Price: Single-user version, $695; six-user version, $2000.

Contact: Cyco International, Inc., 1908 Cliff Valley Way, Suite 2000, Atlanta, GA 30329, (800) 234-2926 or (404) 634-3302.

Inquiry 1176.

Circuit Board CAD with Virtual Memory

Pads-2000, a printed circuit board CAD system, uses virtual memory management to let you design boards that contain more than 2000 equivalent 14-pin ICs, CAD Software says.

In addition to supporting large circuits, the program includes a copper pour routine that fills a designated area while leaving included tracks and pads isolated. The program's autorouters include heuristic, maze, and push-and-shove algorithms. Other features include checking on-the-fly, the rotation of components and pads in $\frac{1}{10}$-degree increments, and resolution at 1 micron.

Pads-2000 runs on the IBM PC with 640K bytes of RAM and a hard disk drive.

Price: $6995.

Contact: CAD Software, Inc., 119 Russell St., Suite 6, Littleton, MA 01460, (800) 255-7814 or (508) 486-9521.

Inquiry 1177.

Architectural and 3-D Piping Works with AutoCAD

The ASG Architectural program, for creating contract documents for residential and high-rise buildings, lets you work in multiple-story buildings within one AutoCAD file. When you create a floor, you can copy part or all of the plan to another floor by identifying common elements.

ASG 3-D Piping lets you draw pipes in three dimensions and convert them to 2-D and vice versa, the company says. You can sketch out a piping layout with center lines and access the program's Quick-Mode to pick and place single line fittings, and the program scales the pipes to size automatically in 3-D. AutoFit automatically draws connecting pipes between 3-D fittings, accounting for socket or threaded engagement and weld thickness.

The piping module works with AutoCAD release 9.0 or higher on the IBM PC. The Architectural program works on AutoCAD for DOS; OS/2; Sun, Unix, and Ultrix machines; and the Macintosh. Both modules require the ASG Core.

Price: ASG Architectural, $1000; ASG 3-D Piping, $1000; ASG Core, $500.

Contact: ASG, 4000 Bridgeway, Suite 309, Sausalito, CA 94965, (415) 332-2123.

Inquiry 1178.

New Harvard Graphics Backs Up Your Presentation

A new version of Harvard Graphics includes a feature called HyperShow that lets you tailor the flow of a presentation during its delivery. If, during the presentation, someone asks for clarification on a slide, you can click on a button that activates a backup slide with additional information.

The program integrates Draw Partner and includes a gallery of predesigned business charts into which you can plug data. You can also update charts with fresh data without losing your annotations.

Harvard Graphics 2.3 runs on the IBM PC with 420K bytes of RAM. The program includes 10 animated sequences and can import Excel and 1-2-3 data or charts.

Price: $495.

Contact: Software Publishing Corp., 1901 Landings Dr., P.O. Box 7210, Mountain View, CA 94039, (415) 335-6440.

Inquiry 1126.

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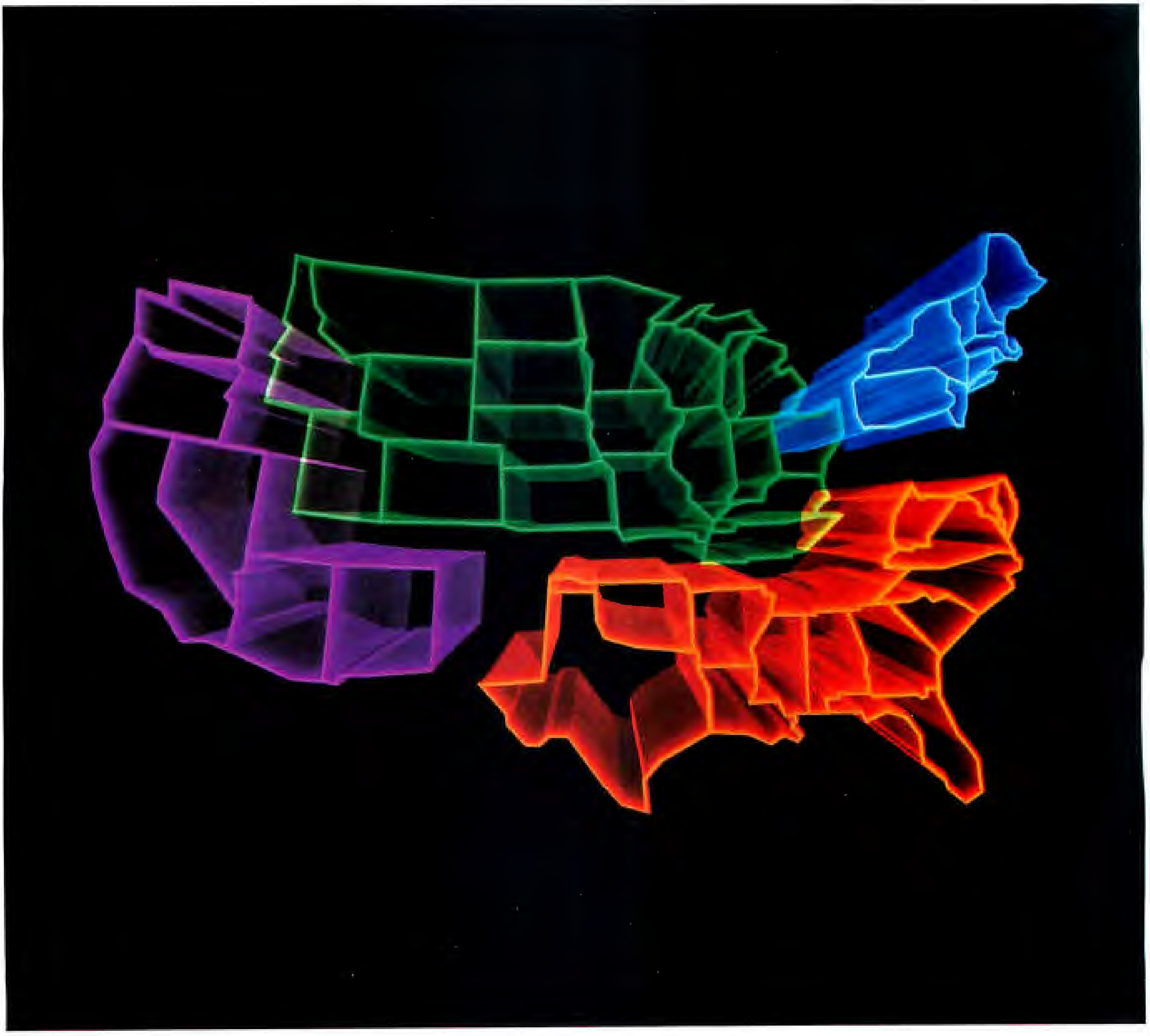

PHOTOGRAPHIC IMAGE: ALEX PIETERSEN © 1989

Ramsey: Windows 3.0 Not Quite the Taco

To hear Bill Gates tell it, Windows 3.0 is good for users and developers of the Macintosh because it keeps Apple honest by providing a low-cost alternative to the Mac's intuitive, friendly interface. But how do Mac developers feel about Windows 3.0? "It looks ridiculous next to the Mac."

That opinion of Windows 3.0 was voiced by David Ramsey, a former software engineer for Apple, during a presentation in May sponsored by Milwaukee's North Shore Computers.

"If you've got a DOS machine, you should really run out and buy it," he conceded. "But it's like getting a taco at Taco Bell—which isn't really criticism per se, they're nice in their own terms—but you know it's not really a taco. I mean, if you go to Mexico, they're not going to use ground beef. . . sour cream, and a little carefully grated cheese."

But during a private interview, he said, "If you've got a 386 and about 4 MB of memory and such, you're really in Fat City with Windows 3." Although he said the Windows 3.0 user interface is still "Mickey Mouse next to the Mac," Apple should view this as a major threat. Although he said the differences between Windows and the Mac can't easily be demonstrated quickly, with all the hype surrounding Windows 3.0, people will say they don't need the Mac: They can buy an AT clone and run Windows.

Ramsey paid a back-handed compliment to Windows 3.0: "The help system in Windows is. . . much nicer than the help system in [Apple's] System 7. But I guess in Windows, you'll need a lot more help."

When asked about Windows 3.0's overall performance, he replied, "The performance of 3.0 is pretty good. The press has been hyping on the user interface stuff. I think the only advantage of 3.0. . . [on a 386 machine] is it uses memory much, much more effectively. It's much more intelligent about running non-Windows applications. And Windows applications can be written now that can ignore 640K-byte barriers, and it'll take care of all that for you automatically."

But how does Windows 3.0 look to a Mac developer? "The user interface is pretty wretched, actually. They've got more windows and icons. For example, you can't do something that you think would be obvious, like drag an icon out of a window. If you try, the cursor turns into a little circle with a slash through it. And you can't do it. If you want to move files like you do on the Mac, you have to run a separate application called File Manager, and then you get graphical directory trees. . . ."

While Ramsey conceded that this implementation works, he pointed out that it requires a separate mode. "You have to remember that an icon in the window

continued

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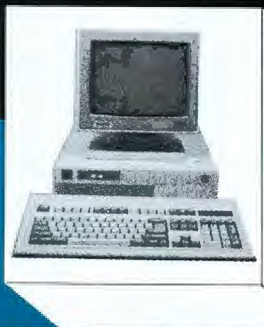

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- 1.2M 5.25" and 1.44M 3.5" Drives
- 40M Hard Drive/33ms/1:1 Interleave
- 14" VGA Color Monitor
- 16-bit VGA 800x600 with 256K
- 2 Serial/1 Parallel/1 Game Port
- MS DOS™ v4.01 and GW BASIC
- Eight-in-One by Spinnaker Software
- Dexxa Mouse with Paint Progam
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represents a program or a file, but if the icon's on your desktop, it's a *running* program or an *open* file."

He continued by observing that "the interface in 3.0 is a lot nicer than the user interface in 2.11, and to DOS people, they'll really think it's wonderful." He referred to the Windows 3.0 price tag of $149. "It's pretty nice in the DOS world, but, like I say, take it on its own merits."

—Jean Mickelson

Integral Scientist Debuts in Colorado

A beta version of Integral Scientist, a program for chemists and others who work in the physical sciences, was the topic of the June general meeting of the Front Range PC Users Group. Written by Front Range member Dave Trump, the program features a user interface that resembles the periodic table. When you select an element in the table, you get up to 60 more pieces of information on the element.

The program includes a solutions calculator that converts units in 24 categories. As you type in a formula for chemical compounds, the program calculates all the elements in the compound and returns its molecular weight.

Trump, who is marketing the program as shareware for $20 through 1990, says he developed the program because for many scientists, "their ability to use computers for their fields is limited by a lack of easy-to-use informational software." A scientist can choose from several data acquisition applications on a host of hardware platforms, but Trump says not many applications exist for scientists "who just want to use the computer as a tool for science."

Contact: Front Range PC Users Group, 305 Magnolia St., Suite 152, Fort Collins, CO 80521, (303) 223-6618. For information on Integral Scientist, call (303) 225-9491.

MICRO to Get Firsthand Look at Windows 3.0

Members of the Mile High Computer Resource Organization will get to see Windows 3.0 up close at the group's general meeting on August 30 at the Glendale Community Center. The meeting will begin at 5:30 p.m., starting with the opening of the group's shareware library, DOS tutorials, and a swap meet.

The group's September meeting is slated to feature a demonstration of Silverado, the database that works with Computer Associates' SuperCalc5 spreadsheet. Ken Reeves of Poqet Computer will also be on hand to show the company's small pocket computer. At the October meeting, Ashton-Tate will demonstrate Applause 2.

Contact: Mile High Computer Resource Organization, 3311 West 92nd Place, Westminster, CO 80030, (303) 426-6669.

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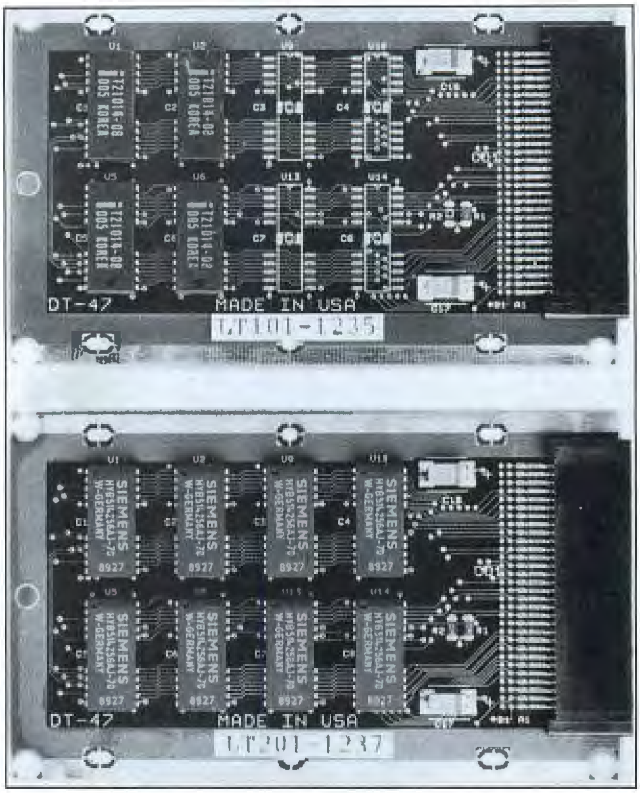
Expand Your Compaq LTE/286 Memory

Newer Technology's two memory-expansion modules for the Compaq LTE/286 let you increase the total system memory of the laptop to 1.6 MB or 2.6 MB.
Price: 1-MB module, $595; 2-MB module, $995.
Contact: Newer Technology, 7803 East Osie, Suite 105, Wichita, KS 67207, (800) 678-3726 or (316) 685-4904.
Inquiry 1004.



Newer Technology says that its memory-expansion modules are 100 percent compatible with the Compaq LTE/286.

Estimate Materials and Prepare Cutting Lists

Workhorses says that the Carpenter's Dream program simplifies the process of material estimating and preparing cutting lists for home construction. You can use it to estimate material needs.

The cutting rafter segment of version 2.1 computes truss calculations and determines the critical measurement of the level line from the bottom of the subfascia to the outside wall, letting you adjust the rafter cut so that the soffit with respect to window trim will be perfect. The roofing program computes the amount of half-lap roll roofing needed and the amount of cold process to go with it.

Carpenter's Dream gives you long-point to short-point, with overhang included. It computes the length of your first jack rafter and determines the difference in length for each jack rafter. Version 3.0, shipping later this year, will let you do what-if analyses when looking at different construction proposals.

Carpenter's Dream runs on the IBM PC with 360K bytes of RAM.
Price: Version 2.1, $99; version 3.0, $149.
Contact: Workhorses, Inc., 805-B 14th St., Golden, CO 80401, (800) 777-2477 or (303) 279-8551.
Inquiry 1008.

A Text Retrieval Program for Unix

ZyLab's Unix version of its ZyIndex text retrieval system now supports color, letting you set any of 16 foreground colors and eight background colors for windows and menus. ZyIndex lets you search your system for words, phrases, numbers, and dates. The program offers techniques for searching by numeric ranges, prefix and suffix wild cards, concept searching, and complex queries in the form of logical expressions.

ZyIndex for Unix runs on a 386-based machine running SCO Unix System V/386 release 3.2, Interactive 386/ix release 2.0 or higher, or SCO Xenix 386 release 2.3.
Price: $695; four-concurrent-user version, $2495; additional users, $695.
Contact: ZyLab Corp., 3105-T North Wilke Rd., Arlington Heights, IL 60004, (708) 632-1100.
Inquiry 1006.

Mini Version of TK Solver for the Mac

The developer of TK Solver Plus, an equation processing solver that lets you enter formulas and rules to solve equations, has released a scaled-down version of the program for the Macintosh. MiniTK lets you solve for 24 simultaneous equations with up to 32 variables and includes the backsolving capability of TK Solver Plus.

The program includes a scientific calculator and 24 models for fields such as mechanical engineering, chemistry, financial analysis, and others.
Price: $20.
Contact: Universal Technical Systems, Inc., 1220 Rock St., Rockford, IL 61101, (815) 963-2220.
Inquiry 1005.

ZyIndex for Unix features two interactive tools that let you narrow a search for a word. The thesaurus box in the top left lists synonyms, while the box at right shows close approximations of the word. The screen at the bottom displays previous queries.

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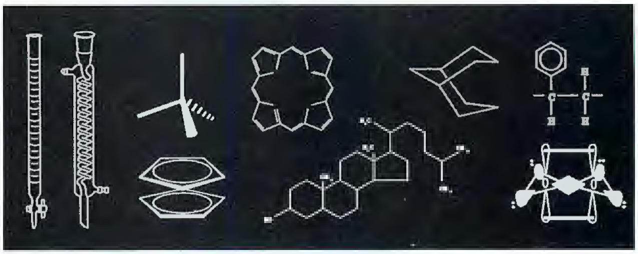
Science Figures and Symbols for SlideWrite Plus

Advanced Graphics Software's Science Figure Pack of chemical symbols, lab equipment, maps, and markers lets you create chemically oriented graphics presentations when used with the company's SlideWrite Plus presentation graphics program for the IBM PC.

Symbols include basic building blocks, compounds, polymers, nucleic acid bases, nucleosides, and others. Building blocks include bonds, arrows, ligands, and ring, crown, and atomic orbital structures.

The geographic library includes a map of the U.S., individual states, and regions.
Price: $99.
Contact: Advanced Graphics Software, Inc., 333 West Maude Ave., Suite 105, Sunnyvale, CA 94086, (408) 749-8620.
Inquiry 1009.



The Science Figure Pack includes figures for lab equipment, perspective structures, porphyrins, three-dimensional bonds, chain polymers, and other symbols for SlideWrite Plus.

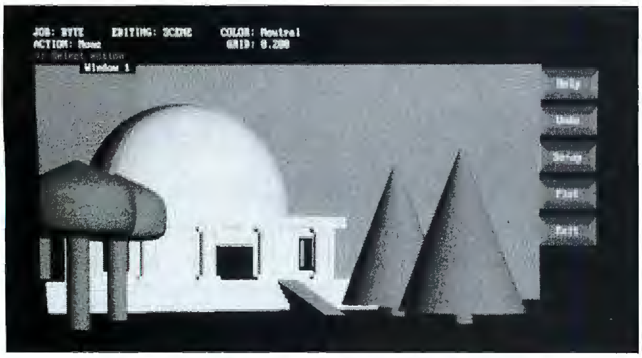
Twelve Utilities for the Mac

Now Software's package of 12 utilities for the Macintosh include AlarmsClock, Customizer, DeskPicture, InstantAccess, MemorySetter, NowMenus, Persistence, Print Previewer, Profiler, RearWindow, StartUp Manager, and WYSIWYG Menus.

With the WYSIWYG Menus utility, handy for desktop publishing and word processing, you can pull down the font menu and see what each typeface will actually look like in the size you select. NowMenus lets you pop up the menu bar without having to move the mouse. InstantAccess lets you assign default folders to your applications.

MemorySetter lets you allocate RAM on the fly to memory-hungry applications running under MultiFinder. RearWindow lets you move and copy files from inactive windows without activating them. Persistence prevents start-up icons from wiping each other out at boot time. The StartUp Manager lets you control which INITs and cdevs load when you turn on your Mac.

Now Utilities runs on the Mac Plus with System 6.0.2 or higher.
Price: $149.
Contact: Now Software, Inc., 520 Southwest Harrison St., Suite 435, Portland, OR 97201, (800) 237-3611 or (503) 274-2800.
Inquiry 1012.



The three-dimensional MiniCAD program includes a solid-model display option for showing a shaded rendering of any object.

3-D MiniCAD for the First-Time User

Featuring many of the capabilities found in high-end CAD programs, 3-D MiniCAD is designed for ease of use, letting you create a drawing within a few hours of taking off the shrink wrap, its developer says.

According to Abbot, Foster & Hauserman, 3-D MiniCAD supports three-dimensional modeling, extruding, rotating, and stretching of objects. You can also view a drawing in up to four ways, with each view in its own window.

The program runs on the IBM AT with a hard disk drive and an EGA or VGA display.
Price: $99.
Contact: Abbot, Foster & Hauserman Co., 44 Montgomery St., Fifth Floor, San Francisco, CA 94104, (800) 562-0025 or (415) 955-2711.
Inquiry 1011.

Mac Forms Software Supports Formulas

Power Up Software says that the new version of Fast Forms supports percent and formula operations, in addition to basic mathematical operations between data fields, such as addition and multiplication.

The company also improved the program by letting you create a custom form and fill in, print, and save the form without having to exit the application. You can also save forms and data for further editing, importing, and searching.

The program runs on the Mac Plus.
Price: $179.95.
Contact: Power Up Software Corp., 2929 Campus Dr., San Mateo, CA 94403, (415) 345-5900.
Inquiry 1010.

Design Your Home on the IBM PC and the Mac

Abracadata, developer of the Design Your Own Home series for the Mac or IBM PC, has released Architecture for the Macintosh, which now supports 8-bit color.

Architecture provides drawing tools, predrawn architectural objects, support for multiple-page drawings, overlays, and a stud/beam tool to calculate how much lumber you'll need.
Price: Architecture: Mac and IBM PC versions, $99.95; Apple II version, $69.95; Apple IIGS version, $89.95.
Contact: Abracadata, Ltd., P.O. Box 2440, Eugene, OR 97402, (800) 451-4871 or (503) 342-3030.
Inquiry 1013.

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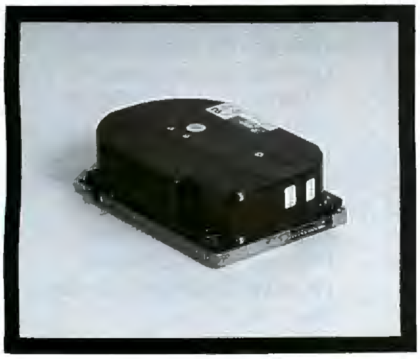

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XT-4170E/S	179MB	14ms	1,145	1,285
XT-8380E/S	410MB	14.5ms	1,595	1,765
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LXT200A/S (3.5″)	202MB	15ms	895	925/1,035

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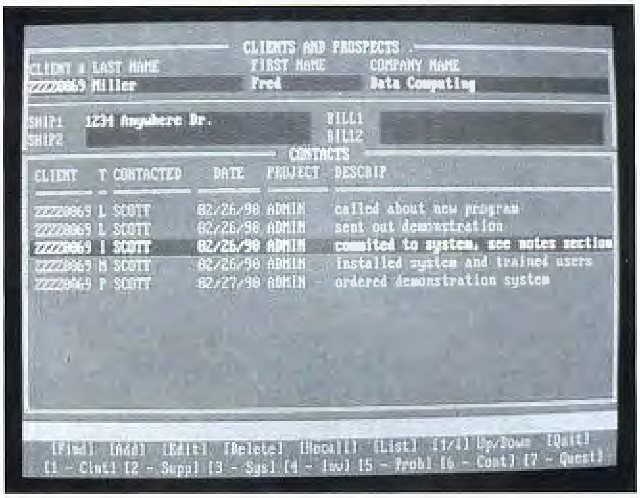
Sell More Software is written in Clipper. It runs on the IBM PC with DOS 3.0 or higher and is LAN-compatible.
Price: $750.
Contact: Droege Computing Services, Inc., 3200 Croasdaile Dr., Suite 304, Durham, NC 27705, (919) 383-9749.
Inquiry 997.



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Konexsys's Knet (for Knowledge Network) Library 1.0 includes a set of more than 250 C routines for creating, maintaining, and querying a semantic database. With the library, plus a linker and compiler, you can build a database with a built-in low-level theory of meaning. This is necessary in applications for emergency management, police support, or battlefields, where fast response, data flexibility, and simple query methods are required.

Applications of the library, available for the Mac, OS/2, and Unix environments, require at least 4 MB.
Price: $495.
Contact: Konexsys Corp., 3825 Academy Pkwy. South NE, Albuquerque, NM 87109, (505) 344-8891.
Inquiry 1001.

A Database for the Broadcast Newsroom

Alpha-Omega Applications, a broadcast-oriented software company, developed Soar for broadcast newsrooms that need a way to store, organize, archive, and retrieve information regarding on-air stories.

The program, written in dBASE and compiled with Clipper, lets you file stories by title, reporter, photographer, and date aired. You can store a story synopsis plus a tape and time code pointer that tells on which tape the story resides and where. The company says that it designed the program with the idea that not everyone in the newsroom is a computer genius, so a reporter, editor, or support person can learn it in just a few minutes.

Soar runs on the IBM XT with 640K bytes of RAM and a hard disk drive.
Price: $249.
Contact: Alpha-Omega Applications, 7817 Alhurst St., Jacksonville, FL 32211, (904) 273-0945.
Inquiry 998.

Your Passport to Fast Mail Delivery

Env, a mailing program for the Hewlett-Packard LaserJet and compatible printers, can convert the ZIP code in an envelope address to U.S. Postal Service Postnet bar code, letting you take advantage of Post Office sorting equipment for faster delivery.

If you're tired of struggling with mail merge, you can install Env as a TSR program, letting you capture and print the mailing address from within your word processor or database, Pike Creek Computer says. With one keystroke, you can display the address of the last printed envelope. The company says that it tested Env extensively on Post Office sorters.

Env runs on the IBM PC with 256K bytes of RAM.
Price: $49.95.
Contact: Pike Creek Computer Co., Inc., 2 Galaxy Dr., Newark, DE 19711, (302) 239-5113.
Inquiry 999.

Leave Translation Headache at the Junction

Tools & Techniques' new version 3.02 of Data Junction, its data conversion tool, lets you import and export native file formats to and from other formats, including Clarion, Q&A, Lotus 1-2-3 release 3.0, DataFlex, askSam, Oracle, and many others. With Data Junction, you can sort, extract, rearrange, edit, and enter records, fields, and bytes into the output format required, the company says.

Formats supported by the standard version include 1-2-3/Symphony; dBASE II and higher; FoxBase; Clipper; Enable; fixed, fielded, and delimited ASCII; askSam; DIF; and mail-merge data (WordPerfect, WordStar, and Microsoft Word).

The professional version supports all the standard formats plus SYLK, Excel, ACT!, DAC accounting, Platinum, Maximizer, SuperCalc, Btrieve, c-tree, Paradox, R:base, Clarion, DataFlex, binary and packed data, and mainframe EBCDIC.

The advanced version supports all the others plus Informix, Uniplex, XDB, Oracle, and C-ISAM.

Each version requires 512K bytes of RAM and a hard disk drive.
Price: Standard version, $99; professional version, $199; advanced version, $299.
Contact: Tools & Techniques, Inc., 1620 West 12th St., Austin, TX 78703, (800) 444-1945 or (512) 482-0824.
Inquiry 1000.

OUR MAN IN MOSCOW

Jerry gets a firsthand look at perestroika in action

In 1919, Lincoln Steffens, at the time known as "America's philosopher," went to the newly created U.S.S.R. On his return, he reported breathlessly, "I have been over into the future, and it works." I could easily sum up my trip to the Soviet Union by saying, "I have been into that future, and nothing works." While my summary wouldn't be quite true, it would surely be a lot more accurate than Steffens's was.

One can hardly become an expert by spending a week in a foreign capital. Of course, I had some familiarity with the U.S.S.R. before I went, so part of my week was spent confirming hypotheses; but despite all my reading, there were a number of surprises, as well as some changes.

First, the good news: glasnost—openness—is in full force, and that *is* working, at a pace that surprises everyone. Let me illustrate.

The eleventh annual conference of the World Media Association was held in the International Hotel, said to be the best hotel in Moscow. In fact, it isn't: the best one is the Octoberskaya.

However, that hotel doesn't even appear in most guidebooks, and it is pretty much reserved for heads of state and important dignitaries. As an example, the Reverend Sun Myung Moon, Mrs. Sadat, and people of that rank were in the Octoberskaya.

Meanwhile, former Senator Gary Hart and Representative Richard Ichord were with us in the International. The International is still miles better than the usual places Intourist puts you in—and in most respects compares favorably with a Holiday Inn in, say, Biloxi, Mississippi, or Nashville, Tennessee. That is, there's certainly nothing wrong with the hotel, but there's nothing all that fancy about it either.

The International and all its facilities are *beryozka* (hard currency only) establishments: you can't pay your bill, or buy a drink, with Soviet rubles. You need U.S. dollars or Swiss francs or West German marks. They'll happily take your Visa or American Express credit cards, though. You might contemplate the situation: suppose that the best hotel in New York City or Washington, D.C., was reserved for foreigners, had all the signs in Russian, and wouldn't take U.S. dollars; would we be embarrassed about that?

Like all hotels where foreign visitors stay, entry to the International is through one and only one point, past a hard-eyed doorman. A uniformed militia officer (police sergeant) stands nearby. Only months ago, that doorman would have barred Soviet citizens from entering; indeed, he would not admit the Soviet wife of a U.S. newsman!

Soviet citizens meeting foreigners were frequently searched and otherwise harassed by the KGB. When we called some of our Russian friends to arrange a meeting and suggested they come to the International and meet us in the lobby, we were told, "We wouldn't be allowed in there."

I explained that while there was a doorman, no one seemed to have any trouble.

"They know who to stop."

I managed to persuade one friend to try, although he was sure he would get in trouble. In fact, no one paid him the slightest attention as he came into the lobby. He was so startled that he used the lobby phone to call friends and tell them; it was, after all, the first time in his life he had ever seen that lobby, which is

continued

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something like, say, the Hyatt Atlanta, although less opulent. Except for the Bolshoi (wonderful!, both building and ballet performance) and the Kremlin, the International lobby was certainly the fanciest—and cleanest—public room that we saw in Moscow.

In the past, American visitors were discouraged from leaving tour parties, and they were generally followed if they tried to go off on their own. Now, no one bothers to pay any attention. We like to walk, and Roberta and I walked all over the city, through parks and into working-class districts.

We bought food in state grocery stores and watched people standing in line for nearly anything worth buying—an enormous line formed only four blocks from the Kremlin, as there was a report that fresh fish was on sale inside.

Another time, a line started to form instantly when a man set up a pushcart outside a large department store on Kalinin Prospekt: he was selling rolls of vinyl wallpaper, and he began a feeding frenzy the moment that he opened for business.

We walked and took the Metro—the Moscow subway system does work, even at rush hour, and it's clean and neat and efficient—and no one followed us. The only people who paid us any attention at all were chaps asking if we wanted to change any money. Such private transactions are strictly illegal, and we politely declined; but we got six or eight such offers an hour when we were in crowded places, and no one seemed afraid of the police.

continued

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Each is no more than 8 ounces and can fit in a shirt pocket. They're small but tough and capable, built for the rigors of business on the road.

They connect to practically any telephone, public or private, via standard RJ-11 jacks or an optional acoustic coupler. They adhere to Bell and CCITT standards world-wide so you can connect to other modems (or fax machines) almost anywhere. They're powered by a single 9-volt battery or through an AC outlet, whichever is more convenient. And, they're easily shared as external peripherals among co-workers.

The WorldPort family of modems. They're built for travel, whether it's to extreme environments, to exotic locations or just down the hall.

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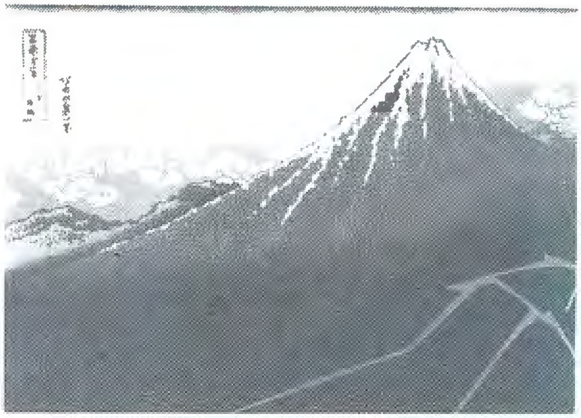

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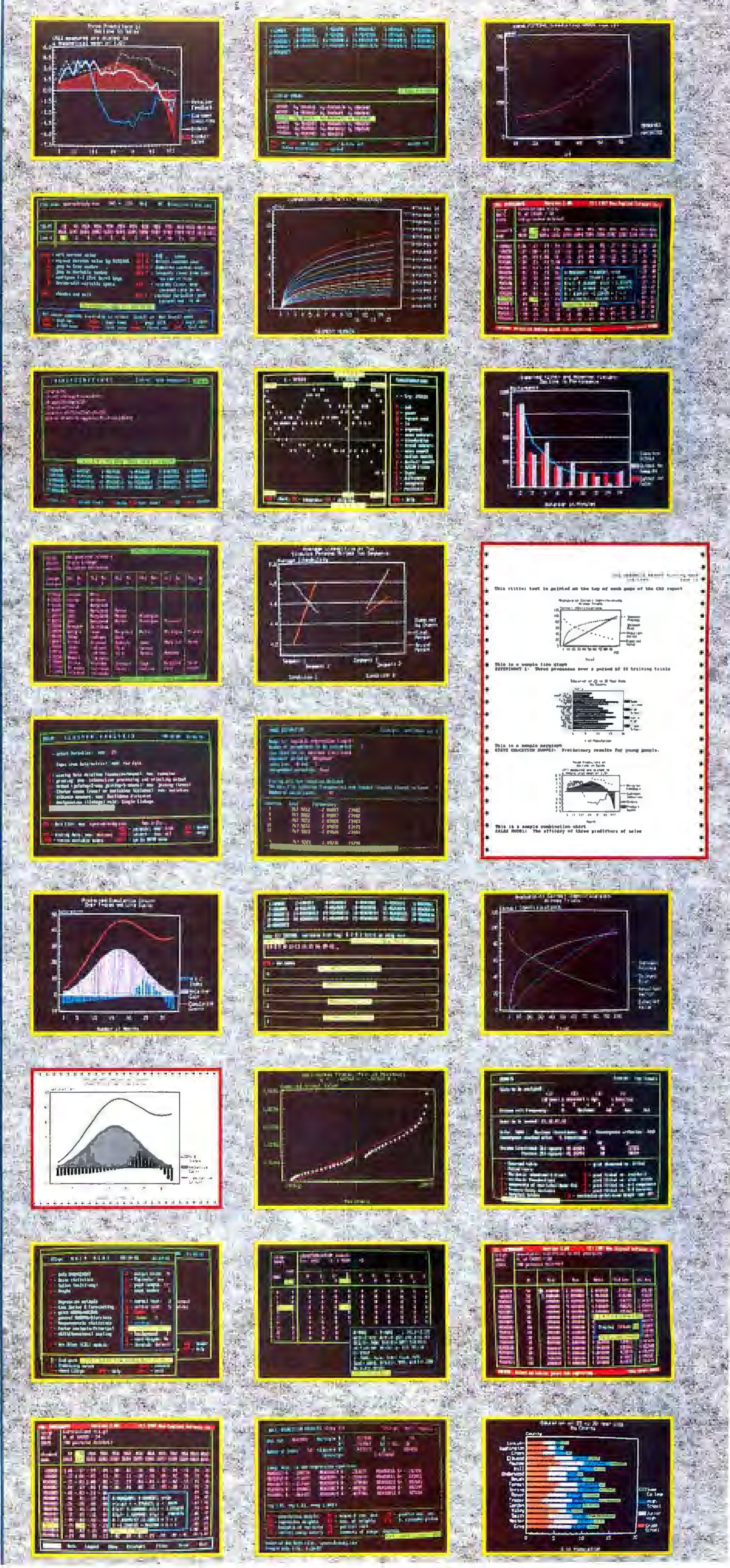

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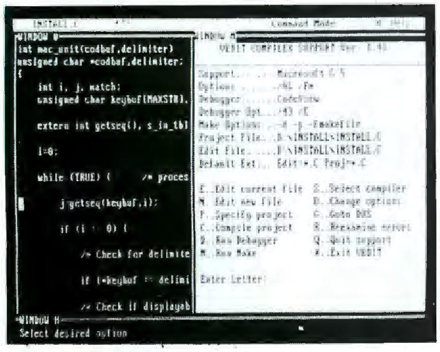

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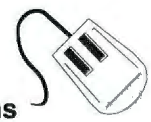

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Free Enterprise

Perestroika, economic reorganization, is not working. Everyone we met says that things are getting worse, not better. This isn't a full report—for that, see the Fall issue of Jim Baen's "bookazine" *New Destinies*—but I'll try to summarize the situation.

The major effect of perestroika is to allow a free market in a limited number of goods. For example, farmers, after meeting their quota for goods to be delivered to the state wholesale grocery distributors, are now allowed to set up shop in public markets and sell whatever else they've grown. That's quite a change. A few years ago, it would have been considered an economic crime with severe penalties.

Moscow, as both the financial and political capital—sort of like New York and Washington put together—gets the benefit of much of this, since it's the largest and best-paid market area. Moscow is also at the latitude of Juneau, Alaska; the growing season is short. The city is thus chronically in need of fresh vegetables during the winter.

The major vegetable seems to be the cucumber. At the International, we had cucumbers three meals a day. Only once did we get carrots, and then only one carrot each. They were quite proud of that carrot. Dinner at the Union of Soviet Writers also featured cucumbers and caviar; it has a very nice restaurant, but there weren't any other vegetables.

The only time we had sliced tomatoes was at a very high-level luncheon in a private dining room of the Praga, said to be the best restaurant in Moscow; the lunch was with the president of one of the Institutes of the Academy of Sciences and three other fairly high-level scientific administrators. In a word, finding fresh vegetables in winter and spring is rare in Moscow.

In the state stores, cucumbers are sold for 1 ruble a kilo. Alas, there are none for sale. The state grocery stores had kasha, rice, wheat flour, butter, milk, and what looked like beef chuck, all for sale at *very* reasonable prices—you could buy enough oatmeal to live on for a month for about 6 rubles—but little else, and no vegetables at all. However, in the public markets, cucumbers are readily available for 20 to 30 rubles a kilo.

Now, what's a ruble worth? That's not a simple question. At the state currency exchange booths, it was 6 rubles for a dollar. The street price was between 14 and 18 rubles per dollar, depending on how hard you negotiate. (I didn't do this, but a former U.S. Embassy official who was down the hall from us did and got 18.) Looked at that way, 20 rubles doesn't sound like much for 2 pounds of cucumbers—just slightly less than you would pay at a U.S. supermarket.

However, the average Russian salary is 300 rubles a month. Some make less. Most retirees, including retired engineers as well as bus drivers, get 100 rubles a month. Five percent to 20 percent of your monthly income is a *lot* to pay for a kilo of cucumbers. . . .

In other words, the first stages of perestroika have produced more goods, but now they're no longer for sale at prices most people can afford. Before perestroika, you had to stand in line for cucumbers, but you could afford them. Now you don't stand in lines, but the prices are very high.

Tekhnika

Now to connect this with computers.

The big problem in the U.S.S.R. is not selling what you can take there. As an example, it took only 4 hours to arrange to have all my books, both science fiction and my old computer books, translated and published, with quite respectable press runs—200,000 copies—and decent royalty rates. It appears that in a couple of years Niven and I may both be ruble millionaires.

Despite the meager salaries, many Russians have rubles, because there's little to buy. You can sell almost *anything*. It's quite true about the long lines at the McDonald's on Pushkin Square; I saw them, every day, all day, noon to well past dark. You could sell blue jeans, or Nike shoes, or Maidenform bras, or coffee, or Marlboro cigarettes, on any street corner. Sales are not a problem—as long as you're willing to accept rubles.

The problem is that the ruble is not a convertible currency: *no* foreign country will take rubles for *anything* (with a few exceptions like Cuba; but then the Cuban currency isn't convertible, either). Moreover, the Russian government won't take rubles for many things, including seats on Aeroflot, the Soviet national airline.

At the *beryozka* stores, there are some neat items that might be worth buying for export, and the prices are in rubles. Not real rubles, but "gold rubles," worth in theory 1.6 dollars per ruble. Actually, it's a bait-and-switch operation: there are no gold rubles. The prices are in rubles to make them look lower: 600 ordinary rubles would be only $100, but 600 gold

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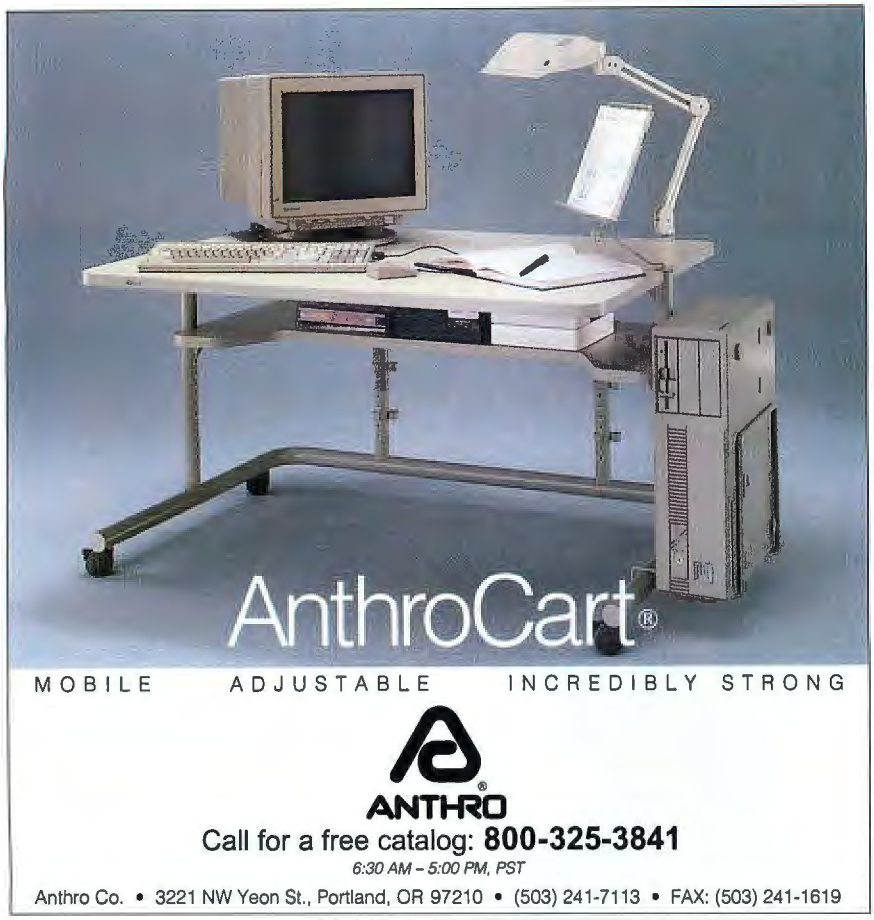

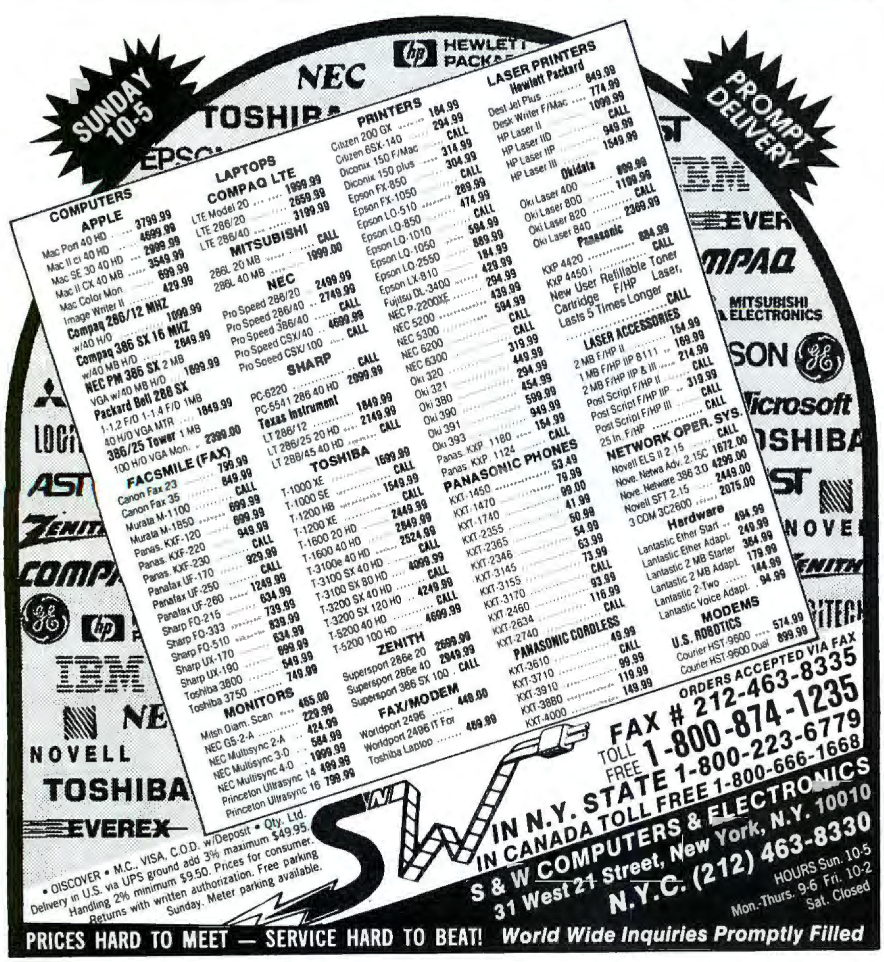

rubles is nearly a grand. Moreover, the store won't take rubles of any kind anyway: you must pay with hard currency or a credit card.

Tekhnika thought it had a way around the problem. Tekhnika was a cooperative, which is something like a western private corporation but, as they found out, with fewer rights.

Tekhnika salvaged waste logs and branches from Soviet rivers: the Soviet lumber operations are carried out with the usual Soviet efficiency, which is to say they're very wasteful. Tekhnika was able to pay good prices for river gleanings, which were exported to Japan. Japan is desperate for lumber of any kind, to use for everything from paper pulp to toothpicks, so there was no trouble selling there. In Japan, Tekhnika bought IBM PC clones; they could get a complete machine for about $500 U.S., roughly equivalent to 3000 rubles. Such machines sell in the U.S.S.R. for 30,000 to 50,000 rubles. Business was good.

Too good. Many Russians resent profits. They don't believe anyone can do anything worth, say, 25,000 rubles a year when the annual base salary of a Soviet engineer is under 4000 rubles. Tekhnika came to the attention of the authorities. Regulations were devised. Special taxes amounting to more than 50 percent were imposed. Barter was forbidden. Pretty soon, Tekhnika shut down. Incidentally, their high profits were disclosed when one of the partners loyally paid his Party dues from his earnings, writing a check for 92,000 rubles to an institution that paid him 130 rubles a month. . . .

ParaGraph

Cooperatives make too much money, so the Soviet government, while claiming to be in favor of perestroika, hampers them in every possible way. Joint ventures, in which Soviet institutions (and thus, indirectly, the government) own half, have an easier time of it.

Our friend Arkady Borkovsky, whom you've met here before, was back in the U.S.S.R. when we got there, and he arranged for us to visit ParaGraph, a software firm and one of the most successful joint ventures in the U.S.S.R. ParaGraph is owned 50 percent by Matrix USA (a U.S. venture capital firm), 25 percent by the Academy of National Economy of the Council of Ministers of the U.S.S.R., and 25 percent by the Central Economics and Mathematics Institute of the Academy of Sciences of the U.S.S.R.

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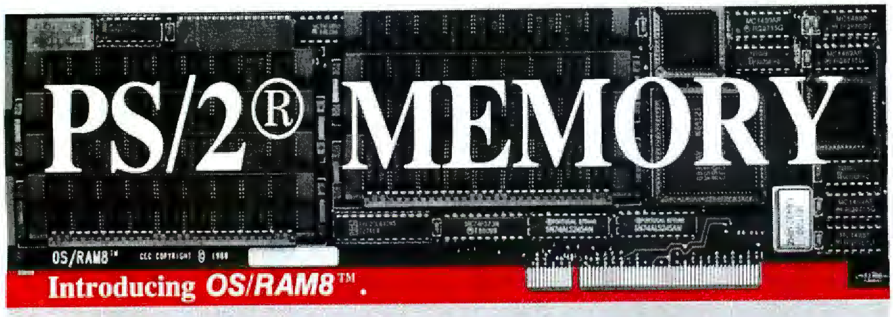

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their names imply, so ParaGraph has fewer problems than the co-ops do. On the other hand, as far as I can tell, the Soviet owners are happy enough to take their money and keep out of the way: Dr. Stepan Pachikov, the general director of ParaGraph, seems to run things there without any direct interference.

Of course, he's still operating in Moscow, where little works. The firm's offices are in a pre-1915 building that may have been a residence; whatever it was, it has no elevator, the rooms have high ceilings but are not laid out for office efficiency, and the electrical wiring is laid externally on the walls and usually works; but it's still a building that has received little preventive maintenance in the last 70 years. The parking lot out back is unpaved mud, and not a block away are the remains of a similar building that fell in a few years ago and now sits there, a pile of rubble. Note that this is in a desirable part of Moscow, within walking distance of Pushkin Square.

Even so, ParaGraph's offices are very good compared to, say, the office suite of Murat Ackchurin, poet, friend, and my literary agent in the U.S.S.R. Murat has better accommodations than many government clerks, so good that the government is trying to raise his rent to 40 percent of his publishing income.

ParaGraph's offices remind me a lot of a start-up in the early days of Silicon Valley, what with folding banquet tables, and holes in the walls, and computers stuffed into odd corners. There are other similarities: except for accent, a room full of ParaGraph programmers is nearly indistinguishable from such a group at the annual Hackers' Conference.

The conversations are the same, and, thanks to ParaGraph's profits and Western connections, so is the clothing: blue jeans, sneakers, and backpacks. It's about a 90/10 split between beards and clean-shaven. Think of a room full of people ranging in appearance from Dan Bricklin to Captain Crunch, and you'll have it. (There are women employees, but I didn't see any women programmers.)

Apparently, BYTE is well read in the U.S.S.R.; a number of people came to the ParaGraph offices to meet me. One of them was Alexey Pazhitnov, designer of the Tetris and Welltris games (distributed in the U.S. by Spectrum HoloByte). I told him these games are so popular in U.S. computing establishments that some suspect them of being a Russian plot to slow down productivity. I'm not sure that isn't true. . . .

We took 10 programmers and visitors to lunch in a co-op restaurant. There are about a dozen of these in Moscow; they have plenty of food available, but they're very high-priced compared to state-owned restaurants. It served Georgian cuisine, and we had four or five courses for everyone. The bill came to 110 rubles: 20 bucks American, or a third of an engineer's monthly salary, depending on how you look at it.

Cyrillization

ParaGraph has a number of products in development. Most of them are pretty specialized and have something to do with letting your computer speak Russian. While most Soviet programmers speak English, and programming is done in computer languages that use English words and the Latin alphabet, English isn't all that widespread in the U.S.S.R., and all Soviet writing—including word processing—is done using the Cyrillic alphabet.

ParaGraph has a Cyrillization program that will convert Microsoft Word, Framework, Ventura Publisher, Paradox, and dBASE IV. The installation is nearly automatic; their Installer works easily and painlessly, provided that you know something of what you're doing. I put that stricture in because a Cyrillic keyboard is *very* different from any Latin-alphabet keyboard.

Cyrillic needs a whole bunch of keys for special purposes, and Cyrillization programs generally move things like the period and semicolon to new locations, and that can get tricky. However, if you just want to fool around with Cyrillizing your system so that you can play with Russian, you can do it. Just run the Installer.

When that's done, you'll have Cyrillic on-screen and Cyrillic fonts for your printer. Your help messages can be in either Russian or English. There's also some spelling checking capability.

ParaGraph's programs sell very well in the U.S.S.R.; ParaGraph has made a lot of rubles out of this. They also sell a fair number of manuals. There are about 100,000 PCompatibles in the U.S.S.R. Microsoft Word, Framework, and other Western programs are nearly universal over there, and nearly all those copies are pirated. They pretty well have to be: at a street price of $200, even at the official rate of 6 rubles to the dollar, Word would cost a full three months' salary for an engineer! No wonder manuals and help files sell well.

Such sales earn rubles, but what ParaGraph's sponsors need is hard currency from sales in the West. Up to now, overseas sales have been spotty, but I think they'll take off pretty soon. I don't know how many Russian users in the U.S. need

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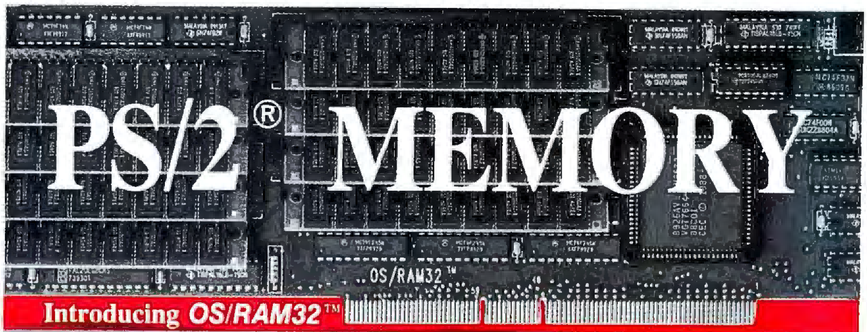

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the capability for working with Cyrillic, but I'd guess it's a fair number, and as international relations improve, there will be more.

ParaGraph's programs work, and they have a number of good Cyrillic fonts. Check first to be sure the Cyrillization program will run with your video board, software, and printer; but if you need Cyrillic, at $199 with the fonts and Installer, this is the easy way to go.

Neat Hacks

Since ParaGraph has attracted most of the top programmers in the U.S.S.R., it should be no surprise that they write good code. Given the difficulty of getting equipment—Russian-made floppy disks sell for 10 rubles and are useless; Russian-made hard disk drives are nearly unobtainable and don't work worth a darn anyway, while Western component imports are subject to a weirdly calculated but high import duty—the ParaGraph programmers have learned to be very efficient in their use of computer resources. It reminds me of the early days of the MIT hackers.

They've got several programs in the works. For example, there's an intriguing expert-system generator called Dora. It's in English and creates rules; the inference engine is similar to the Edinburgh engine, but it seems to handle incomplete information better than any other I've seen. A sample expert program predicts the outcomes of U.S. presidential elections using a fairly small number of variables; interestingly, not only is the program pretty good at "predicting" the outcomes of past elections with its rules, but it also marks cases that it thinks are ambiguous or anomalous. One such was Hayes versus Tilden.

There's also ParaDisk, an encryption scheme similar to Lattice SecretDisk, but it has neat disk handling, including ways to partition your disk into protected and unprotected areas.

They are working on a handwriting recognition system. I was induced to write a note (on ordinary paper) for them to scan in with a Logitech ScanMan Plus. I warned them that *no one* can read my handwriting, even when I *try* to make it legible, but they insisted. Surprisingly, the program got about 80 percent of it. They had me write out the same message several times, and they're determined to teach their machines to read Pournelle. I wish them luck—I've got some trip notes that even I can't read.

Finally, there's a game, Perestroika, for the Atari ST. The game isn't a lot of fun to play—at least not for me—because it's arcade-style, and I always have a lot of trouble controlling things with the Atari mouse. On the other hand, it has wonderful graphics, and the "plot" of the game is the best summary of life in the U.S.S.R. I have ever seen.

You start with your little character in the anteroom of a seemingly endless series of bureaucrat offices. Everyone is out to get you: militiamen in blue uniforms, KGB in green with cornflower blue hats; literally everyone. However, if you can manage to push the bureaucrat for that floor into his office, you can then (and only then; normally, he's not *in* his office, but running about at random) rearrange the scrambled picture of Gorbachev on his wall until it's right—at which point the bureaucrat gets scared and becomes your ally, and you can go try to convert other bureaucrats. You also pick up various tickets and papers that can transform other enemies into friends. However, there are evil bureaucrats trying to convert your friends back to the old ways.

I'm not sure anyone, including its designer, has ever actually won this game; I'm not even sure there is a "win" designed in it. Which makes it very much like life in the real U.S.S.R.

If everyone in the U.S.S.R. had the talent and drive of the ParaGraph people, perestroika would be a snap. So far most people don't—the slogan is still "We pretend to work, and they pretend to pay us"—but my advice to American business is to keep an eye on Russia. There are a lot of very smart and well-educated people in the U.S.S.R.—their schools are miles better than ours—and if they ever get their act together, our children may find that competing with Japan and the Little Dragons was the warm-up, the European Common Market was the preliminaries, and an awakened and reorganized U.S.S.R. is the main event.

Portfolio

I've carried the Atari Portfolio for some time, and my son Alex has used it even more. As Alex says, if you like the Wizard or the Boss, you might consider spending a bit more and getting a *real* computer, which the Portfolio is. It's a bit heavier and larger than the Wizard, but it will still fit—more or less—into a pocket, and it's a full PCompatible machine, with DOS and a bunch of utilities, like an address book in ROM. Handy thing to have around.

On the other hand, I have to confess I don't use it a lot, and the reason is that I have trouble typing on it; that keyboard, while complete, is quite small, and I can't get my fingers on it. I also find I forget how to do certain things and have

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to figure them out all over again.

So. It was late at night, in the coffee shop/bar of the International Hotel in Moscow. I was drinking coffee; I noticed that the man at the next table was using a Portfolio.

Moreover, I knew him: Bruce Herschensohn of KABC-TV. "Hullo," I said. "We met a few years ago when I was chairman of the Space Development Conference in Los Angeles." He was too polite to say he didn't remember me, so I had a chance to ask how he liked the Portfolio.

He loves it. Since he got it, he never uses anything else. He has a portable printer and one of those cigarette-pack-size WorldPort modems—the one I have is by Touchbase Systems and is called a Travelcomm 1200—and he writes all his radio and TV speeches and columns on the Portfolio. It has his address book, and expense account, and phone list—the Portfolio can whistle the Touch-Tone numbers to dial for you—and in general his whole office is right there in that pocket-size machine.

"I like mine, too," I said, "but don't you have trouble typing on it?"

"Not a bit," he said, and proceeded to show me; and enlightenment struck.

Bruce is a two-finger typist and always has been; and for a two-finger typist, the Portfolio is just as fast, and maybe faster, than a regular computer. After all, the two-finger typist is staring at the keyboard, not the screen—and on the Portfolio, you can see the keyboard *and* screen at the same time. No wonder it's faster! As I said, enlightenment; and watching him pound away at that machine, I actually began to regret that I'm a (self-taught) touch-typist.

As a sort of defense, I hauled out Sir Zed, my Cambridge Z88, which I carried to the U.S.S.R., and used it to make notes, which I later transferred over to the (heavy) Zenith 286 SupersPort I'd lugged through the Los Angeles, London, Frankfurt, and Moscow airports along with Sir Zed. It wasn't the same, though, and I really began to envy Bruce with his Portfolio.

"Don't you forget how to do things?" I asked.

"Yes," he said, "but I fixed that." He showed me: the Portfolio uses battery-backed RAM cards to load programs. You can also write to a blank card; and Bruce had used one to make himself a complete help file indexed in a database. If he has a problem with one of the Portfolio's functions, he can load in that card and look up whatever it is that's bothering him.

So. Both my objections overcome. Now, I'm not going to abandon touch-typing, nor am I going to give up my big 386 machines with DESQview; but I have to admit that if I could learn to use that handy little Portfolio as well as Bruce Herschensohn uses his, I'd sure give up carrying both Sir Zed and the Zenith on trips.

If you're not afflicted with touch-typing, look into the Portfolio; it won't do everything, but you may find that it's all the computer you need. Bruce Herschensohn did.

QuickBASIC Revisited

Roberta Pournelle's Reading Program works; that is, it teaches kids to read. It doesn't much impress publishers, mostly because they think that the graphics are primitive (they are), and while that doesn't matter—the graphics are intended only to get kids to look at the screen, and you don't want them *too* interesting—the publishers are afraid that the critics and reviewers will hate that crude look.

It's been a bit frustrating. On the other hand, Roberta has had steady direct sales, and copies of her program are in use all over the world, in home study classes, schools, and lots of adult institutions teaching English. I believe it's now in use on every continent and in most states. Still, I keep promising to clean up those graphics, and I finally got around to working on them. In particular, I dug out the stuff on how to graft in graphics done with the Microsoft Mouse Paintbrush program into a QuickBASIC program.

For small images, that turns out to be easy if a bit tedious; Microsoft furnished the information, which involves loading the Frieze TSR program furnished with Paintbrush and using QuickBASIC's BSAVE to take care of the rest. Another way suggested by Martin Heller—moderator of the science conference on BIX—involves using QuickBASIC's ability to SHELL in the run-time version of Paul Mace's Grasp, or the public domain PICEM, a graphics file viewer; for more details, get on BIX. There are times when I think there is *nothing* I can't find out from one or another BIX user.

However, Roberta's program has to run on very primitive equipment; we often get requests for versions that will run on the original IBM monochrome board, since schools tend to get the cheapest stuff and keep it a long, long time. Her Reading Program was originally written for CGA (including monochrome CGA) boards, and it uses the

Screen 2 mode, which gives us another problem: while some Hercules graphics boards can handle QuickBASIC's Screen 2 high-resolution mode, others can't; and the old monochrome boards don't have any graphics modes whatever.

I know ways around most of this, but it makes for very tedious programming, and including all those error traps makes for fat, slow code. Fortunately, there is a remedy: the Crescent QuickPak Professional library of QuickBASIC routines. The Crescent package has Monitor, an assembly subroutine that will tell the program precisely what kind of monitor it's working with; HercThere, which will test to see whether, given that the system has a Hercules board, the Hercules adapter driver MSHERC.COM has been loaded; and just a whole bunch of stuff like that.

It also has a number of assembly routines to print arrays and strings very quickly with precise control, meaning that Roberta can build up a number of screens of pseudographics images using ASCII characters. It's even possible, using Crescent tools, to give the images the appearance of animation.

I also relearned a trick I had forgotten: inside the QuickBASIC environment (and everywhere else in DOS for that matter), it's possible to put the graphics images corresponding to ASCII characters above 128 and below 32 onto your program screen so you can see just what kind of odd graphics image you can make. The trick is to hold down the Alt key and then use the numeric keypad in Num Lock mode to enter the ASCII number of the character you wanted.

If this means nothing to you, go to your PCompatible. Get a DOS prompt. Now hold down the Alt key and use the numeric keypad to enter, say, 177. Release the Alt key, and a rectangle should appear on your screen. Other numbers will give other figures. Alt 33 will give you an exclamation point, and Alt 222 makes a tall skinny rectangle. In BASIC, you can even make string literals this way. Note, though, that it's wise not to do that with character 26, since that's the end of file marker, and when the QuickBASIC loader sees that character, it stops loading your program.

Anyway, the past week I have been going through Roberta's program and replacing a number of QuickBASIC multiline activities (e.g., `LOCATE x,y then PRINT Something$`) with Crescent assembly functions that accomplish the same thing in one line. The result has been to "shrink" her code while making the source code more readable.

PDQ

Crescent also has a new and improved version of PDQ, a library you use to link with at compile time rather than the standard Microsoft library that comes with QuickBASIC. PDQ doesn't have all the functions and utilities that come with the Microsoft library, but it has a lot of them, and Crescent has a deal now that lets you use floating-point math with PDQ.

PDQ does no run-time error checking, meaning that you want to thoroughly debug your program with the full Microsoft library linked in until you're sure of it. Then link with PDQ; the resulting code will be smaller and faster than the same program written in C, and the source will be a lot more readable.

Bill Gates has always said that for pure productivity—writing programs that run, and writing them *fast*—you can't beat BASIC. He even has a standing challenge that he can write, debug, and get running any complex program faster by working in the QuickBASIC environment than any other programmer in the world can do it in any other language. I don't know that anyone ever took him up on it; after all, going head to head with Bill Gates is likely to be a losing proposition regardless of the merits of the languages involved. Still, it's an interesting challenge, and one that is worth thinking about.

The objections to BASIC used to be threefold: spaghetti code, because there were no real structuring commands in BASIC; inability to access low-level things like chip registers; and fat, slow code once you got it running. Modern QuickBASIC answers all those objections. In regard to the first two, there are now plenty of data structures available and statements that let you get down to any level you like. The third objection is solved by using the Crescent tools, particularly PDQ.

I got started in microcomputers with BASIC, and although I've worked with and partly learned a dozen other languages, I find I keep coming back to BASIC—and every time I do, I find the language much improved.

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Winding Down

It's the darndest thing: at the National Computer Graphics Association show, I saw the Genius Genitizer, a neat, moderate-cost digitizer tablet. I have always wanted one. I spoke to the people in the booth.

When we got back from Russia, there it was, complete with power adapter (which plugs into a special RS-232C DB-25 plug, which then connects to either COM1 or COM2 on your computer), a stylus, and the cursor control. There are software drivers to set this up for CAD or to become an artist's palette. More software lets the Genius Genitizer pad substitute for your mouse in programs that want mice. There are disks and manuals galore.

There is everything you need, except, in all the manuals, disks, and boxes, there is not one hint as to the address of the company that makes the Genius Genitizer. The copyright is in the name of the Kun Ying Enterprise Co. Ltd. of Taiwan; but there is nary a hint of where on Taiwan the company is located, much less what the U.S. address might be.

I sure like this gadget, but it's a mighty mystery how I can tell anyone about it. More if I can find out more.

The book of the month is *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics* by Roger Penrose (Oxford University Press, 1989). It's heavy slogging but great fun. The CD-ROM of the month is for the Mac: the Guinness Disc of Records (Pergamon Contact Solution, Irwin House, 118 Southwark St., London SE1 OSW, UK, 44-71-928-1404). This is the whole *Guinness Book of World Records*, all organized in HyperCard stacks on a CD-ROM.

The game of the month is Sword of Aragon from Strategic Simulations, and yes, I know it was the game of the year last year; I still find myself playing it. This time, I'm determined to win without using magic (other than healing, which I consider medicine) at all. It's sure a challenge.

The gadget of the month is a wonderful thing that will turn your PC into—are you ready?—a Geiger counter. The RM-60 from Aware Electronics instantly makes your PC—portable or desktop—into a radiation monitoring device. Test the radon levels in your home or office. Using it is simple: plug the gizmo—which is about the size of a pack of cigarettes and connects to the plug with ordinary telephone cord—into either the serial or parallel port of your PC. Run the supplied software, read the instructions, and learn all about radiation. Take it on your next airplane trip and find out what happens at higher altitudes.

I was going to take the RM-60 to the Soviet Union, but at the last minute I got nervous: suppose they thought I was spying? As it happened, no one would have cared, so I missed the opportunity to test whether Chernobyl did anything noticeable to Moscow. Maybe next time. ■

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerryp."

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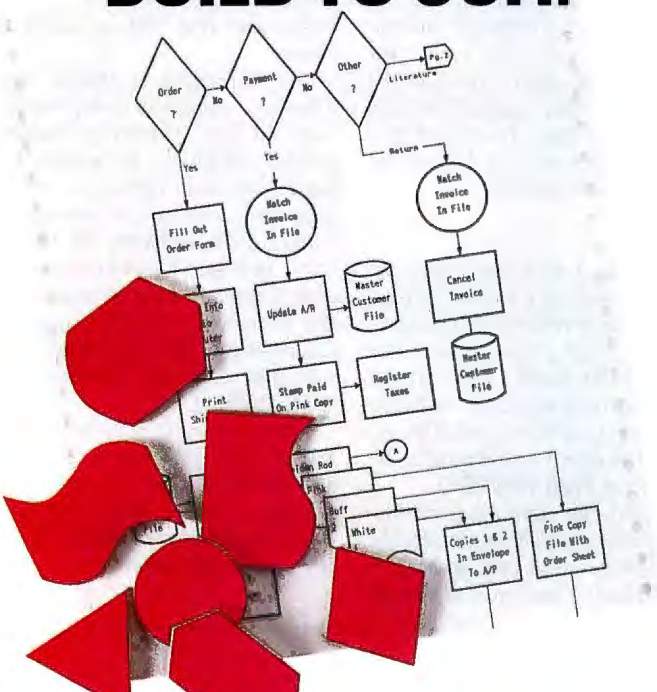

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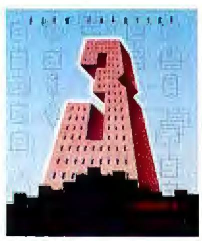

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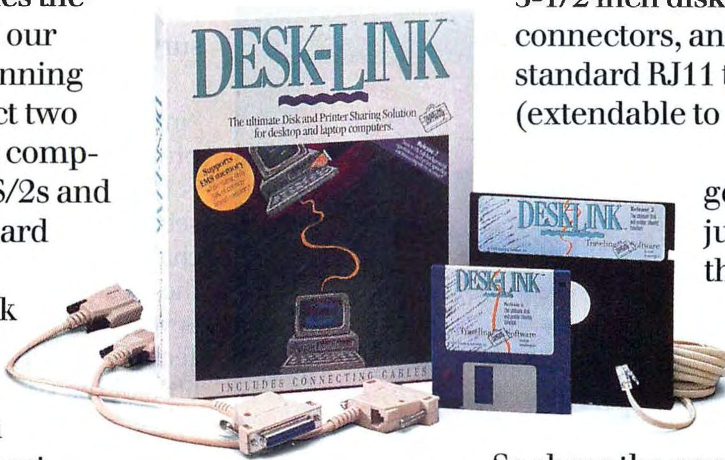

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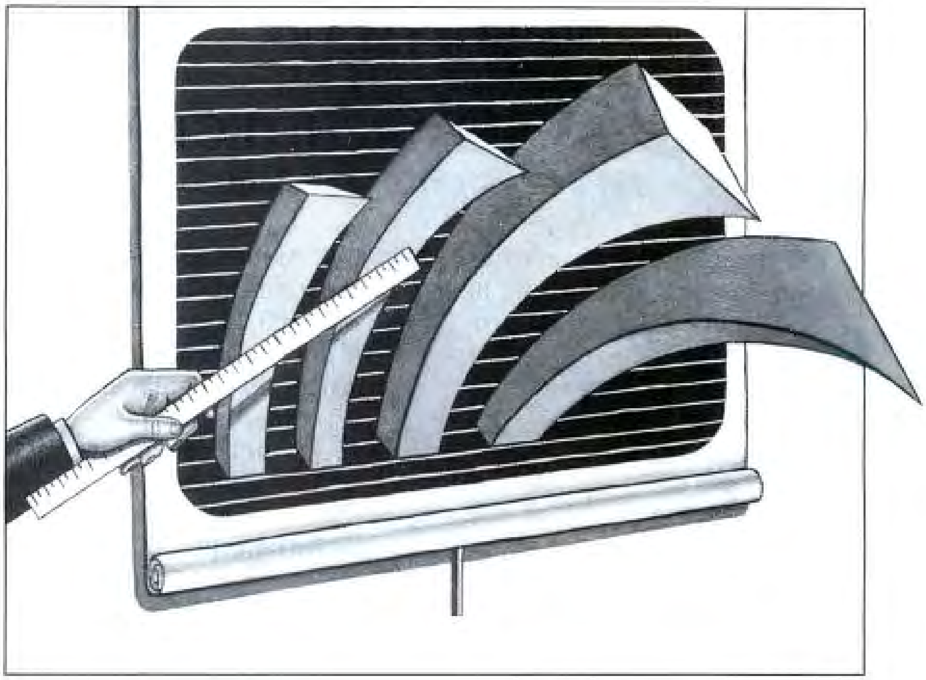
CHARTING THE COURSE

Suddenly, it was time for me to graduate from felt-tip pens and acetate overlays



"That's right, Wayne. You have to use 35mm slides," said Cathy, the woman from Unisys who was saddled with the job of handling speakers for the Open Forum. She paused for a moment and then added, "It's in the contract." She was right, of course. Unisys wanted high-quality presentations from the speakers at the Open Forum, and that meant slides. Clearly, the overhead transparencies that I'd used for other presentations wouldn't be good enough.

The problem was, I had put off arranging for presentation materials until a few days before the Open Forum was set to get under way in Los Angeles. Now I had to turn out quality graphics quickly. The talk was on LANs, so I needed drawings and graphs as well as the traditional bulleted lists.

With time running out, I did what any sane person would do. I called the company graphics department and asked for help. That worked, and in a few days, I had the slides in time to take them to the conference. Unfortunately, I also had to pay for the time that the people in the graphics department had spent creating those slides.

When I was asked to speak at the next Open Forum in New York, I knew that I would have to update the presentation myself. This meant that I would have to find something that would run on my Zenith Z-386 and produce slides as nice as those the graphics department had done on its Macintoshes. Fortunately, this type of software is available, and it's easy enough to use so that I could create my own graphics.

A Thousand Words

There is, of course, more to presentation graphics software than the ability to create pretty pictures. You must be able to enter the information you want easily, and the material needs to be presented in a format that meets your requirements. This may mean that, in addition to pictures, you want bar and line graphs to represent numerical values, bulleted lists to represent important points, and the ability to draw pictures.

In the case of my presentation, I had to come up with a picture that would represent the topologies of various types of LANs, drawings that would illustrate information flow, and of course, bulleted lists. Most of what I had done for the first presentation was still valid, but because of some changes in both the LAN technology and the vendors, I would have to add a couple of new slides. This meant that I had to use a package that would support both drawings and traditional charts.

I looked at three packages that are aimed at business presentation graphics: DrawPerfect from WordPerfect Corp., Applause II from Ashton-Tate, and Harvard Graphics from Software Publishing. Each of these three programs is designed to support business graphics, but they are all very different in the way that they do it.

A Matter of Emphasis

The packages that I looked at differ more in their emphasis than in their ultimate audience. All of them are aimed at business users but start from different places. DrawPerfect, for example, is a drawing program that also includes charts and graphs. Applause II, on the other hand, is a business graphics program that has a tightly integrated drawing component.

continued

ILLUSTRATION: JENNIFER SKOPP © 1990

Harvard Graphics contains no drawing capability at all; it assigns that task to Draw Partner, which is included as a separate program.

Each of these capabilities—that is, word charts, graphs, and drawings—is necessary for a package that will do business presentations. In addition, most business users would consider other criteria as well, including the ability to create output for plotters and film recorders and the ability to create three-dimensional charts and graphs.

Now that the software exists to support more sophisticated drawing capabilities, business users are demanding them. This is especially desirable in certain circumstances where representatives of several companies will be making presentations. In an atmosphere like this, the traditional flat, black-and-white overhead transparencies look dull and boring. They may be good enough for a meeting on new company parking rules, but not at meetings where speakers will be publicizing their companies.

ITEMS DISCUSSED

Applause II $495
Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90509
(213) 329-8000
Inquiry 1101.

DrawPerfect $495
WordPerfect Corp.
1555 North Technology Way
Orem, UT 84057
(801) 225-5000
Inquiry 1102.

Harvard Graphics $495
Software Publishing Corp.
1901 Landings Dr.
P.O. Box 7210
Mountain View, CA 94039
(415) 962-8910
Inquiry 1103.

Meeting the Standards

A presentation graphics package is useful only to the extent that its capabilities reflect the work you want to do in creating your presentations. If a feature is missing or very hard to use, then that package loses its usefulness to you. For this reason, few business users will create their slides using a word processing program or a paint program. While some slides can be created this way, they are not designed for business presentation graphics, and using them can be difficult.

The most traditional presentation device is the bulleted list. This is simply a list of the topics that you, as a speaker, will address. You have this list on-screen while you talk to reinforce the points you're discussing. You can create a basic bulleted list with nearly any kind of software, including a word processing program, but it may not be a pretty sight. Users are beginning to demand that the text on the slide be colored and that the background be smoothly gradated. Gradation and color give a more pleasing appearance, providing you don't let it become garish.

A good way to create slides that have colors and gradated backgrounds is through the use of a film recorder. This is a device that attaches to your computer's video output and creates slides while you wait. Another good way is to create your images and send them on disk

continued

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to a graphics service that specializes in such things. The cost of creating a 35mm slide from a disk image is about $10. Each of the packages I looked at includes a brochure for such a graphics service.

Business users have also come to expect colors and three dimensions when they see a graph. They usually want a gradated background and often a combined graph with some values reflected as line or bar charts and others as a pie. Of course, all graphs should be available in three dimensions, not just the bar or the pie. Graphs also need titles, legends, values of x and y scales, footnotes, and other values reflected as percentages. Pie charts often need a segment separated out for emphasis, and charts with multiple pies should be able to scale the pies for relative value. Bar charts should be able to display the bars side by side or overlapped.

The drawing module should be able to create block diagrams and organizational charts that combine images and text. Basic shapes should be available as a library so that you don't have to create each 3-D arrow or picture of a computer the first time you use it. Manipulating screen objects should be as much like working on the Macintosh as feasible (short of legal action by Apple, of course) so that you don't have to retrain the staff every time they change machines.

Presenting the Facts

I found that I liked Applause II from Ashton-Tate, partly because it was so well integrated and partly because it had the best-looking output. You can create 3-D line graphs with Applause II, and you can change the point of view in the perspective used in 3-D, neither of which I was able to do with the other packages. In fact, I had so much fun creating presentations with Applause II that this column was nearly late.

This is not to say that any of these three packages is deficient. They are not. In fact, all three are perfectly suitable for most business applications, and preferable for some. DrawPerfect, for example, comes with a shell that allows you to switch between it and WordPerfect and move your drawings directly into a WordPerfect document. If you are planning to illustrate a report, this is a very useful feature. Harvard Graphics is the top-selling package, so it's supported best by third-party vendors. All three packages can import data from ASCII files and Lotus spreadsheets, of course.

It's clear that presentation graphics programs are going to be a hot area for business users. You now have the ability to incorporate impressive color displays that it once took a graphics department to create, and you can do it yourself in minutes. As film recorders and slide services become better established, you should see a better grade of presentation. Of course, that means that you can no longer create a quickie transparency with a felt-tip pen and some acetate, but maybe that's just as well. ■

Wayne Rash Jr. is a contributing editor for BYTE and technical director of the Network Integration Group of American Management Systems, Inc. (Arlington, VA). He consults with the federal government on microcomputers and communications. You can contact him on BIX as "waynerash," or in the to.wayne conference.

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

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New York Times

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William Press
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Harvard University

"Mathematica will revolutionize the teaching and learning of math by focusing on the prose of mathematics, without getting lost in the grammar."

Steven Jobs
President,
NeXT, Inc.

Mathematica®

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Some facts:

Function: Numerical, symbolic, graphical computation, interactive programming. Integrated technical computing environment.

Numerical Computation: Arbitrary precision arithmetic, complex numbers, special functions (hypergeometric, elliptic, etc.), combinatorial and integer functions. Matrix operations, root finding, function fitting, Fourier transforms, numerical integration, minimization, linear programming.

```
In[1]:=
3^70
Out[1]=
2503155504993241601315571986085849
In[2]:=
Hypergeometric2F1[7,5,4.1,3-I]
Out[2]=
-0.00403761 - 0.00295663 I
```

Numerical Computation

Symbolic Computation: Equation solving, symbolic integration, differentiation, power series, limits. Algebraic operations, polynomial expansion, factorization, simplification. Operations on matrices, tensors, lists.

Graphics: 2D, 3D plots of functions, data, geometrical objects. Contour, density plots. 3D rendering with intersecting surfaces, lighting models, symbolic descriptions. Color PostScript output, publication quality graphics, animation (most versions).

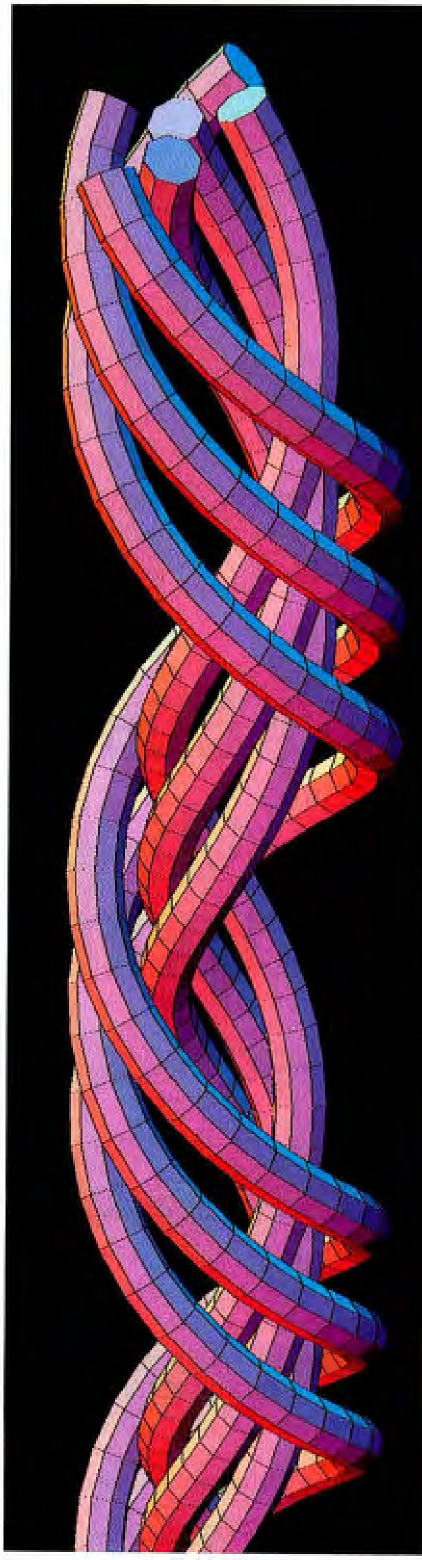
```
In[1]:=
Integrate[x/(a + Exp[x]), x]
Out[1]=
```

$$\frac{x^2}{2a} - \frac{x\ \mathrm{Log}[1 + \frac{E^x}{a}]}{a} - \frac{\mathrm{PolyLog}[2, -(\frac{E^x}{a})]}{a}$$

Symbolic Computation

Programming: High-level, interactive, symbolic system. Full procedural language, functional programming constructs. General transformation rule paradigm based on pattern matching.

External Interface: Input from external files, programs. Output in TeX, C, FORTRAN, PostScript. Interactive external process control (most versions).



Graphics and Visualization

Macintosh User Interface: Notebook interactive documents mixing text, graphics, animations, *Mathematica* input, output. Macintosh front end can be used with kernels on other computers. Macintosh graphics standards used.

Documentation: "*Mathematica*: A System for Doing Mathematics by Computer" by Stephen Wolfram (Addison-Wesley, 1988) available at bookstores. Additional documentation supplied with specific versions. *Mathematica* Journal to be published in 1990.

Versions Now Available: Apple Macintosh: \$495 (Plus, SE, etc.); \$795 (II, IIx, IIcx, SE/30, etc.) • 386-based MS-DOS systems: \$695 (no coprocessor); \$995 (287/387); \$1295 (Weitek) • Apollo DN 2500-4500, 10,000: from \$2400 • Data General AViiON: \$2,800 • DEC VAX VMS, ULTRIX, RISC-based systems: from \$2400 • Hewlett-Packard 9000/300, 800: from \$2400 • IBM AIX/RT: \$2400 • MIPS: from \$2800 • NeXT: bundled as standard system software • Silicon Graphics IRIS: from \$2800 • Sony NEWS: from \$2400 • Sun 3, 4, 386i: from \$2250 • Supercomputer and other versions also available. • Educational, volume, reseller, and other discounts available • Now shipping Version 1.2.

```
log[1] = 0
log[E] = 1
log[x_ y_] := log[x] + log[y]
log[x_^n_] := n log[x]
log'[x_] = 1/x   (* derivative *)
log/: InverseFunction[log] = exp
log/:
Series[log[x_], {x_, 1, n_}] :=
 Sum[-(-1)^k (x-1)^k/k, {k,1,n}] +
                        O[x,1]^(n+1)
```

High-Level Programming

Implementation: 770 pre-defined *Mathematica* functions (C source 180,000 lines). Design, development led by Stephen Wolfram. Version 1.0 released June 1988.

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Awards: Best 10 New Products, *Business Week* 1988 • Editor's Choice Award, *MacUser* 1989 • Award of Distinction, *BYTE* 1988.

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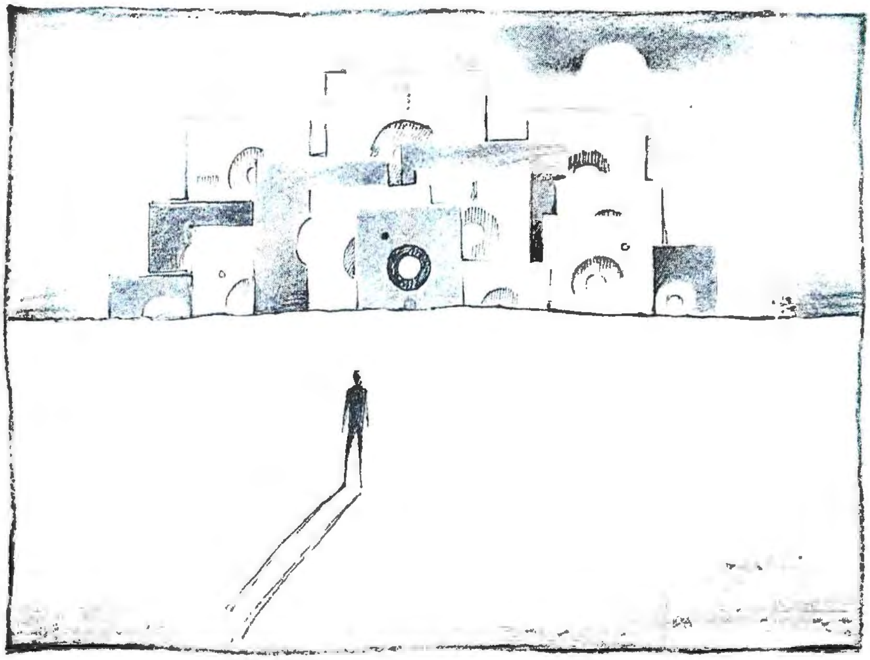
THE FREE SOFTWARE HIT PARADE

A tour of my favorite and most-used free programs for Unix



After reading my last few columns, you're probably eager to hear more about the incredible wealth of public domain or free Unix software. This month's column covers some of what I have personally found to be the most useful and interesting offerings (including some games). Simply running `ls -ut /own/lbin` shows me what the most recently accessed programs in my system's private directory are. If nothing else, they include some of the packages you might want to look for first.

Again, if you need a place to find any of this software, you can write to the address mentioned in my June column for a printed list of dial-up or file transfer-protocol archive and public access Unix sites, or you can retrieve the same information from BIX under unix.bin/listings. I hope last month's column showed that you don't have to be any kind of a guru to compile this kind of program.

Apologies in advance to the generous authors of the software mentioned herein: Since I didn't have *all* your names, I didn't think it fair to list *any* names. You know who you are, and so will anyone who uses your software. Thanks, from all of us.

Less Is More

You're probably familiar with the `more` program, invented by necessity after high-speed terminals became popular and looking at files with `cat` became difficult. The `more` program (and its System V sister, pg) lets you look at files a screenful at a time. A free utility, `less`, lets you scroll backward and forward through a file (or a pipe of data) quickly and easily, as if you had an endless two-way buffer. It's a good program to start your public domain career with, as it has been ported to almost everything available and is quite stable.

I probably use the `less` program more often than anything else on my system. I've aliased its name to `m` to save typing (another holdover from `more`; habits can be hard to break).

Take the e Train

Do you find yourself editing files in so many different directories that you forget which file you were last working with? Do you type a lot of `ls -t` commands to find out what you've been up to? The e program (another one-letter command!) can solve this problem. Simply typing e in a directory will bring up the `vi` editor with the file you were editing most recently. Typing e - shows you a list of the nine most recent files (or argument lists) you've worked with. Then, typing the appropriate number resumes that session. An invisible database kept in your home directory performs this magic.

The documentation for e implies it will work only on BSD-derived systems, but I've had it running just fine on SCO Xenix. Also, there is no reason why you couldn't use it for editors (or even programs) other than `vi`; the path name of the program to be executed is nicely broken out as `VI` in the `e.h` file.

Remove Without Remorse

I've been using the `del` package for many years. It came out on the network when I got my first Unix computer in 1983. The `del` utility is meant to be used in place of `rm`, but is reversible, so you can undelete files. It works simply by moving deleted files into an invisible directory; the files are then swept by a `cron` daemon (called `skulker`) once a night. All files left for more than 24 hours (you can change this) are then removed permanently by

continued

another program called expunge.

How can you remember to use `del` rather than `rm`? The best way to use `del` is to install it, test it, and set it up as an alias to `rm` for all users, so that you won't even have to think about it until you `rm` a file that you wanted. Then, just type `undel` and the filename and breathe a sigh of relief. If you don't have aliases, just move your current `/bin/rm` to `/bin/RM` (so it's still there if you need it) and then link `del` to `/bin/rm` (you'll have to modify expunge if you do this, since it wants to run the real `rm`).

The `del` utility has saved me from an ignominious fate on numerous occasions.

The elm Electronic Mailer

One of the best-supported free programs available, `elm` is indispensable to anyone who uses E-mail regularly. It provides a full-screen interface to mail messages, supports many addressing schemes and the standard pathalias database, and basically lets you use and manage E-mail messages without thinking too much about the transport mechanism. It's intuitive. What more could you want?

Daisy, Daisy...

The bicycle built for two in the song referred to an 1800's side-by-side model. It was much more convenient for romance than the single-file tandem bikes we have today. There is a convenient program named `sbs` (side by side) that lets you put two text files up on the screen next to each other and then scroll them independently (even sideways). It's not quite the same as using `diff`. It is especially handy when the files are similar but have been formatted differently. When you need it, it's very handy to have.

Laser Support

There are many programs being distributed to support PostScript output devices on Unix. Some, such as `a2ps`, `mp`, `psf`, and `pps`, translate text files to a PostScript-printable form (one called `necp5` can emulate an Epson printer). Others, like `psplot` and `plot2ps`, are designed to allow Unix plot output to be printed in PostScript. Then there's `ghostscript`, a GNU near-PostScript clone; `tpscript`, a ditroff (device-independent `troff`) to PostScript translator; `tek2ps`, which converts Tektronix 4014 output; `giftops`, for .GIF graphics files; and `sun2ps`, for Sun raster files.

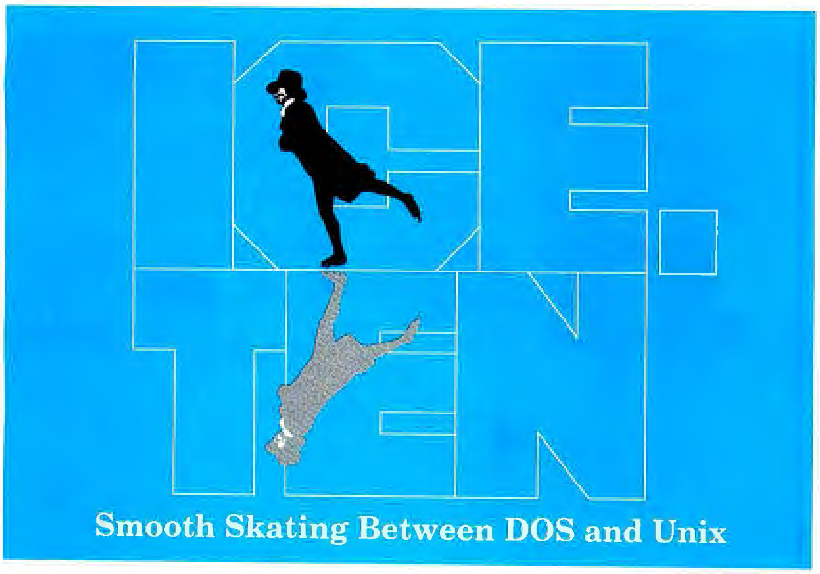
As a LaserWriter Plus owner and a great believer in PostScript (it is an elegant and generally applicable solution to many graphics and typesetting needs), I collect these kinds of programs. Almost all have proved useful at one time or another. Owners of LaserJet printers can find several similar programs to use.

Utilities Again

Be sure to get copies of the programs `compress`, `arc`, `uudecode`, and `unshar`. You'll find all of them almost mandatory for working with the various types of files that come across the network, as well as for attempting to fit those files onto your hard disk. The `compress` and `arc` utilities are used to get the traditional 10 megabytes of data into a 5-MB disk (and to get it back out again). The `uudecode` program lets you encode binary data into ASCII form so you can send it by E-mail or post it to the network. The `unshar` program safely breaks up text-based archives that have been posted into their component parts.

Others, like `patch`, `dist`, and `perl`, are also useful. Their distinction is that

continued



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MKS Toolkit reflects its users' needs. Organizations such as AT&T, H-P, ITT, and NCR - all heavily committed to the UNIX system - use MKS Toolkit to create a standard operating environment. Universities, from Harvard to UCLA, use MKS Toolkit to enrich personal research computing environments and double the bandwidth of their PC teaching labs. The National Institute of Standards and Technology uses MKS Toolkit as a standard operating environment for experts and as a POSIX training tool for neophytes.

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Byte Magazine, May 1989

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they were all written by the same very prolific and talented author.

The patch program lets you automatically apply program changes that have been posted to the network (generated by running diff against the old and new versions of the source code) to your copy of program source code.

The dist tool helps you create source code distributions that can easily be configured by the user, for compiling in different machine environments. Perl is a language that combines some of the best features of shell scripts, awk, the C programming language, and sed. It is being used for more and more programs distributed via the network, so it's good to have (as well as being interesting to program in). (See "Scripts Unbounded" on page 235.)

For communications freaks, there are pcomm and xcomm. One or the other should get you into any dial-up site you want, as they support the de facto communications standards (e.g., XMODEM) that are necessary once you leave the Unix world of UUCP and cu.

Fun and Games

It seems like everyone has heard of the game Rogue. It started as a program posted on Usenet and then rapidly spread, as did word of its addictive qualities. There are also Ultra-Rogue and Super-Rogue and a few other variants with different names, such as Hack. Rogue is a full-screen adventure game that is nothing like Nintendo but can find you playing at 4 a.m., wondering why you are still awake.

A well-written program called atc lets you play air traffic controller for a variety of propeller-based and jet planes. While not as sophisticated as some of the commercial products, it can still turn you into a quivering mass of jelly in short order. It also has the major advantage of being termcap-based, so it runs on any terminal.

If you have an ANSI-compatible (DEC VT100 terminal or IBM clone) display, check out gclock. It produces a 24-hour display that can't be ignored.

How about sc, the free Unix spreadsheet that's so configurable you can even change its name? I could go on for quite a while with this stuff. Just find a Usenet site that gets comp.sources.unix and comp.sources.misc, and you're ready to go.

Here's a quick one free. I call this program largest. Try it out:

```
ls -l $* | sort -r -n +4 -5
```

A Brief Note

This month marks the end of the first year of this column appearing in BYTE. I'd like to thank all of you who have been reading it, and especially for sending your kudos and suggestions to the editors. I do read all letters and have been making a valiant attempt at answering them, although speedy replies are not often possible. A note by E-mail to infopro!david or posted to the unix.bin/ask.david conference on BIX will generally give fastest results. ■

David Fiedler is executive producer of Unix Video Quarterly *and coauthor of the book* Unix System Administration. *He has helped start several Unix-related publications. You can reach him on BIX as "fiedler."*

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

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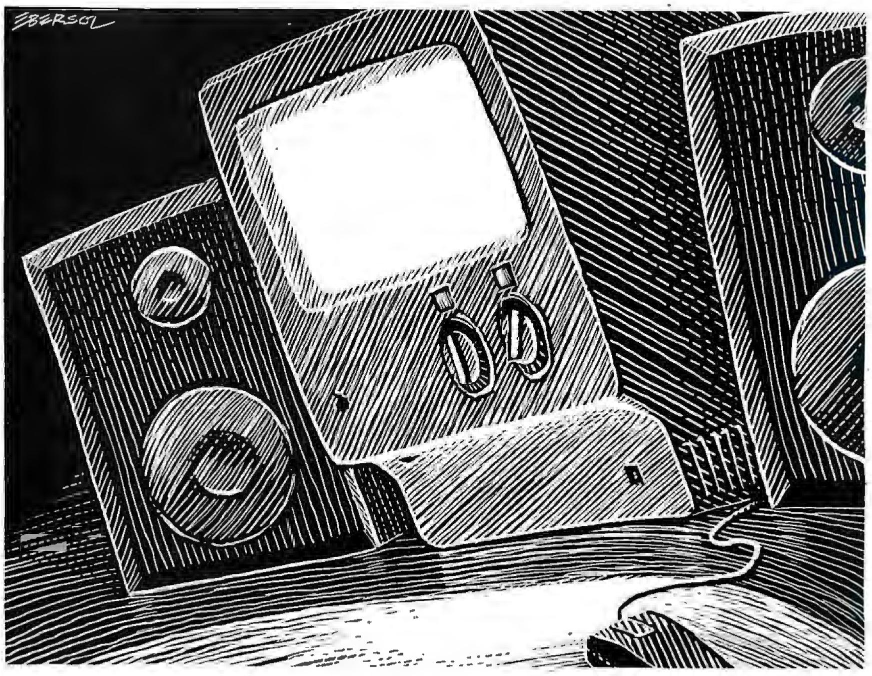
MULTIMEDIA FOR EVERYONE

Even Mac Pluses and SEs can participate— if you first define what multimedia is



Last month, I focused on the high end of the Macintosh product line, where hot Mac IIcis and hotter IIfxs ran as CAD workstations, working alongside fast 386- and i486-based PCs, Sun SPARCStations, and IBM RISC System/6000s. But what about the low-end Mac? Not all of us can afford a IIci or a IIfx. The real question then becomes: Do low-end Macs mean low-end applications? If you own a Mac Plus or SE, are you limited to grinding along doing word processing, small spreadsheets, terminal emulations, or simple flat-file databases?

No way. The low-end Mac is not a processing weakling, no matter what you've read elsewhere. While it's not a superfast floating-point number cruncher, it can handle some cutting-edge jobs: applications like multimedia.

Multimedia Possibilities

Are you surprised? Doesn't multimedia need mega amounts of processing power to compress real-time NTSC video and process compact disk-quality stereo sound at 44 kHz? I'll answer that question by approaching the multimedia issue from a different angle.

How many of you use your Mac (or any computer, for that matter) to edit videotape? Or to control real-time video and sound? If you believe the figures recently published by several industry groups, the number of computer users involved in high-end multimedia applications is minuscule. The trends show that this number isn't going to be increasing any time soon. Which is very interesting, given the position that Apple has staked out for multimedia with its higher-end Macs.

But that's not the world of reality for most Mac users. Many of us are trying to get some basic multimedia capabilities out of our less than state-of-the-art machines. As I mentioned earlier, most of us are lumbering along with the Mac equivalent of the XT: a Mac Plus or, if we're lucky, a Mac SE.

I have this same problem in my computer lab. We have an aging lab, where two-thirds of our equipment consists of Mac Pluses. To squeeze every last bit of performance and usability out of them, we have upgraded them to within an inch of their lives, with 4 megabytes of RAM, SCSI hard disk drives, and DirectServe network service. But they're still aging machines, with the problems of a 9-inch screen, a slow processor, and sluggish video performance that works against even a basic multimedia application.

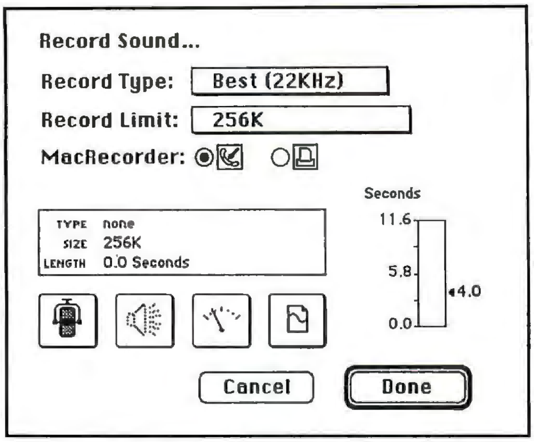
But even with this kind of less-than-sterling hardware, you can still get a lot of basic multimedia work done with a Mac Plus or an SE. The trick, of course, is to enlarge the concept of multimedia.

Here's what I think of when I think of multimedia: recording screen sessions, creating basic animation and moving graphics on the screen, recording and using snippets of digitized speech and music, and integrating the entire mélange for some purpose. Many examples come to mind: training materials or presentations, managing simple voice mail over a LAN, or making a computing environment more amenable to a particular user's needs.

An Academic Example

Let's take an example with which I am intimately familiar: teaching introductory programming to liberal arts students. Using HyperCard as the programming environment, with its basic animation and graphics capabilities, my

continued



The dialog box for MediaTracks voice recording is easily understandable, even without the manual.

students add digitized speech and music to their homework stacks using Farallon Computing's MacRecorder, which is a digitizer sound system. They also use Farallon's ScreenRecorder and MediaTracks to record and edit Mac screen images for inclusion in stacks or as separate "programming entities" that their stacks pass control to.

The MediaTracks editor looks much like Farallon's best-selling SoundEdit software. Thus, it is instantly familiar to the students, who have captured and edited sound on the Mac. With MediaTracks, students can mark points on a software "tape" of screen shots, cut and paste pieces of these tapes, and add sound through MacRecorder.

The MediaTracks tapes can then be jazzed up with buttons, icons, arrows, spot text (similar to the annotations you would add to static charts), and other image overlays.

None of this editing requires scripting ability, which is important to my students, who are struggling with HyperTalk. While the ScreenRecorder software records screens in monochrome, annotations and picture overlays can be added in color. This fits my needs well, since most students do their initial work on a Mac Plus and may tweak their software tapes and stacks on a color Mac II later during the course. The ScreenRecorder control panel couldn't be simpler, looking much like a simple VCR control panel.

The MediaTracks voice-recording control dialog box is easy to figure out, even if you skip reading the manual, as most students do (see the figure).

The beauty of the MediaTracks connection is that you can have many different ways to play back MediaTracks tapes: from the MediaTracks editor itself, through the ScreenRecorder 2.0 desk accessory, from HyperCard (using the MediaTracks playback XCMD), through the MT Player (an application designed to play back MediaTracks tapes), or by using the MediaTracks editor to create tapes that become stand-alone, double-clickable applications. This means that my students can use just about any software application that can launch another application to play back their MediaTracks tapes.

The combination of HyperCard, MacRecorder/SoundEdit, and ScreenRecorder/MediaTracks is unique. I haven't found any combination of software that does the basic multimedia job that my students and I need on any other computer. This might change down the line, though, since Farallon has announced that it is developing many of its Mac products (and unnamed new products) for the Windows 3.0 market. But for now, the Mac makes my multimedia day.

In many ways, HyperCard has been oversold as a personal programming tool and undersold as a great entry application for multimedia programming, especially as a way to learn about hypertext. HyperCard is my multimedia glue. There is nothing better on any other personal computing platform for this purpose.

Tip of the Month: Manage Your Mac Networks Easily

Managing a LocalTalk or PhoneNet network of Macs has never been a picnic; it's even worse if you have a mixed network of PCs and Macs on the same cable. I've been casting about for good tools for my own networks and for my clients for some time now, and I have often resorted to using $30,000 Network Sniffer boxes to get the kind of detailed real-time statistics about the networks that I need. But a new "kit" of network management goodies from Farallon has the distinct possibility of replacing my expensive Sniffers and all the other software flotsam and jetsam that I now use.

Called the PhoneNet Manager's Pack, it's a software-only kit that works over AppleTalk-compatible networks. The kit includes many useful network management programs. There's the network management software: TrafficWatch II, NetAtlas, NetStats, CheckNet, and StarCommand. Next, Timbuktu 3.1 shares computer screens and exchanges files. Finally, the kit includes utilities and documentation, including a videotape that takes you through the process of planning and installing a network.

A software subscription updates all these products for a year for $995. This includes your initial software disks and all the documentation. If you add up the separate list prices of these programs, you end up with something like $2000, so the PhoneNet Manager's Pack is a particularly good deal, especially since the software it includes is good stuff.

With the exception of CheckNet and StarCommand, all these programs have been thoroughly revised for this new kit. Each program is part of an overall "attack" on the AppleTalk network management problem. TrafficWatch II, for example, analyzes traffic patterns and error rates on Ethernet or LocalTalk networks and displays the results as tables that can be analyzed as is or imported into Excel. NetAtlas creates logical maps for all the nodes that are network-visible, including mail servers, workstations, and routers on AppleTalk networks and internetworks. NetAtlas works across LocalTalk, EtherTalk, or TokenTalk LANs, making it useful for mixed internetworks.

CheckNet, which searches and reports on all active devices on LocalTalk, EtherTalk, or TokenTalk, is mostly unchanged from its last release. NetStats is new, giving you a continuous graphical monitor of your network traffic and error rates (e.g., packet collisions, retries, and ping times). NetStats' display is reminiscent of the Network Sniffer.

You don't need a PhoneNet installation to get a lot out of the PhoneNet Manager's Pack. All you need is an AppleTalk, EtherTalk, or TokenTalk network of Macs and the desire to get things under control. Check this one out. ■

Don Crabb is the director of laboratories and a senior lecturer for the computer science department at the University of Chicago. He is also a contributing editor for BYTE. He can be reached on BIX as "decrabb."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

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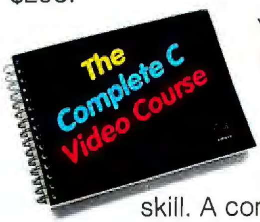

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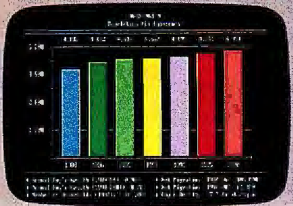

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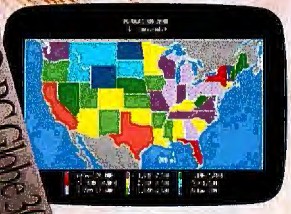

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MANAGING LAN MANAGER 2.0

A look at OS/2's latest approach to LAN management

I have been working with the beta version of Microsoft's LAN Manager 2.0, and it's just loaded with features. Since it's a beta copy, what I describe here may differ from what you will find on your dealer's shelf, but probably not by much. I can think of only a few examples of useful features in Microsoft beta software that never made it to final versions.

OS/2 has the advantage over DOS vis-à-vis LANs in that it was designed to support them from its very inception. For instance, one of the big features of version 1.2, the High Performance File System (HPFS), is pretty neat for stand-alone processing, but on closer inspection it was built with LANs in mind: Its access control lists make that clear.

Data Integrity with Disk Mirroring

The one convenient thing about working with mainframes is that when I do something really dumb, like deleting a file, there's always a backup, and generally one no more than a day old. And if a disk drive crashes, generally nothing important is missed, again because of the fault-tolerant nature of mainframe operating systems.

More and more, this kind of safety net is being built into IBM PC-based networks, like Novell's NetWare SFT (System-Fault Tolerant). In this vein, LAN Manager 2.0 will mirror HPFS volumes, so you can plunk two 330-megabyte ESDI hard disk drives into your server and have one act as a real-time fallback for the other. Expensive? Not really: This type of drive is in the $1500 range these days. Avert one disk disaster, and you've paid for the extra drive.

LAN Manager has a feature called *replication*, wherein you can direct that a file or subdirectory on a workstation must be updated to match a file or subdirectory on a server. This is another way to ensure data integrity.

Security

Running a LAN under the IBM PC LAN program was tough under version 1.23 and lower. Not much security, no traffic-monitoring capabilities, and lousy performance pretty much guaranteed the market to Novell. LAN Manager makes the security manager's job a bit easier. I used to say that security and LANs are like oil and water—they don't mix well, and it takes a lot of work to keep them together.

What does LAN Manager offer? How about user-specific access control, network alerts when security is threatened, security when a server doubles as a workstation (with a new version of HPFS), and password age control.

Under the old PC LAN program, you couldn't assign passwords for different users; you assigned passwords to resources. A subdirectory called DATA on the server, for example, would get its own password, say, "swordfish." Everyone who used DATA used this password. This, as you'd imagine, makes security pretty tough. LAN Manager is more modern, and, like Novell, it offers mainframe-style security. It is possible to say that user X can read only file Y, but user Z can read or write file Y.

Those of you who are not LAN administrators may be shaking your heads. "Who wants to have to assign file-specific rights to each user? That would take centuries!" No, it's not that bad. You can create a group, describe its rights, and assign individuals to a group. That way, all the people in a department get the same rights, with little extra work necessary from you.

continued

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And, for the security-conscious, the administrator can even set up *network alerts*. You can request an alert if someone tries to access a file for which he or she has no privileges, or, more likely, you'll set up the alert only after five or six consecutive illegal tries. Ditto for illegal log-on attempts. You can also arrange alerts if the server is running out of disk space (you set a critical space level from 0K bytes to 64 MB) or after a certain number of network errors have occurred.

LAN Manager has taken some hits in the trade magazines over the past few years concerning server security. The argument goes something like this: If you set up a security system on a server, the security is in place only when the server is acting as a server. There's nothing to keep someone from going to the server, rebooting it with a regular DOS disk, and reading the hard disk. The reason is, of course, that volumes based on the file allocation table (FAT) have no intrinsic security.

Novell's security is superior, it is argued, because rebooting a Novell server under DOS in the hopes of snooping yields no joy: The hard disk is formatted in a Novell format, quite unreadable to DOS. Thus, Novell's non-FAT disk approach offers an extra level of security en passant. Nifty as Novell is, I must beg to differ with this argument on two points.

First, merely going to an unusual disk structure and claiming that it's more secure just because vanilla DOS can't read it doesn't impress me much. There is a program floating around BBSes (no, I'm not going to name it) that reads Novell volumes under DOS.

Second, let's get real: This happens only if the bad guy gets to the server in the first place. There is no such thing as network security without physical security. Period. Take it and lock it up somewhere, like you do the mainframe. You wouldn't put the mainframe operator's console out by the front door, would you? Treat your servers the same way. But, for those who don't agree with me....

A new version of HPFS, HPFS386, provides security. If you install LAN Manager with HPFS386, you can lock out local users. Even a reboot under non-LAN Manager OS/2 will yield no joy, or so we're told. HPFS386 was introduced for another reason, however. It improves even further over HPFS in disk access.

And, finally, what would security be without passwords? There are two kinds of passwords. The first kind are those random ones like 4Rf2!DD that are almost as hard to remember as they would be to guess, and thus get written in some hard-to-guess place like the bottom of the keyboard. The second kind are easy to remember, like your first name, and so are also easy to guess.

In any case, you've got to force users to change passwords regularly. LAN Manager lets you force them to change the passwords about as often as you like, and it even keeps users from changing from their favorite password to something else and then changing right back.

Administration

Keeping track of an OS/2 LAN Manager LAN is a bit easier. Servers can be remotely controlled over the LAN, avoiding the need to run around the building to watch accounting's, finance's, and contract administration's servers.

And, as networks get larger, administrators will want to start charging back for services, much in the same way that mainframes do currently—users may have an account of X dollars in "funny money," and every LAN access burns down that account a bit. LAN Manager contains the hooks to do such a thing.

Odds and Ends

You'll recall that I warned you away from DTK BIOSes because they didn't run OS/2. DTK has sent me its latest stuff, and I'm happy to report that it runs IBM OS/2 1.2 just fine. Like many other BIOSes these days, the DTK offering includes Setup right in the ROM, a feature worth its weight in gold. Having to root around for a bootable floppy disk with Setup on it is one of my pet PC peeves.

My simple HPFS benchmarks still generate mail. Terry E. Lindeman reports that HPFS really outshines FAT for accessing large files, and he kindly sent along a benchmark program to prove it. Again, I have no argument with him. I merely reported that for the kinds of things that most of us do—reading documents or spreadsheets under 1000K bytes in size and searching databases under 1000K bytes or so—HPFS volumes don't show a big improvement over FAT volumes. For most of us, however, HPFS offers two excellent benefits: long filenames and extended attributes. ■

Mark J. Minasi is a managing partner at Moulton, Minasi & Company, a Columbia, Maryland, firm specializing in technical seminars. He can be reached on BIX as "mjminasi."

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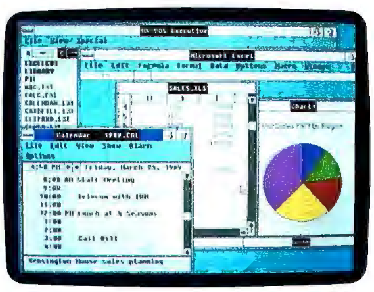

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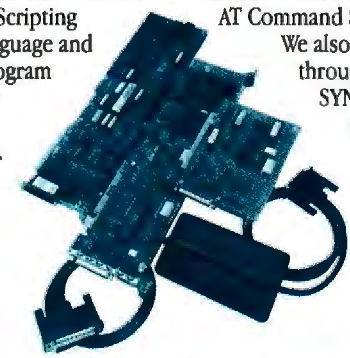

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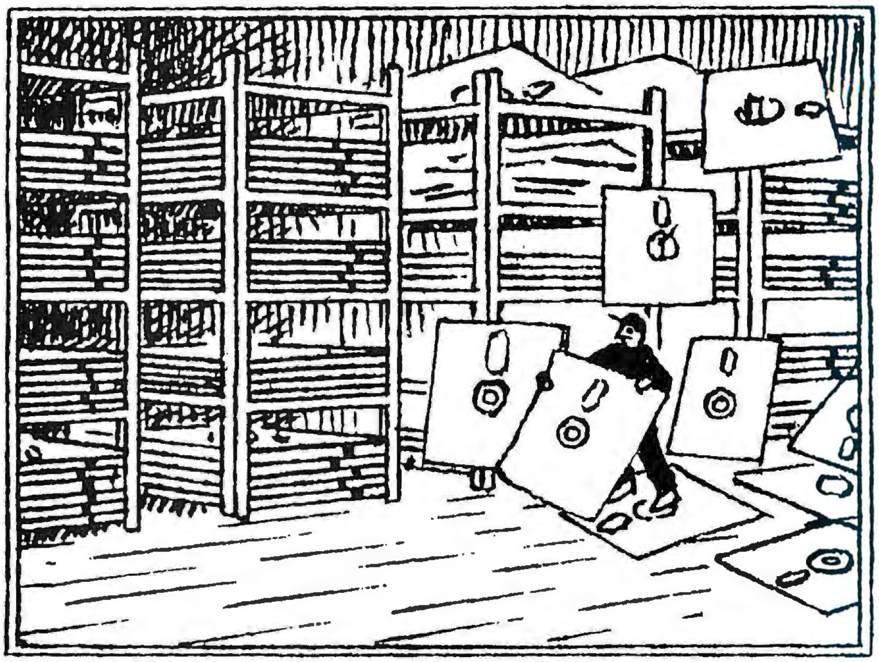
Managing today's large server disks is a pain in the neck



Everyone who uses a computer eventually ends up on space patrol. Sometimes the mission is just reconnaissance: Find a lost or missing file. More often, however, the job is to search and destroy: The disk is full, and it's time to free some space.

Both problems are bad on a PC's local hard disk, but they're dramatically worse if you're trying to manage one of today's large servers. If you don't keep enough space free, users who need server storage will scream for help. Delete or back up a file that a user needs, however, and you will hear the same screams.

As with so many LAN problems, the solutions shouldn't be as hard as they are. With a little help from the LAN operating system, or, failing that, from third-party vendors, your tour of duty on space patrol can become much simpler.

Reconnaissance

If users can't find last year's earnings spreadsheet or a copy of Lotus 1-2-3 to run, they have a right to complain; they know the files are somewhere on the server. If you're the administrator, however, you might not know whether those files are missing, on a backup tape, or merely invisible to the user because of the way file access permissions are set.

The LAN operating system won't do much to help you, but several third-party products will. One such PC LAN tool is XTreeNet, a LAN version of XTree from XTree Co. XTreeNet displays a hierarchical picture of a selected volume's directory tree and a listing of the files in a highlighted directory. You can perform any of the usual file operations—delete, copy, rename, view, or change attributes—on those files.

XTreeNet helps you search directories quickly when you know the filename and have time to browse the disk. It doesn't help much, though, if you remember what's in the file but can't recall the filename, or if you're sitting in a program that's waiting for you to enter the name of a file to open.

A Macintosh product, Go Technology's MacTree, works very much like XTreeNet. Another Mac program, Working Software's Findswell, remedies one of these deficiencies by letting you search for a file any time a program prompts you for a filename. Findswell adds to the Open dialog box a new button that lets you find all the files that have a specific string in their name.

Many other tools also let you search for files whose contents include a specific string. By using a few of these file management products, you can make file reconnaissance relatively painless.

Make Room for Data

Today's utilities offer less help when it's time to free up space on crowded server disks. You can ask users to clean up their files, but that usually does not free enough space. More likely, you'll end up hunting for files to delete.

That's not an easy job. You don't want to delete anything crucial, because it's a major hassle to restore individual files from backups. You can try to be careful and delete only files that no one has touched in a long time, but spotting those files is quite difficult. NetWare and LAN Manager 2.0, for example, maintain for each file the "date last accessed," which sounds like a perfect way to spot the files that you want to back up. Unfortunately, both products change a file's date last accessed any time that a backup program touches that file.

The answer to this problem should come from the LAN operating system.

continued

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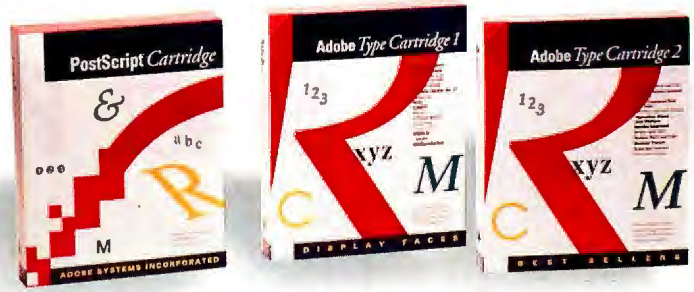

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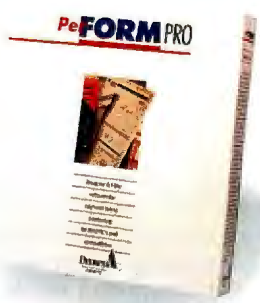

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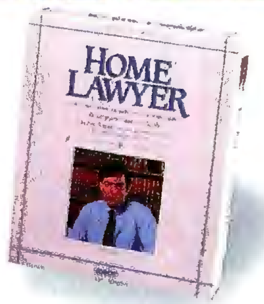

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6994 □PercentEdge 1.0 .... 69.
Timeworks ... NCP
6253 ▣Publish-It! 1.1 .... 115.
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6675 □TOPS Network Bundle 3.0 ..... 159.
3720 Flashcard 2.1 *(AppleTalk network card; 1 year warranty)* .... 155.
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5179 ▣LapLink III 3.0 .... 95.
True BASIC ... NCP
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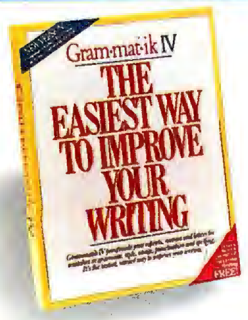
6771 ▣Memory Master 1.0 .... 45.
WordPerfect Corp. ... NCP
3804 □WordPerfect 5.1 .... 265.
6685 ▣DrawPerfect 1.1 .... 279.



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7372 □World Atlas .... 42.
6436 ⊞Hunt for Red October .... 20.
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3438 ▣Young Math *(ages 5 to 8)*....... 22.
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4107 RAMpage Plus 286 512k .... 419.
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Boca Research ... 5 years
7001 BOCARAM/AT PLUS *(0-8 Meg) (LIM 4.0 extended)* .... 125.
7061 BOCARAM/XT 0K *(0-2 Meg, LIM 4.0)* 99.
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6998 I/O Board for AT .... 59.
6999 I/O Board for Microchannel S/S/P . 109.
6995 SuperVGA *(800 x 600, 16/8 bit)*... 135.
7026 1024 VGA *(16 bit non-interlaced, 512K)* .... 219.
Brother International ... 1 year
5787 HL-8e Laser Printer........... 1699.
5788 HL-8Ps PostScript Laser Printer . 2949.
CH Products ... 1 year
7340 Flight Stick .... 49.
7345 Rollermouse *(Trackball) serial* 85. *bus* 99.
Compucable ... 2 years
1604 2-Position switch box .... 25.
Cuesta ... 1 year
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5655 150 Plus Printer *(Parallel)*........ 359.

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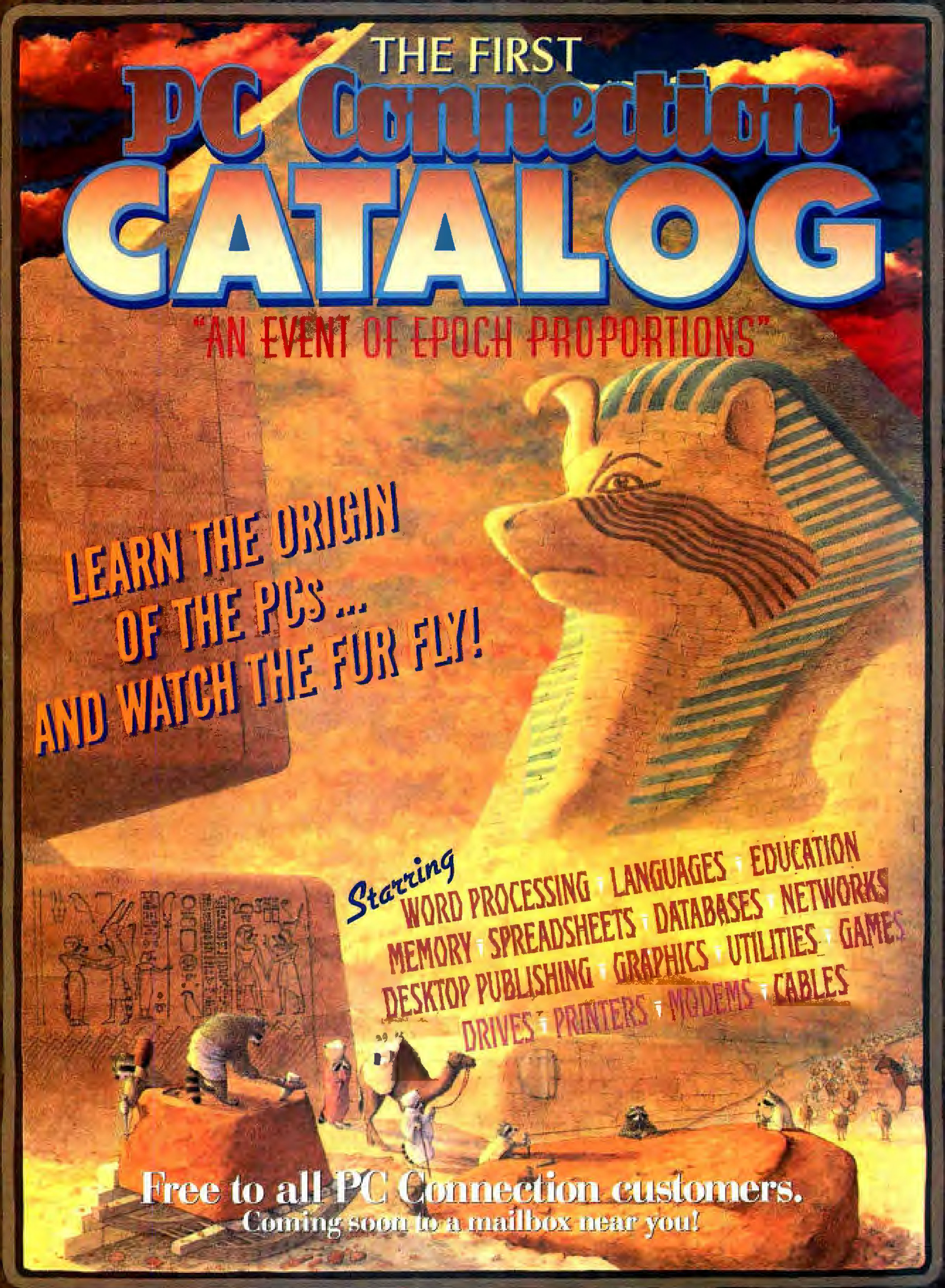

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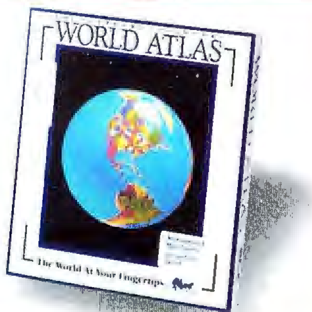

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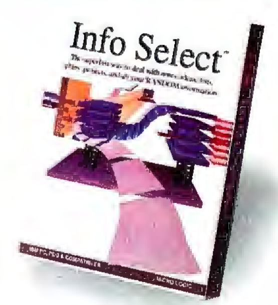

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5286 2400 Baud Int. MNP Modem *(Lev. 5)* 175.
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Incline Village, NV 89450
(702) 831-3100
Inquiry 1072.

Network Archivist $1795
Palindrome Corp.
850 East Diehl Rd.
Naperville, IL 60563
(708) 505-3300
Inquiry 1073.

XTreeNet ....$395 per server
XTree Co.
A Division of Executive Systems, Inc.
4330 Santa Fe Rd.
San Luis Obispo, CA
(805) 541-0604
Inquiry 1074.

For help, Novell and the other LAN operating-system vendors should look to minicomputer and mainframe operating systems, which have dealt with similar problems for years.

Those systems used a tiered storage model that puts the server's normal, fast hard disk drives at the top of a list of storage alternatives. The files that users most frequently work with live on those drives. Below them are slower, but still on-line, storage devices, such as WORM (write once, read many times) optical disks. Off-line backup devices, typically tape subsystems, sit at the bottom of the heap. Ideally, the LAN operating system should automatically migrate rarely used files down the hierarchy. (We're not talking here about backups, but rather about archives; a backup is a copy of a file that's on-line, while an archive might hold the only copy of that file.)

The LAN operating system should also make that migration invisible to users. If you read a file that has moved from a hard disk drive to a WORM drive, the only noticeable difference should be the access time. If you try to read an archived file, the LAN operating system should tell you that it's no longer on-line and give you the name of the archive device that holds the file.

This last step might sound like an odd request, since you can't see files that you archive off-line. But the LAN operating system should leave a placeholder for each archived file. This zero-length file's only function would be to inform users of where the file really resides.

The Network Archivist

One third-party product that provides many of these services is Palindrome's Network Archivist, a tape backup system. Network Archivist maintains an on-line database for each server volume; that database lets it tell users not only what's on the volume, but also which files it has archived.

To provide its archival and backup services, the program requires that administrators follow a strict tape-rotation regimen. The most common rotation requires five tapes (or tape sets), one of which you keep off-site.

Network Archivist's backup system classifies all files as either stable or nonstable. Stable files are those that haven't changed for a period of time that you can specify. Such files go at the front of backup tapes; nonstable, changing files follow them on the tape. The program doesn't mess up the network operating system's date-last-accessed information for the files it copies to tape; it remembers that information for each file it copies and then restores the date after it completes the copy.

Network Archivist's on-line database lists both on-line and archived files.

Over time, this scheme lets Network Archivist copy to tape only those files that have changed recently, thereby reducing the time that daily backups require. The program keeps copies of stable files on three different tape sets, so no one tape is irreplaceable. As the stable area of a tape fills up, the program "retires" that tape.

Network Archivist's archival system uses the same tapes. It can archive files automatically, or you can configure it to wait until your disk is full. You can even control which of the stable files it archives. You might, for example, define as stable those files that haven't changed in three months, but archive those files that no one has touched in six months.

Network Archivist then deletes those files and updates its database. (Copies of those files do exist in the stable areas of three tapes.) To help users find archived files, you can tell Network Archivist to leave behind a placeholder file for each file it deletes. A TSR program that users run on their PCs intercepts attempts to read or write those files and lets users know that the files are in the archives.

Administrators also get some help: Network Archivist can display a "superdirectory" that shows all files currently on-line and those on an archive tape.

A First Step

Network Archivist takes a big step in the right direction, but it still has plenty of room for improvement. Palindrome presently offers no solution for LAN Manager–based LANs or for Mac users. Network Archivist also does not implement a full multilevel storage system. Perhaps most important, to use this product you must buy into the vendor's entire tape backup subsystem. That's fine if you're just getting into tape backups, but many users already have a large investment in backup gear.

We don't blame Palindrome for this shortcoming; the company offers a heck of a product, and the people there are doing what they can both to serve users and, of course, to make money.

No, the LAN operating-system vendors should solve these problems. All LAN operating systems should have file fields for both the date last accessed and the date last backed up. They should add the concepts of migration and archiving to their file systems. Client software should warn you when you try to read a file that's on an archive. And so on.

It's not enough just to provide servers and operating systems that can hold thousands of files; vendors also have to help users manage those files. ■

Mark L. Van Name and Bill Catchings are BYTE contributing editors. Both are also independent computer consultants and freelance writers based in Raleigh, North Carolina. You can reach them on BIX as "mvanname" and "wbc3," respectively.

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

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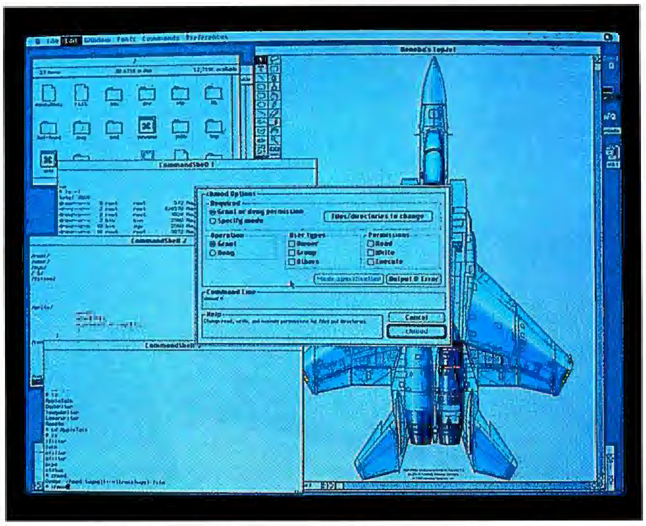


A/UX 2.0: Unix with a Friendly Face

You sit down in front of a Mac IIci and go about the day's business. You run several Mac applications simultaneously, do a spelling check on a report with a desk accessory (DA), print the report to a networked laser printer, and finally copy the file to an AppleShare file server for archiving. A typical Mac running MultiFinder, right? Wrong. The Mac's actually running **A/UX 2.0**, Apple's latest version of Unix, which now supports MultiFinder. This setup combines the best of both worlds: You have access to Unix's preemptive multitasking operating system with its plethora of tools, while enjoying the Mac's ease-of-use graphical user interface and many of its applications.

Apple based A/UX 2.0 on AT&T's Unix System V.2.2 with BSD 4.3 extensions. It's compliant with the IEEE's POSIX, the federal government's FIPS, and the System V Interface Definition (SVID) specifications. It uses both the System V file and Berkeley fast file systems. You have a choice of command-line interpreters: C, Bourne, or Korn shells. The X Window System is available as an option.

I examined a beta version of A/UX 2.0 on an external 80-megabyte hard disk drive connected to a Mac IIfx with 32 MB of RAM and also to a Mac IIci with 4 MB of RAM equipped with an Apple 8•24 Display Card. From a CD-ROM disk, the A/UX kernel installation was the easiest I've seen. You connect the CD-ROM drive to the Mac, format and partition the external hard disk drive, stick in several floppy disks and answer some questions, and then leave the Mac alone for an hour while it does the rest. After that, a log-in window appears, and you're ready to go.

With sufficient physical RAM, A/UX allocates 16 MB of virtual memory for a version of MultiFinder designed to operate under Unix. A/UX runs MultiFinder as a preemptive Unix process along with other Unix programs, which provides both system resource sharing and memory protection. Mac applications still run cooperatively under MultiFinder, which means that an errant Mac application can hog MultiFinder's time slice, or it can crash itself or other Mac applications, including MultiFinder.

However, you have access to all the Mac's features: You can run graphics applications, pick a laser printer from the Chooser DA, and let Print Monitor output your file in the background. Applications, however, must be "32-bit clean" to run in the A/UX environment. That is, they must use proper memory management and the same 32-bit addressing as the host operating system, or they crash.

The A/UX drive appears as a Mac drive, with subdirectories and files appearing as folders and icons, respectively. Copying and sharing files becomes a matter of clicking and dragging icons. When you insert a floppy disk into the SuperDrive, a dialog box queries you to determine whether it is a Mac or A/UX disk.

Under the Apple menu, where the DAs and running applications hang out, is a CommandShell application that gives you access to the Unix side. You open one or more Unix command-line interface windows and run different interactive sessions in each. For writing documents, there's the traditional `vi`, but you get a Mac-style editor, as well.

Also inherited from MPW is Commando, a utility that supplies interactive help for Unix tools. After you type in a Unix command and press Command-K, a dialog box appears. It contains buttons and controls that guide you through the command's options and features. Clicking on buttons and typing options assembles that command's arguments. When you're done, the dialog box disappears, and you press the Return key on a syntactically correct Unix command line. While you'll still need a good grasp of Unix concepts to make the best use of Commando, it lets a novice get things done.

A/UX has many features that make it stand out from Intel-based Unix systems. It can operate in the 24-bit color mode, making it suitable for high-resolution graphics or three-dimensional modeling.

Overall, I'm impressed by the stability of this version of A/UX. I'm tempted to use it as my operating system of choice, even though the majority of my work would still be with Macintosh-based applications.

—Tom Thompson

THE FACTS

A/UX 2.0
$995 on floppy; $795 on CD

Requirements:
Mac SE/30 or II (68020-based Mac II needs 68851 paged memory management unit installed) with 4 MB of RAM and an 80-MB hard disk drive.

Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Inquiry 985.

A Cure for What Ails DOS

The latest incarnation of **DR DOS**, Digital Research's MS-DOS clone, is an innovative and intriguing operating system that's thoughtfully designed.

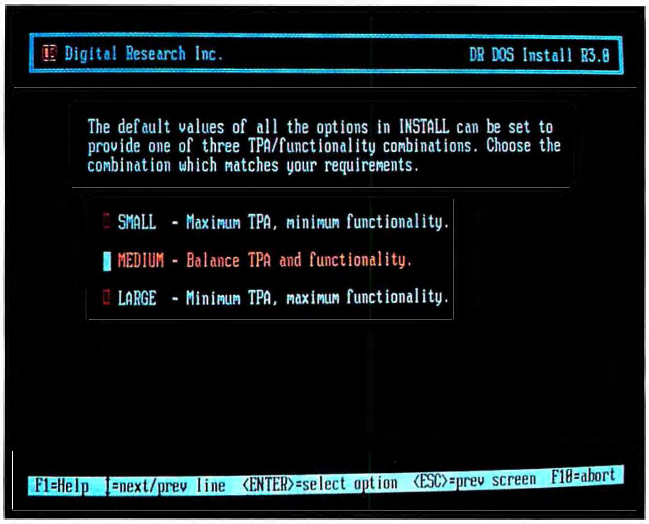
Version 5.0 is also packed with the extra features that Microsoft's own operating system should have (and might eventually have if the long-rumored MS-DOS 5.0 becomes a reality).

As the people at DRI make very clear, it's not pronouced "Doctor" DOS, although the analogy isn't far off the mark, since it indeed "cures" many (but not all) of MS-DOS's shortcomings.

DR DOS isn't new; it was first introduced in May 1988 as an OEM-only product. Its claim to fame is that it's designed to be easily incorporated into ROM, perfect for use with disk-space-hungry laptop computers. DR DOS still is easily ROMable, but the just-introduced version 5.0 has lots more to it.

If you're going to consider replacing your familiar-yet-frustrating MS-DOS with a clone, the first question that undoubtedly comes to your mind is, "How compatible is it?" I tested DR DOS on a wide variety of machines and with some finicky applications. Despite the weird device driver and TSR curves that I threw at it, DR DOS didn't falter once.

If you have gone through the sink-or-swim exercise of installing MS-DOS on a system, you'll find DR DOS a revelation. There's an extensive installation utility that gives many choices and explanations of numerous options. In MS-DOS, I never used many of the built-in utilities, because I often couldn't figure out what they did. This is not so with DR DOS. After I made a variety of choices, DR DOS automatically created the correct AUTOEXEC.BAT and CONFIG.SYS files for my configuration. If you want to change things, you can rerun setup at any time.



THE FACTS

DR DOS 5.0
$199.95

Requirements:
IBM PC, AT, PS/2, or compatible.

Digital Research, Inc.
Box DRI
70 Garden Court
Monterey, CA 93942
(800) 443-4200
(408) 649-3896
Inquiry 986.

I appreciated the ability to put multiple lines of options in my CONFIG.SYS and AUTOEXEC.BAT files. If I put a question mark in front of a line, it asked me at boot time if I wanted that line run. In one fell swoop, I eliminated a half-dozen different setup files.

I found MemoryMax the most interesting and useful feature of DR DOS. It's a memory management feature that works with 386- and i486-based systems, along with 286-based systems that use Chips & Technologies' NEAT or LEAP chip sets.

MemoryMax moves the core of the operating system, along with DOS buffers, drivers, networking software, and TSR programs, into high memory (i. e., memory above 640K bytes and below 1 megabyte). That left me with a very generous 620K bytes of base memory for running RAM-hungry applications like Paradox. I could even run Ventura Publisher without having to unload my Novell NetWare drivers.

ViewMax is a graphical DOS shell that's based on Digital Research's GEM interface. There's also FileLink, a simple LapLink-like file transfer utility; a command-line history; and the ability to protect files, subdirectories, and even your entire system with multiple levels of passwords.

A feature that isn't immediately useful to end users, but could ultimately be very important, is BatteryMax. Designed for use with portable computers, BatteryMax's patent-pending capabilities must be incorporated into the hardware design.

BatteryMax checks the application status 20 times a second. When it detects that the system isn't being used, it switches the hardware into an ultralow-power standby state. Digital Research claims that it increases battery life by two to three times and that laptops incorporating it will appear later this year.

I liked DR DOS 5.0, especially because it eliminates so many of the hair-tearing idiosyncrasies of MS-DOS. And doing that without compromising compatibility wasn't easy. Should you spend $200 to replace your MS-DOS? That's not an easy question to answer. To its credit, Digital Research offers toll-free unlimited customer support. That, along with the extra added goodies, just might make DR DOS worth the price of admission for you.

—Stan Miastkowski

IQ Scan: About as Friendly as They Get

Scanners used to be the Cadillac of peripherals: big, expensive, complex, and suited only for the most dedicated power users. But as applications like desktop publishing and document storage and retrieval become routine, a scanner is almost a necessity. At least I found plenty of uses for the flatbed **IQ Scan** from Pentax Teknologies.

What I first noticed about

continued

the scanner was its long and narrow flatbed design. This lets you scan legal-size documents of up to 8½ by 14 inches—making it ideal for handling those all-too-common large graphics or jumbo books.

Installing the IQ Scan was a snap. The PC version that I tested came with a half-length add-in board. And since it didn't have any jumpers, I just plugged it in, connected the cable, and was off and running. For use with the Macintosh, the scanner comes with a SCSI. To install the Mac version, you just plug it in. (It emulates the Apple scanner.)

A scanner, of course, isn't of much use without special software. If your desktop publishing or fax software already handles a scanner, you can buy the IQ Scan sans software. But Pentax also offers it bundled with software ranging from simple image scanning to high-end character-recognition packages.

Using the IQ Scan was amazingly simple. It has a minimum of controls—just on-line, halftone, and contrast switches. Everything else is controlled from software. The IQ Scan is so quiet that I hardly knew it was working, except for the glow from its yellow-green fluorescent light source.

It takes the IQ Scan about 17 seconds to scan a full-size page. It outputs the image in bi-level (line art), dithered, or 16-level gray scale at up to 300 by 300 dots per inch. Character recognition, as you'd expect, takes a bit longer—an average of approximately a minute a page.

—Anne Fischer Lent

THE FACTS

IQ Scan
$1399 with serial interface for PC; $1599 with SCSI for Mac; sheet feeder, $595

Pentax Teknologies
880 Interlocken Pkwy.
Broomfield, CO 80021
(303) 460-1600
Inquiry 987.

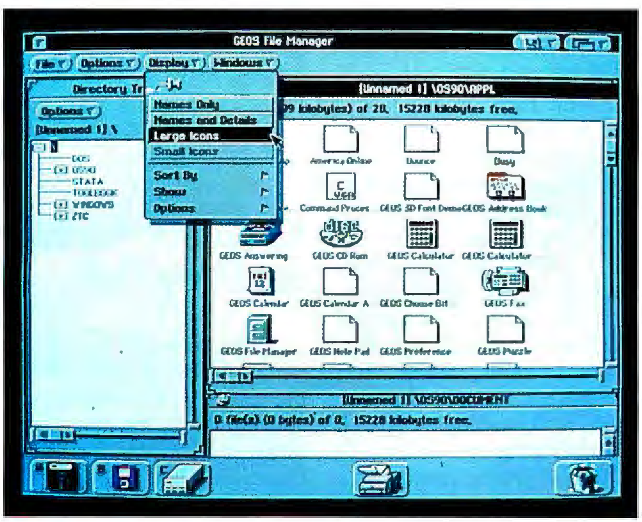
The OS/90 Operating System: Looks Great, Less Filling

Before you let the shipping crew haul away the last of your 640K-byte, 8088-based PCs, you should take note of what GeoWorks (formerly Berkeley Softworks) has planned for them.

Depending on your degree of involvement with it, GeoWorks' **OS/90** can be many things to you. GeoWorks claims that OS/90 is most of the operating system that OS/2 is, all the window management and graphical applications environment that Presentation Manager and Windows are, and then some. This is a study in potential: Much of what GeoWorks portends for OS/90 does not yet exist. The documentation paints a fairly bright target, however, and if GeoWorks hits it, it will indeed have a product that combines the best of OS/2 and Windows while adding unique value.

The best thing that can be said about OS/90 is that it doesn't constrain CPU or memory requirements; OS/90 is built to run adequately on an 8088 and impressively on a 286 or better. If you have expanded or extended memory, OS/90 will use it, but since OS/90's kernel uses less than 100K bytes, you don't need extra RAM.

Windowing and graphics are an integral part of OS/90's kernel. It also supports what GeoWorks calls a "PostScript-like" imaging engine that outputs scalable, transformable graphics and text. Accessible kernel and library services are instituted as objects that can be subclassed to make it easier to build a user interface object, like a text editor, into an application. Like Windows 3.0, OS/90 comes with a raft of prebuilt applications, including a word processor, a graphics editor, a communication program, and various SideKick-like accessories.



The demonstration clearly shows OS/90's direction and present progress. I found it easy to install, and once loaded, it took over the system and put up a display of large icon buttons. Another great strength of OS/90 became apparent right away: Among these buttons are tiny screen representations with the captions "DeskMate," "Motif," "Open Look," and "CUA." With OS/90, you can choose your favorite interface.

At the time of this review, Motif and Open Look were licensed, and CUA and DeskMate were fully implemented but not yet licensed. I was skeptical about the way they worked, but clicking on the Motif button did, in fact, fire up OS/90's file manager, and applications started with Motif's look and feel.

GeoWorks' attention to detail in graphical-user-inter-

continued

THE FACTS

OS/90
Under $200

GeoWorks
2150 Shattuck Ave.
Berkeley, CA 94704
(415) 644-0883
Inquiry 988.

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11. Position Independence: Both position independent code and data can be generated if needed.

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DEPARTMENT 21
4248 BELLE AIRE LANE
DOWNERS GROVE, ILLINOIS 60515 USA

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face emulation is striking; very little is left out. One long-term goal is to turn OS/90 into a tool that developers can use to write applications that conform to multiple commercial GUI specifications.

DOS compatibility is limited to running a single program outside of OS/90. If you click on a DOS program icon in the file manager, OS/90 will unload itself, run DOS, and reload itself automatically.

In its final form, OS/90 will encompass a complete set of C and assembly development tools, a symbolic debugger, and an interactive GUI design tool. It does not deliver multitasking or GUIs to existing DOS programs. What it does offer is a wealth of capabilities for the developer who wishes to incorporate multitasking, threads, scalable fonts, and commerical GUI compatibility into an application, without sacrificing its ability to run on unexpanded, less expensive PCs.

—Tom Yager

Right Before Your Eyes

Private Eye, Reflection Technology's 1¼- by 1⅓- by 3½-inch headset-mounted computer monitor, is certainly one of the most interesting goodies to come along in quite a while. For over a year, Reflection Technology was secretive about the details of Private Eye. But finally, the secret's out. After a year of promises, marketing hype, and well-orchestrated coyness about how it works, I found that the reality was slightly disappointing.

Putting a CGA-compatible computer monitor in this small a package certainly wasn't a trivial undertaking. Sure, your garden-variety video camera includes an eye-size monitor, but it's far from computer resolution, uses a comparatively large amount of power, and weighs a lot. Private Eye weighs less than 2½ ounces and draws just ½ watt of power. It uses a vertical line of 280 LEDs and a vibrating mirror that works along with some sophisticated electronics to "paint" the screen image as the mirror moves the line in front of your eye. Characters (and graphics) are red on black.

Installation wasn't difficult. Private Eye comes with its own special half-length card that replaces your current graphics card. Since my AT clone uses a monochrome display, I didn't even have to change my setup.

Your brain needs to acclimate itself to Private Eye, both on a conscious and an unconscious level. My first impression on taking a peek into Private Eye was, "This is awful." But patience is a virtue. As stressed in the manual, you need a 2- to 3-minute "training period" for your eye and brain to get accustomed to Private Eye. After a few minutes, the display suddenly popped into clarity and relative comfort.

You need to keep both eyes open while using Private Eye. Your brain integrates the screen image and the background, and you end up with a screen image that appears to float in the air in front of you. There's a sliding focus adjustment that I had to do lots of fiddling with initially. I could set the focus on the same plane as what I was working on, which is very comfortable for the eyes.

THE FACTS

Private Eye
$795

Requirements:
IBM PC, AT, PS/2, or compatible with a free 8-bit expansion slot.

Reflection Technology, Inc.
240 Bear Hill Rd.
Waltham, MA 02154
(617) 890-5905
Inquiry 989.

It took a day or so of occasional work before I was really comfortable with Private Eye. And I had to make some (understandable) changes in the way I worked. For example, the typical cluttered desktop makes for a confusing background image. And I had to change the setup of some of my applications so that they didn't show black characters on a red background, which I found too distracting.

With a list price of $795, Private Eye is expensive. But that's understandable, because at this point each one is essentially hand-built. It won't get much cheaper until (and if) it comes into mass production. Reflection Technology also promises higher-resolution (and eventually full-color) versions of Private Eye.

The potential innovative uses for Private Eye are brainboggling. Reflection Technology says that many companies are working on integrating it into truly small and portable laptop computers, hand-held instruments (e.g., oscilloscopes), and video games. Images of surgeons monitoring crucial life signs without looking up from their work or of real-time headset-mounted maps for delivery people are certainly intriguing. But, unfortunately, they're still far off in the future.

To be fair, Private Eye isn't designed for full-time use on a desktop PC. But until I can see what Private Eye can really do, I'll stick with my venerable, eminently comfortable, amber desktop display. ■

— Stan Miastkowski

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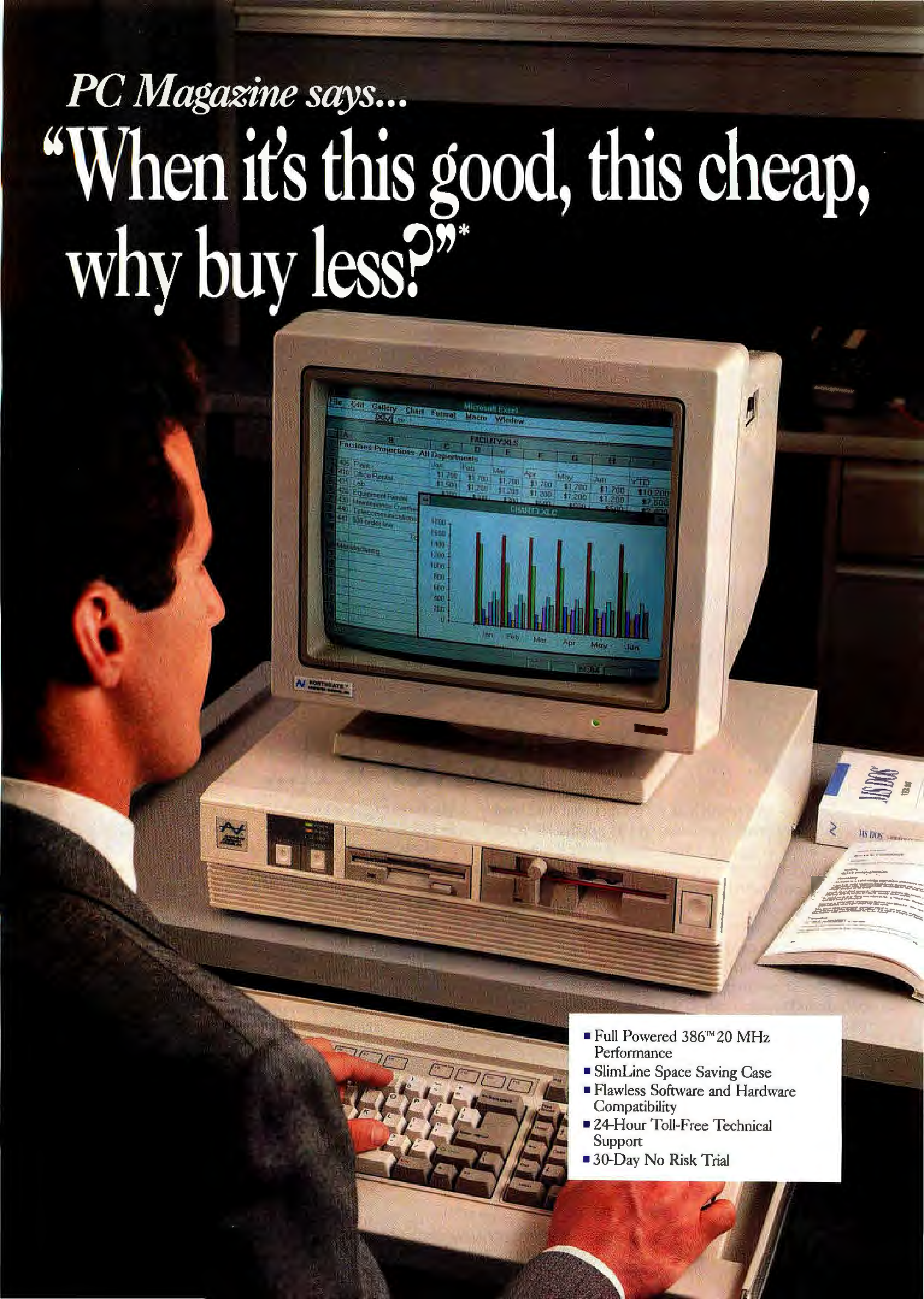
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Windows Shopping

Pricey and Elegant Multimedia Development

In these times of hype, almost every software company bandies about terms like "object-oriented," "multimedia," and (naturally) "easy to use." Since I usually have as much faith in these claims as I do in Friendly Fred's Used Cars and Computers, I approached **Authorware Professional** with a healthy dose of skepticism. But I was surprised. Authorware is truly object-oriented, and it makes the development of splashy graphics and sound almost trivial. I definitely give the company a check-plus for honesty.

Authorware, as its name implies, is software for "authoring," which has come to mean creating multimedia applications—usually for training or reference uses. A Macintosh version of Authorware has been available for a while; the company has just shipped a version for Windows 3.0.

The alpha version I looked at was in its early stages, still missing a few bells and whistles. That's understandable; but what I saw showed me that Authorware and Windows 3.0 are definitely made for each other.

Right off the top, it's necessary to talk price. Authorware lists for $8000. (You read that right.) If you're a bona fide education professional, you can buy it for $995.

To put it kindly, that's a nontrivial amount of cash. Software that costs this much is a new phenomenon in the microcomputer world, although it's not unusual for packages that run on minicomputers and mainframes.

And that's essentially the point: Authorware isn't designed for individual users. It's a very serious multimedia development environment that's designed for the needs of large corporations. For example, a large telephone company is using the Mac version of Authorware to automate repair and installation manuals, and defense contractors are using it to create portable on-line manuals for aircraft and ship repair.

In the environments where Authorware is being used, the bottom line is crucial, and time is definitely money. According to its developers, Authorware's major claim to fame is that you can create multimedia applications much more quickly than with competing (and lower-cost) packages.

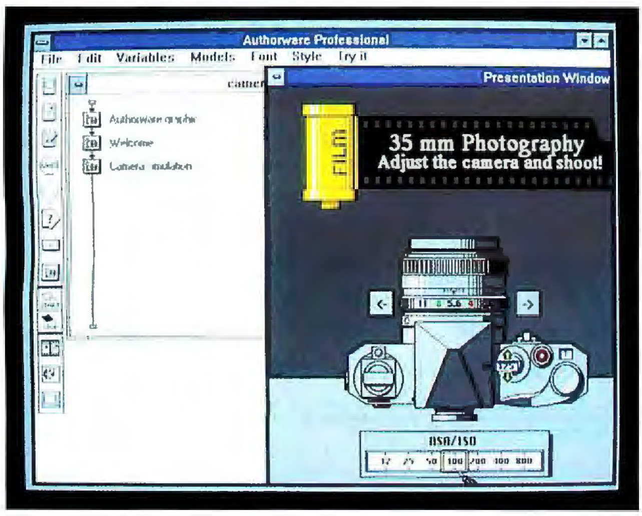
I have to agree. Within minutes after installing Authorware (and without even looking at the manual), I was able to create a small application for choosing among a variety of graphics images that I imported from Windows Paintbrush. And I used animated icons (included with Authorware) to liven up the screen.

If you're still trying to figure out what all this talk about "object-oriented paradigms" means, Authorware will burn off the fog. Its user interface is just plain elegant. When you open a new application, a vertical "flow line" appears in a window. On the left-hand side of the screen are 11 icons for various options. You merely drag icons onto the flow line, double-click on them, and tell Authorware what to do. It's not hard to figure out what the icons mean.

To import a graphic, I dragged the computer-screen icon to the flow line, clicked on it, and told Authorware what file to import and where to find it. Importing animated icons was just as simple; just click on the icon that looks like a piece of motion picture film.

I can only scratch the surface of Authorware's capabilities in this limited space. But what impressed me most was no matter how involved the application you want to create is, the development process is always intuitive. Authorware is the only package I've seen that relies almost fully on graphics objects. And that makes even the most complicated applications relatively easy to develop. You make graphical links between objects by using your mouse to tie them together on the flow line.

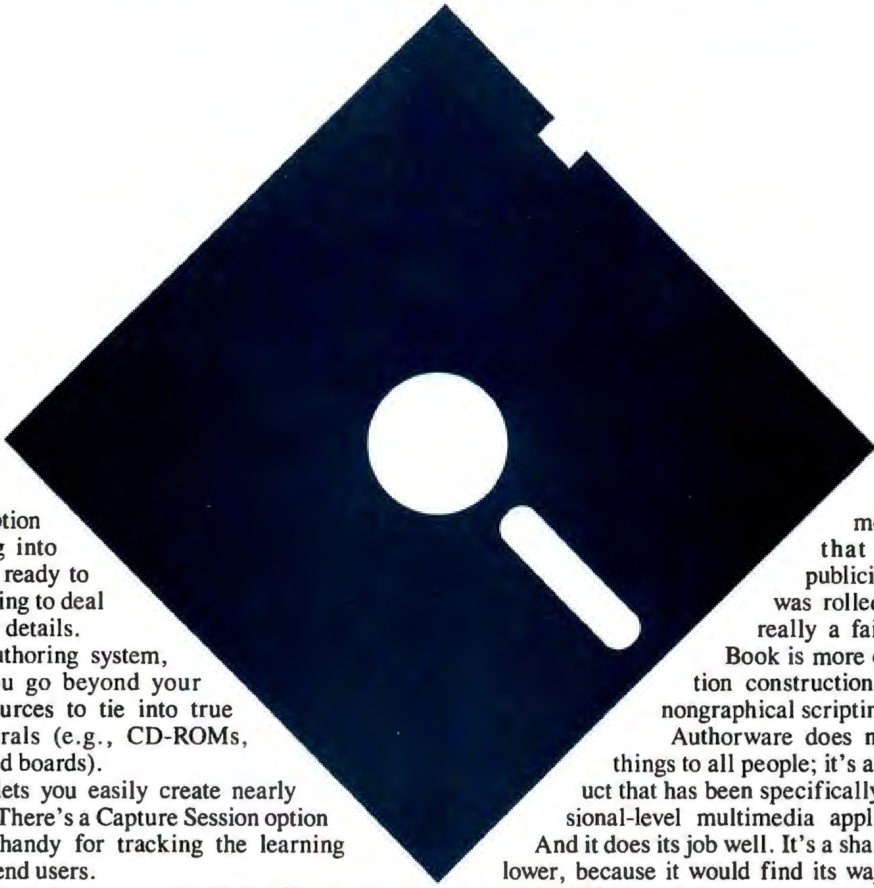
There's also a quite interesting Try It option. This option lets you interactively play with and tweak your application as you develop it. And when it's to your lik-



THE FACTS

Authorware Professional
$8000; for academics, $995

Requirements:
IBM AT or compatible with 2 megabytes of RAM for 16-color development (3 MB for 256-color development), a hard disk drive, and Windows 3.0.



ing, the Package option compiles everything into an application that's ready to run without your having to deal with all the technical details.

Like any good authoring system, Authorware lets you go beyond your basic computer resources to tie into true multimedia peripherals (e.g., CD-ROMs, videodisks, and sound boards).

Authorware also lets you easily create nearly unlimited variables. There's a Capture Session option that is particularly handy for tracking the learning progress of ultimate end users.

Authorware is likely to be compared with ToolBook, Asymetrix's $495 package that received so much publicity when Windows 3.0 was rolled out. But that's not really a fair comparison. ToolBook is more of an overall application construction set that uses much nongraphical scripting.

Authorware does not pretend to be all things to all people; it's a highly focused product that has been specifically designed for professional-level multimedia application development. And it does its job well. It's a shame that the price isn't lower, because it would find its way onto many systems running Windows 3.0. *—Stan Miastkowski*

Current 1.1: IBM's PIM Enhanced

Current 1.1, a new version of IBM's personal information manager for Windows 3.0, partially corrects a problem of the original version, which was the unrealistically few items that were allowed in its categories.

This version will support 4000 items per category, double the original number. You can use Dynamic Data Exchange to enter data into Current or to write data from Current to other DDE applications. Tagged windows can now be saved across sessions, too.

If you upgrade from version 1.0 (which runs only in real mode under Windows 3.0), you'll need to convert your data files. They are incompatible with this new version and could cause corruption. IBM had not released conversion programs at the time of this writing but was promising them soon.

Unchanged is the size limit on required fields. This is not a crippling flaw, but it is a serious bother. Person, company, and project key fields are 25 characters maximum, and 16 characters is tops for appointment, conference-room, expense, note, task, phone-call, and to-do keys. Part of the reason for this is that the key field also displays the entry date of the record—whether you want it to or not. Entry date is one of the least useful bits of information in a record much of the time, so why waste valuable screen space displaying it?

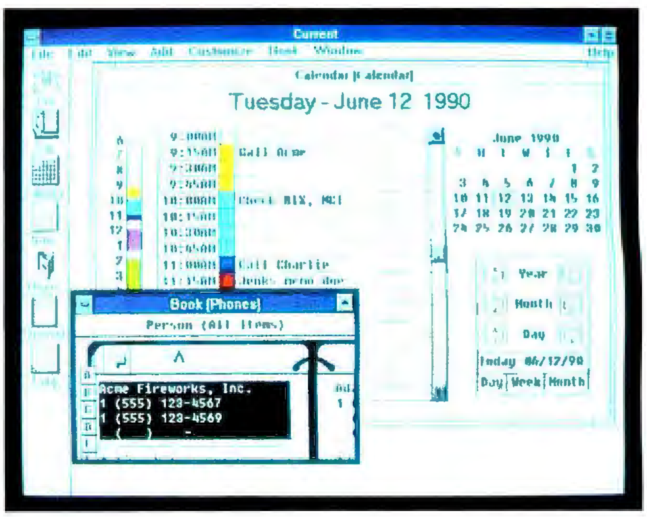
Current includes an outliner in addition to its word processor. The outliner functions, but don't count on it if you're a serious outline freak. It's no substitute for a full-featured one like MaxThink or PC Outline.

continued

THE FACTS

Current 1.1
$395

Requirements:
A 286 with a 20-megabyte hard disk drive and 640K bytes of RAM.



Current's strongest feature is point-and-shoot linking of information. It's easy to keep individual records relatively uncluttered because of this capability.

For example, you could create an entry for Wile E. Coyote in Current's excellent phone book. To show him as being employed by the Acme Fireworks Co., you would step through a scroll box and select Acme (or create a new entry for Acme). Later, a double-click on Acme in Wile's record will jump you to the Acme record; when you close that record, you're back at Wile's phone-book listing. Conversely, Acme's record will show Wile as an employee. Double-click on his name and jump to his phone-book entry, and so on. You can also automate this linking using a built-in menu-driven AI/expert-system rule program.

Current's calendar makes the best use of color of any I've seen. It lets you color-code classes of entries. In weekly and monthly displays, this use of color makes it very easy to grasp what is pending.

Other features include the ability to filter records through four sets of criteria connected by "and" or "or" operators, phone-conversation logs that can be linked to phone-book entries, multiple views of the same information, an auto-dialer, and an expense log.

Despite its annoying field-size limits and relatively low top on the number of records in a file, Current is a good tool. It's easy to learn and use, and it stacks up well against its competition.

—George Bond

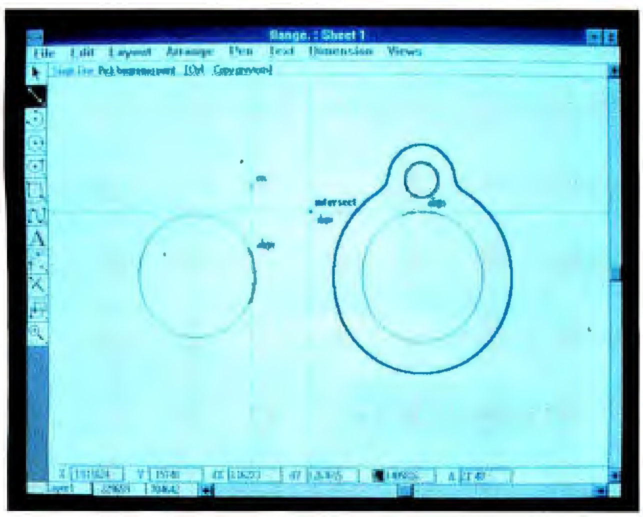
CAD Keeps Getting Smarter

Macintosh CAD got a powerful shot in the arm when Vellum 1.0 made its debut in late 1989. Ashlar now brings this exceptional program to the PC under Windows. I tested a very early alpha version of **Vellum for Windows 3.0**. On a 6-megabyte Compaq Deskpro 386/20 (with an 80387), it's just as snappy as on a 5-MB Mac II; the Windows and Mac versions share binary data files with no fuss whatsoever.

What makes Vellum special is a background agent called the drafting assistant. It continuously scans the geometry you create, anticipating what you might want to do next and selecting points in support of those choices.

Suppose you want to draw a line tangent to a circle and connect it to the midpoint of another line. With the line tool active, you probe the existing entities. When you get close to the midpoint of the line whose midpoint you're seeking, Vellum announces "midpoint" and locks in a tentative selection that you can then confirm with a click. Similarly, the circle; as you browse in its vicinity, Vellum announces key points—"center," "quadrant," and finally "tangent." Click again, and you've got your tangent-to-midpoint line.

In addition to these intelligent object snaps, the drafting assistant offers a variety of useful temporary constructions. Say you want to align the tops of a rectangle and a circle to an imaginary horizontal line. Most CAD programs require that you draw the line, align your objects with it, and then erase it. Vellum anticipates this situation and automatically provides a temporary construction line.



THE FACTS

Vellum for Windows 3.0
$995

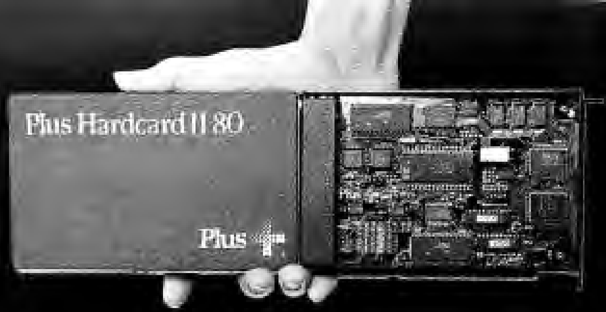
Requirements:
A 386-based PC with a math coprocessor, 4 MB of RAM, and Windows 3.0.

Doesn't all this feedback drive you crazy in complicated drafting situations? Thankfully no, because it's highly context-sensitive. The effect is local, and you can control it by touching the objects that you want the drafting assistant to care about. Simple, yet utterly revolutionary. Every CAD and illustration program should work this way.

As good as Vellum's basic drafting is, there's something potentially even better: integrated parametrics. That's a fancy term for a drawing that works like a spreadsheet. You can assign dimensions to an object using variables and then change the object's proportions by tweaking the values of those variables.

In practice, however, Vellum's parametrics can be vexing. Individual objects work fine. But when I tried to parameterize a set of objects (a flange containing a bolt hole), I ran into problems. Vellum wants to ensure that when you distort a drawing, certain conditions hold: Vertical lines stay vertical, concentric circles concentric, and so on. Unfortunately, the program remains mute when you

continued



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F

violate these conditions. It's easy to create (and surprisingly hard to debug) geometry that you can't resolve parametrically. Ashlar agrees that Vellum should help you build correct parametrics just as it helps with basic drafting and says that it plans to extend the drafting assistant into that realm.

What about three dimensions? According to Ashlar, development of a three-dimensional version of Vellum is on track and the product will ship in the fall. I will be particularly interested to see how Vellum responds to the unique challenges of drafting in three dimensions. In the meantime, I'm delighted to report that CAD for Windows 3.0 is alive and well. *—Jon Udell*

Ventura's Window of Opportunity

The twin pillars of PC desktop publishing—Xerox's Ventura Publisher and Aldus's PageMaker—now rest on the Windows 3.0 platform. For PageMaker, the move to Windows 3.0 was incremental; for GEM-based Ventura, it's revolutionary. In its beta incarnation, **Ventura Publisher, Windows Edition** looks extremely promising.

Longtime Ventura users will appreciate the abolition of the GEM version's clunky, modal orientation. Frame, paragraph, text, and graphics operations flow from the tool palette; there's no "mode selector." Under Windows, lists of components associated with frame and paragraph operations (i.e., the text and image files that pour into frames, and the style tags that control how paragraphs appear) can be simultaneously visible.

Generally, though, it's the same old Ventura. And that is saying a lot. Although Ventura is often compared to PageMaker, its frames, equation and table editors, and index and table of contents generators make it philosophically closer to products like Interleaf Publisher. What can Ventura do that PageMaker can't?

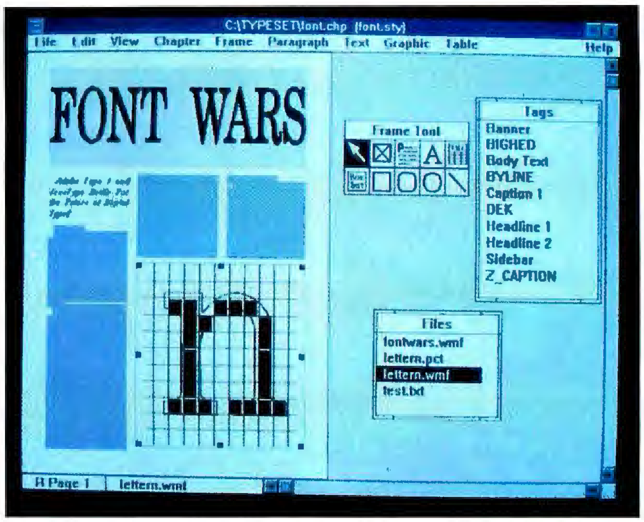
Here's an excellent example: You can anchor an illustration to its reference in the text. Ventura gives you three ways to do this: within a line of text (useful for tiny frames containing special characters), above or below a line (so that a column-wide illustration floats with its reference), or fixed relative to the page (to guarantee that a page-wide figure appears at the top of the page containing its reference).

Ventura also pays more attention to ASCII markup than does PageMaker. You can embed paragraph styles, local emphasis, and index, table of contents, and figure references in plain ASCII text files. This greatly facilitates cooperative projects that funnel the work of multiple authors and editors to a single layout and typesetting workstation.

Moreover, Ventura maintains a two-way link with its raw inputs, exploited cleverly on a network. This, too, can be a great boon to collaborative work.

Although noted for its ability to handle long, automatically formatted documents, Ventura does quite well at free-form design. When you insert a page into a document, it's exempt from the global page format that governs the rest of the document. You're free to place boxed text, line art, and scanned images anywhere on the page. Ventura supports many vector and raster image formats, and it does an excellent job of halftoning. Extensive typographical controls, including automatic pair kerning and interactive tracking, provide more power than most users are ever likely to tap.

Will the Windows version be speedy enough? Happily, yes. Scrolling, paging, and text and image placement felt reasonably snappy. Our first beta copy had trouble multitasking other Windows applications with Ventura, but a later version corrected that problem. Since desktop publishing programs feed on what text- and image-processing programs produce, Windows 3.0's ability to multitask all these programs effectively makes for a remarkable boost in productivity. Now Ventura users can join the party. With Windows, Presentation Manager, and Macintosh versions slated for release this year, Ventura Publisher is not giving its rival PageMaker any quarter. *—Jon Udell*



THE FACTS

Ventura Publisher, Windows Edition
$895

Requirements:
IBM AT or compatible with a hard disk drive, 2 megabytes of RAM, and Windows 3.0.

continued

Objects of Desire

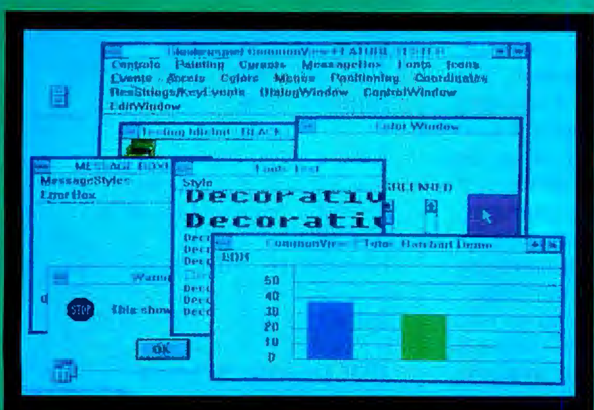
glockenspiel

CommonView 2

Glockenspiel CommonView has really made its mark in the world of Windows development. Thousands of developers have used it to speed up and simplify their projects.

Now **CommonView 2** is available, inheriting the success of its predecessor and extending its capabilities even further to deliver efficient Windows 3.0 apps.

That's because **CommonView 2** works with **Glockenspiel C++ 2.0**, giving you a C++ object-based framework that reduces the complexity, cuts the code, manages memory and lets you stay in touch with what you're really doing. From compilation to execution, **CommonView 2** applications are fast and powerful.



CommonView 2 objects model the real world of Windows. And that's just the beginning - from there **CommonView 2** takes you as far as you want to go.

It doesn't anticipate everything. That's where C++ takes over: its inheritance capabilities enable you to extend the **CommonView 2** framework. Just take an existing object and customize it without affecting the original. A few additional lines of code and you could, for example, turn an edit control into a password control. Then reuse it in other applications.

You *don't* have to learn a complete new language, you *can* integrate existing developments; it *is* portable to PM and NewWave; CodeView *can* be used on your C++ source.

The world wants Windows 3.0 apps now! And with **CommonView 2** you can inherit the earth.

Specifications.

Glockenspiel CommonView 2 includes Glockenspiel C++ 2.0 and Container - the object storage framework. It requires Microsoft C 6.0, the Windows SDK and 1.5 meg of memory. You debug C++ source with Microsoft CodeView 3.0. Glockenspiel C++ supports a completely portable memory management system. Glockenspiel CommonView consists of approximately 65 classes.

Comprehensive documentation includes CommonView tutorial and reference manual, Glockenspiel C++ compiler manual and User Guide, C++ syntax and AT&T Library Guide, pullout guide to compiler switches, *plus* "Programming in C++" by Stephen C. Dewhurst and Kathy T. Stark (Prentice Hall).

On-line hypertext documentation for CommonView reference manual and AT&T guides. Tutorial source code also on disk.

Glockenspiel C++ works from within the Programmer's Workbench with the reference guides instantly available from the on-line Advisor, using Microsoft CodeView for debugging.

Glockenspiel CommonView applications are portable between Windows 2.1 and Windows 3.0, PM 1.1 and PM 1.2 with HP New Wave 3.0 version coming soon.

glockenspiel
class constructors

Glockenspiel, 39 Lower Dominick Street, Dublin 1, Ireland. Phone +353 (1) 733166. Fax +353 (1) 733034. **North America:** *Imagesoft,* 2 Haven Avenue, Port Washington , NY 11050. Phone (516) 767-2233. Fax (516) 767-9067. **Europe:** ***UK:*** *QA Training Ltd.* Phone (0285) 655888. Fax (0285) 650537. ***Italy:*** *Inferentia,* Phone (02) 26680568. Fax (02) 2364258. ***France:*** *Microformatic,* Phone (01) 48701900. Fax (01) 48702729. ***Germany:*** *PSI,* Phone (06021) 492-0. Fax (06021) 492-112. ***Benelux:*** *Rijnhaave,* Phone +31 (71) 218121, Fax +31 (71) 216118.

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Circle 102 on Reader Service Card

Here a Window, There a Window

Some products lead you to expect great things. Such was the case for me with VisionWare's **XVision**. This product is a Microsoft Windows application that turns your PC workstation into an X Window System (hereafter referred to as X Window) server. This way, DOS users can run remote X Window client programs at the same time as local DOS programs. It provides a common user interface for DOS and X Window applications and allows cut-and-paste operations to transfer information between them.

XVision installs easily enough, and the documentation is sufficient to give even beginning users a fair introduction to X Window, Microsoft Windows, and the connections between them.

I tested XVision on a 20-MHz 286 system from VNS America. It was connected to my Unix lab network, with most clients running on an Altos System 5000 (486/25) under SCO Open Desktop. The 286 was loaded with Windows 3.0 and a matching version of XVision. XVision requires a network connection to a remote host capable of running X Window clients. This connection is typically made through an Ethernet card and a third-party TCP/IP for DOS package. In my case, it was PC/TCP from FTP Software.

XVision runs X Window client applications in one of two ways. First, each X window can appear as its own Microsoft window, with the normal Microsoft appearance and behavior. It can be iconified, stacked, resized, and otherwise manipulated as if it were an ordinary local Microsoft window.

The second approach is to give X Window its own display-size virtual screen. The entire X Window session appears inside this screen, to which you can add scroll bars. With scroll bars, the X Window screen can be larger than the physical display. X windows displayed in this way lack the Microsoft windows adornments and must be manipulated through an X Window manager.

When not in full-screen mode, the virtual screen concept can be applied to individual Microsoft-managed X Window clients.

The XVision server is limited in its handling of colors. It is a *static color* server, meaning that the color map is fixed at server start-up time. Requests for specific colors are coerced to the nearest fixed equivalent, but several X Window programs expect to be able to allocate their own colors.

There were still some rough edges on the version of XVision I tested. Mouse actions were sometimes ignored or misinterpreted. One X Window client consistently dropped around one mouse event in three. XVision's keyboard mappings are assignable, but when I selected the 101-key U.S. key map, I found that the quotes were where the tilde should be, and a few other keys were misplaced. The manual warns against key map mismatches between XVision and Microsoft Windows, but everything seemed to check out.

XVision shows enormous potential. For convenience, it is unmatched. The ability to mix Microsoft and X windows on the same screen is as useful as it is visually appealing. It works best in the multiwindow mode, with Microsoft Windows acting as the window manager. It also works well with monochrome applications and those written carefully enough to work with a fixed color map.

I can't recommend it for those who wish only to turn their DOS PC into an X Window terminal. Currently available stand-alone packages are better suited to this. For its intended purpose, XVision serves well. With a little more polish, it could truly shine. —*Tom Yager*

THE FACTS

XVision
$449

Requirements:
A 286 with 1 megabyte of RAM (2 MB is recommended), a LAN card, and DOS 3.0 or higher.

COMPANY INFORMATION

Ashlar, Inc.
(Vellum)
1290 Oakmead Pkwy., Suite 218
Sunnyvale, CA 94086
(408) 746-3900
Inquiry 1028.

Authorware, Inc.
(Authorware Professional)
8500 Normandale Lake Blvd., Ninth Floor
Minneapolis, MN 55437
(612) 921-8555
Inquiry 1026.

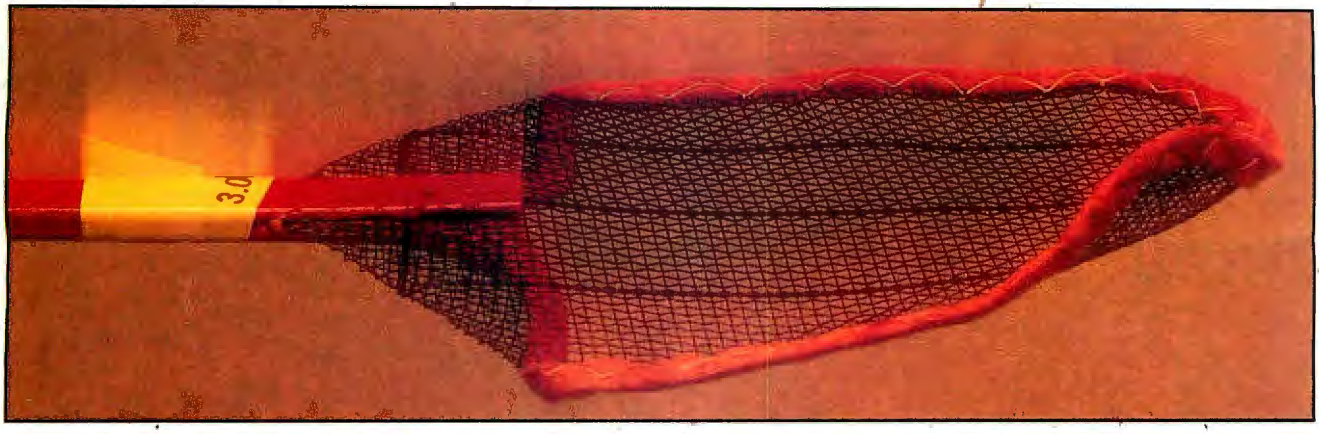
IBM Desktop Software
(Current 1.1)
472 Wheelers Farms Rd.
Milford, CT 06460
(203) 783-7000
Inquiry 1027.

Ventura Software, Inc.
(Ventura Publisher)
15175 Innovation Dr.
San Diego, CA 92128
(800) 822-8221
Inquiry 1029.

VisionWare, Ltd.
(XVision)
57 Cardigan Lane
Leeds UK, LS4 2LE
44-0-532-788858
Inquiry 1030.

continued

The Old Standard For Debugging Just Retired



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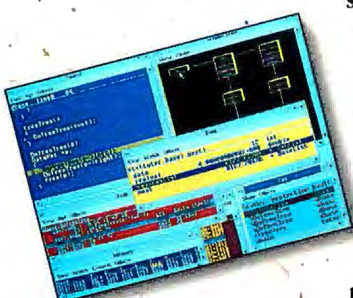

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Microsoft Excel - SALES1.XLC
File Edit Gallery Chart
Format Macro Window Help
File Edit View Show Alarm Options
Format Utilities Macro Window Help
Clock
Program Manager
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Scroll Lock
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DC IN
Power /Speed
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Left Right
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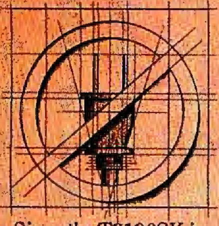
T3100SX
TOSHIBA

The ultimate portable for the ultimate program.



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Windows Shopping

Resource Guide

CAD

DesignView 2.0..........$895
Premise, Inc.
Three Cambridge Center
Cambridge, MA 02142
(617) 225-0422
Inquiry 856.

Drafix Windows CAD 1.1..........................$695
Foresite Resources Corp.
10725 Ambassador Dr.
Kansas City, MO 64153
(816) 891-1040
Inquiry 857.

Inertia .... $500–$4000
Modern CAE, Inc.
1231 Cumberland Ave., Suite A
West Lafayette, IN 47906
(800) 444-6223
Inquiry 858.

Communications

Crosstalk.................$195
Digital Communications Associates
1000 Alderman Dr.
Alpharetta, GA 30201
(800) 241-4762
Inquiry 859.

Da Vinci eMail 3.0 ... $1145
Da Vinci Systems
P.O. Box 17449
Raleigh, NC 27619
(919) 881-4320
Inquiry 860.

DynaComm Asynchronous Edition $295
Future Soft Engineering, Inc.
1001 South Dairy Ashford, Suite 203
Houston, TX 77077
(713) 496-9400
Inquiry 861.

MicroPhone II for Windows..................$295
Software Ventures
2907 Claremont Ave., Suite 220
Berkeley, CA 94705
(415) 644-3232
Inquiry 862.

Rumba....................$595
Wall Data, Inc.
17769 Northeast 78th Place
Redmond, WA 98052
(206) 883-4777
Inquiry 863.

Databases/ Spreadsheets

dbfast for Windows 3.0..........................$395
Bumblebee Software, Inc.
1715 114th Ave. SE
Woodridge Building, Suite 120
Bellevue, WA 98004
(206) 462-0130
Inquiry 864.

db Vista III 3.15........$695
Raima Corp.
3245 146th Place SE, Suite 230
Bellevue, WA 98006
(206) 747-5570
Inquiry 865.

Excel.......................$495
Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
(206) 882-8080
Inquiry 866.

SQLWindows $1295
Gupta Technologies, Inc.
1040 Marsh Rd.
Menlo Park, CA 94025
(415) 321-9599
Inquiry 867.

Superbase 4 version 1.2................$695
Precision, Inc.
8404 Sterling St., Suite A
Irving, TX 75063
(214) 929-4888
Inquiry 868.

Windows Filer 3.04.....$195
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4455 South Padre Island Dr., Suite 43
Corpus Christi, TX 78411
(512) 854-8787
Inquiry 869.

Wingz for Windows 3.0..........................$499
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4100 Bohannon Dr.
Menlo Park, CA 94025
(415) 926-6300
Inquiry 870.

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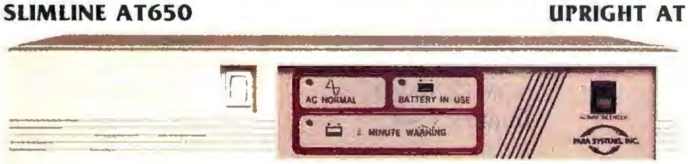

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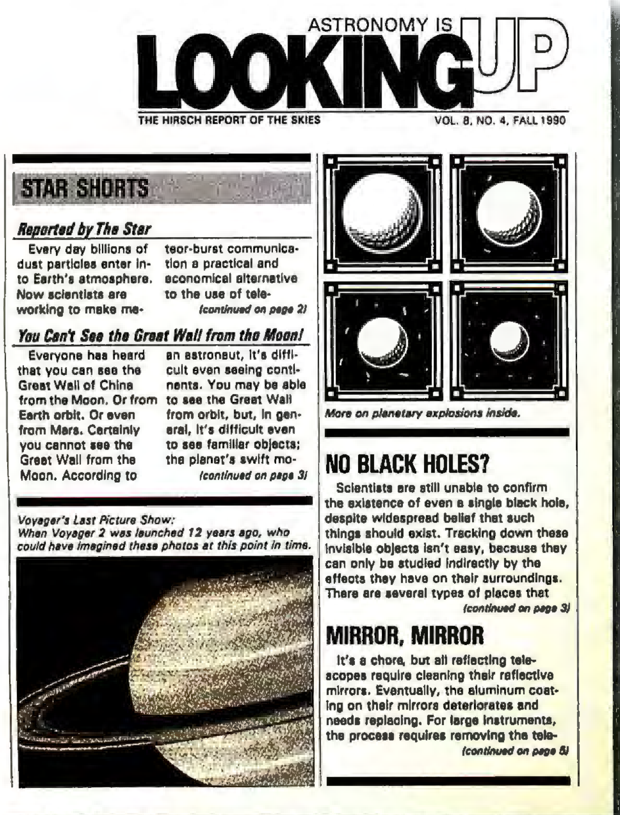


ASTRONOMY IS LOOKING UP

THE HIRSCH REPORT OF THE SKIES VOL. 8, NO. 4, FALL 1990

STAR SHORTS

Reported by The Star

Every day billions of dust particles enter into Earth's atmosphere. Now scientists are working to make meteor-burst communication a practical and economical alternative to the use of tele- *(continued on page 2)*

You Can't See the Great Wall from the Moon!

Everyone has heard that you can see the Great Wall of China from the Moon. Or from Earth orbit. Or even from Mars. Certainly you cannot see the Great Wall from the Moon. According to an astronaut, it's difficult even seeing continents. You may be able to see the Great Wall from orbit, but, in general, it's difficult even to see familiar objects; the planet's swift mo- *(continued on page 3)*

Voyager's Last Picture Show:
When Voyager 2 was launched 12 years ago, who could have imagined these photos at this point in time.

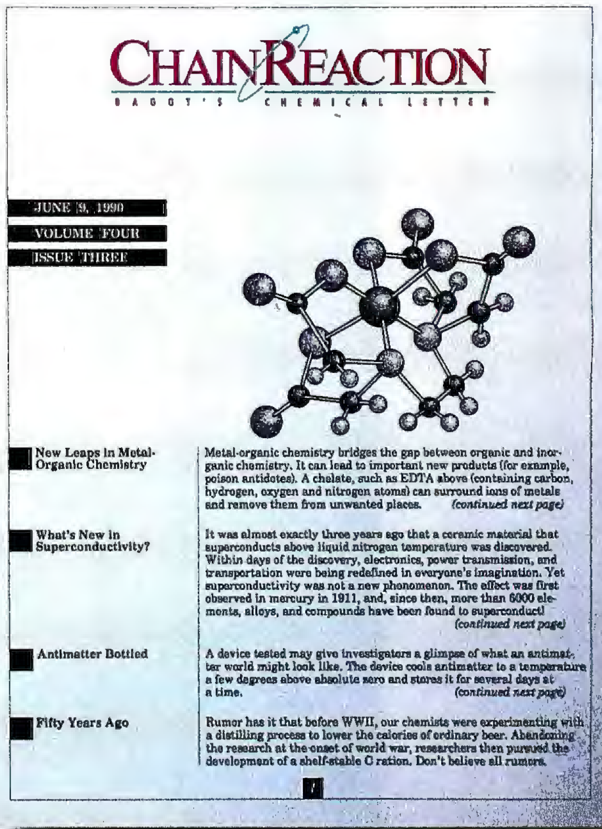
More on planetary explosions inside.

NO BLACK HOLES?

Scientists are still unable to confirm the existence of even a single black hole, despite widespread belief that such things should exist. Tracking down these invisible objects isn't easy, because they can only be studied indirectly by the effects they have on their surroundings. There are several types of places that *(continued on page 3)*

MIRROR, MIRROR

It's a chore, but all reflecting telescopes require cleaning their reflective mirrors. Eventually, the aluminum coating on their mirrors deteriorates and needs replacing. For large instruments, the process requires removing the tele- *(continued on page 5)*



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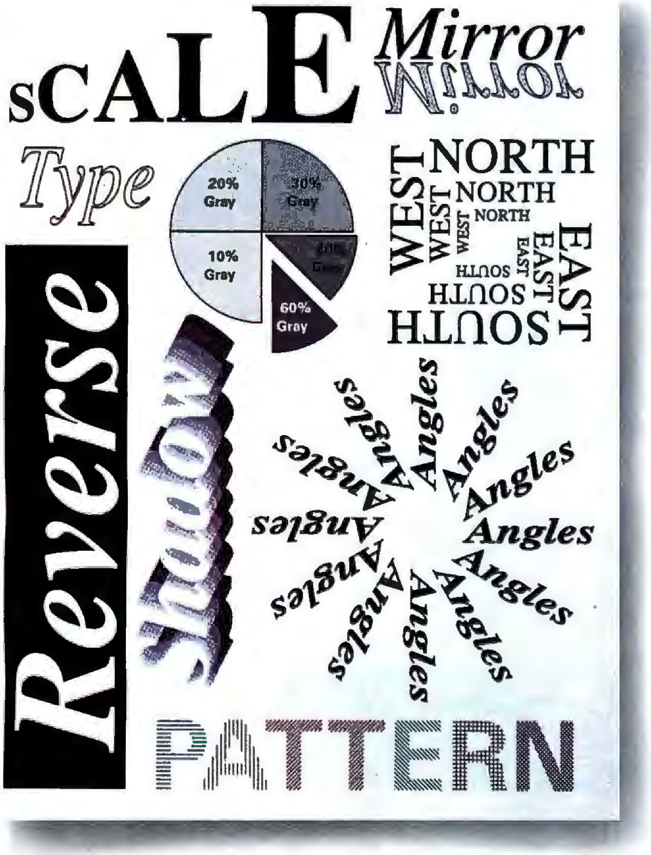

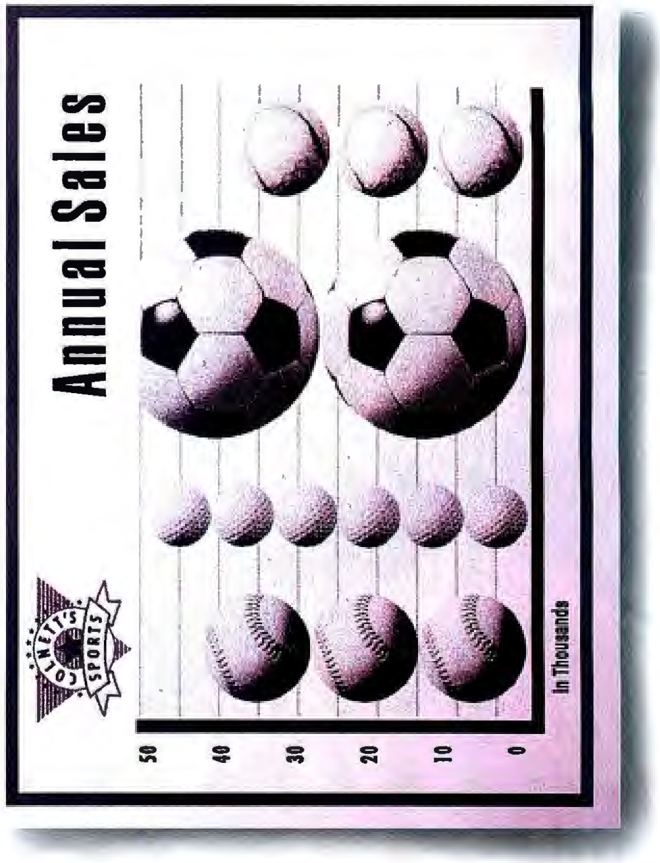

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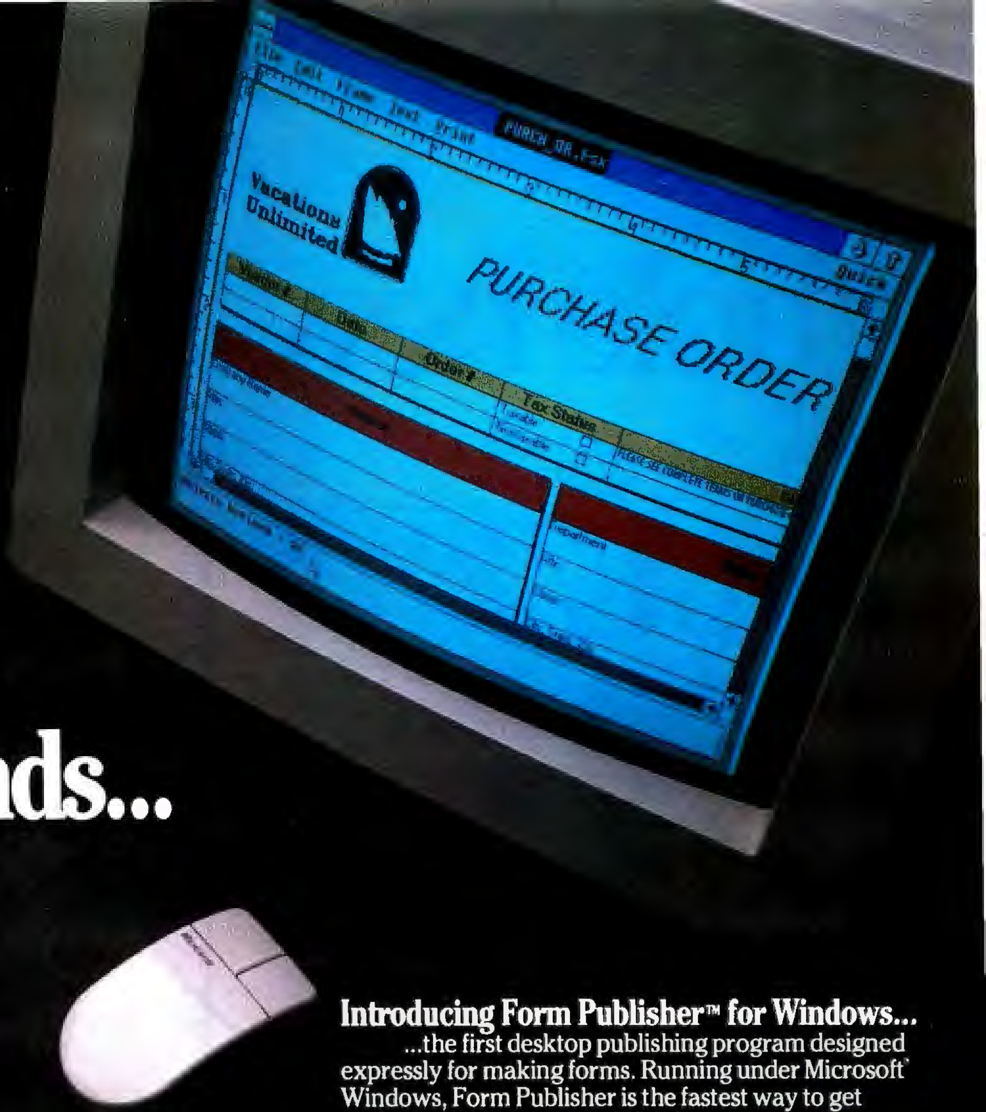

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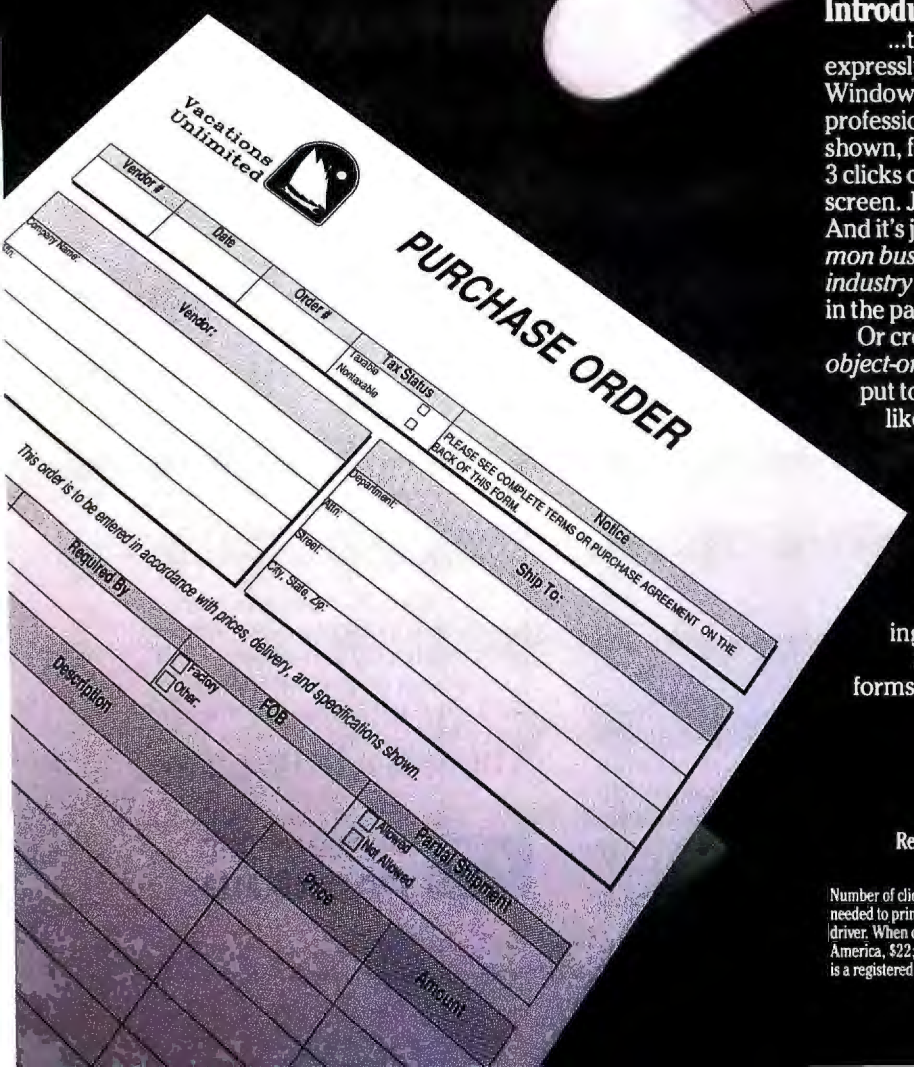

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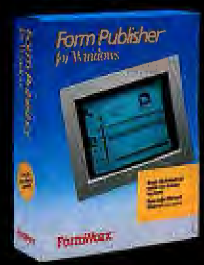

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A Long and Winding Road

Windows 3.0's new memory manager builds on previous Windows architectures

Michael Geary

Windows 3.0's finest feature, its protected-mode memory manager, answers the prayers of longtime Windows fans. By running Windows applications in protected mode on 286 and 386 machines, Windows 3.0 provides access to all the memory installed in the machine. Although this technique dramatically improves Windows' performance and capacity, in a sense it's nothing new: Windows applications have been pretending to run in protected mode all along.

Every Windows programmer knows the pain, and rewards, of dealing with Windows' complex memory management scheme. Managing memory under Windows entails much more than simply using `malloc()` and `free()`. Windows applications have had to deal with handles instead of pointers, movable memory instead of memory that stays where you expect it, and locking and unlocking memory blocks at the right times. It ain't easy, and it ain't fun, but there's no other way to do all the things Windows applications need to do in real mode. And that's the reason for all the extra work. Traditional Windows memory management is a clever simulation in real mode of the capabilities normally associated with protected mode.

Buying Protection

The term "protected mode" is almost a misnomer—protection is not the main issue, addressing is. The most fundamental difference between real mode and protected mode is how programs address memory. Real-mode addressing is hard-wired. If a program asks to read memory address 12345 hexadecimal, that very bit pattern goes out on the address bus. That address may have been specified as a segment:offset pair, perhaps 1230:0045h, but the CPU simply shifts the segment left 4 bits and adds the offset, and that's the physical address.

In protected mode on a 286 processor, it's a whole different story. Programs still use addresses that look just like segment:offset pairs, but there is no simple calculation that produces a physical address. Instead, the "segment" value, now called a *selector*, is really an index into a table of memory addresses that the operating system maintains. The hardware looks up the physical address in that table and adds the offset, and that's the address that goes out on the bus.

There are actually two such tables: the global descriptor table and the local descriptor table. The low-order bits of the selector are used for other purposes. But for this discussion, it's close enough to think of a selector as an index into an address table. The 386 (and i486) has additional addressing modes, notably the 32-bit flat model. Windows 3.0 applications can, with some extra work, use some of the 386 addressing modes, but for the most part they stick with the 286 segmented model.

In protected mode, the operating system has the opportunity to play games with memory. Is memory getting fragmented, as it inevitably would in a fixed `malloc()/free()` system? No problem; you just move things around to get a nice contiguous free block and then fix up the addresses in the descriptor table. Applications will never know the difference, since their selectors don't change. When they access the memory, it may be in a different physical address, but the same selector will get to that memory. The operating system can even toss a segment out of memory completely; when the application tries to reference it, a Not Present fault traps back to the operating system to reload the segment, all behind the application's back.

A Clever Illusion

Real mode doesn't have the luxury of this address-mapping hardware, but nearly anything that can be done in hardware can also be done in software. It's just a small matter of programming. Picture this: When you allocate a segment of memory, instead of receiving a pointer à la `malloc()`, you get a magic cookie called a *handle*. Because you don't have the actual address of the memory, the operating system can move it around or swap it to disk. When you want to access the memory, you run the handle through a `lock` function, which prevents further movement and may load the segment back in from disk, if necessary. The lock function returns the memory's physical address, and then you can use the memory normally. When you're done using the memory for the moment, you call an `unlock` function, and the operating system is once again free to move it or discard it.

This scenario should look familiar to any Windows programmer because it's the same memory management scheme that Windows has used since release 1.0. The Macintosh uses a similar scheme. The reason is the same in both cases: to avoid the dreaded fragmentation problem, and, to a lesser degree, to allow overcommitting physical memory by reloading segments from disk as needed. Fragmentation is a nuisance when it happens within an application, but it can be a

continued

← *Circle 94 on Reader Service Card*

showstopper when multiple applications are allocating memory out of the same limited pool. Windows reloads discarded code segments automatically, although it's usually up to the application to reload discarded data.

Pre-Windows 3.0 Workarounds

Even with the vastly increased flexibility afforded by a handle-based movable memory system, it's a tight fit when you try to cram Windows and two or three large applications into 640K bytes. This is especially true given Windows' ambition to run non-Windows applications as well as native Windows applications. So, each major release of Windows has added new memory management features.

Release 2.03 brought the first improvement, EMS support. Windows used EMS's bank-switching capability to divide the real-mode address space into banked and nonbanked areas. Code and data common to all applications went into the nonbanked area, and each application received its own separate bank of memory in the banked area. This allowed more applications to coexist, since each one could allocate memory out of its own bank without affecting other applications' banks.

Ironically, any individual application was usually worse off than before, because Windows had to draw a fixed line between the banked and nonbanked areas. Applications would normally allocate memory within their EMS bank, which was smaller than the simple contiguous-memory region available when EMS was not in use. But this drawback was overshadowed by the ability to run more applications at once.

EMS is generally not available on a 286 without a special EMS memory card. Ordinary extended memory won't do. Even with an EMS card, most 286 systems support only a weaker form of EMS called *small-frame EMS*.

With small-frame EMS, the base 640K bytes is still common to all applications. Only a 64K-byte chunk of memory somewhere between 640K bytes and 1 megabyte is available for per-application banking. Windows doesn't try to do much with such a small amount of bankable memory besides preloading some code segments into it.

It's only when there is a bankable area below the 640K-byte line—called *large-frame EMS*—that Windows can actually keep all of an application's data and code in its own bank. Unfortunately, setting up a 286 for large-frame EMS usually means pulling chips from the motherboard or setting DIP switches to disable part of the motherboard memory, so the EMS card can fill in that memory using its own banked hardware. Few 286 users have been willing to perform such major surgery on their machines just to run Windows better.

On a 386, memory managers such as 386Max or QEMM-386 do provide full large-frame EMS emulation without special hardware. Ditto for Windows/386: Besides doing a better job of running non-Windows applications by using the virtual 8086 capability of the 386, Windows/386 includes an EMS emulator. So, in practice, 386 systems have been the main beneficiary of Windows' EMS capabilities. Note also that instead of relying on Windows to make use of EMS, an application can call the EMS driver directly to allocate EMS memory for itself.

> *Few 286 users have been willing to perform major surgery on their machines just to get Windows to run better.*

Windows 2.1—in both its 286 and 386 flavors—added one more twist. An 8088 or 8086, with its 20-bit address, can address exactly 1 MB of memory. An address like FFFF:FFFF would overflow the 20 bits—the physical address would be 10FFEFh in this case—but the overflow is ignored, so the address wraps around to the beginning of memory, or FFEFh in this example.

The 286 and 386 do not have this limitation, and the address FFFF:FFFF would actually refer to physical address 10FFEFh. But PC-compatible systems normally mask off the twentieth address bit (A20) to make this addressing work the same as with the 8088/8086.

It's possible to reenable the A20 bit, and the HIMEM.SYS driver that comes with Windows 2.1 does that. Then, addresses do not wrap around and programs running in real mode can address nearly 64K bytes of additional memory, located right above the 1-MB line. This sounds like nothing to write home about, but Windows is such a tight squeeze in real mode that even an extra 64K bytes gives a real performance improvement.

Dawn of a New Era

Windows 3.0 abolishes all these memory limitations and hassles by running Windows applications in protected mode, where all the machine's memory is directly addressable. But we can't forget about real mode, because Windows 3.0 doesn't have to run in protected mode. You can start Windows with a `WIN /R` command to force it to run in real mode. If Windows detects a conflict that would prevent it from using protected mode (e.g., the presence of some other 386 memory manager), it will boot up in real mode automatically. So, most Windows applications still support all the varieties of real mode: no EMS, small-frame EMS, large-frame EMS, and HIMEM (formally known as XMS, for Extended Memory Specification). It's been said that modern CPUs are code museums; Windows 3.0 is a mode museum.

Even though real mode is still available, Windows applications run so much better in protected mode that no one will want to use real mode if they can avoid it. One of the few reasons to run Windows in real mode is to allow older Windows applications to run that would crash and burn in protected mode.

There's a seeming contradiction here: Many—perhaps most—older applications fail in protected mode, yet it's easy to convert Windows applications to 3.0 protected mode. Windows code, by and large, is inherently bimodal. Windows .EXE files follow the same format as OS/2 .EXEs, with a clear separation of code and data segments. The Windows application programming interface (API) leads to practices that work in both real mode and protected mode. Even programs using huge pointers work in both modes, because nearly all Windows applications are written in C, which implements huge pointer arithmetic in a way that's compatible with both real and protected mode.

The problem, of course, is that it takes just one violation of protected-mode rules for a program to fail. Writing past the end of a segment would crash with a protection violation, but, of course, a Windows application that tried that in real mode would probably crash as well, although in a more mysterious way.

Reading past the end of a segment will also fail in protected mode even though it

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may be an innocuous procedure in real mode. I wrote some code in one of my Windows applications that removed some data from a segment and then moved the data after that down to compact the empty space. It had worked without a hitch in real mode, so I was quite surprised to see it fail in protected mode. But then I realized my copy loop was copying too much. It never wrote past the end of the segment, but it did read past the end. In real mode, this copied garbage into the end of the segment, past the end of my valid data, so it didn't make any difference anyway. In protected mode, the hardware caught the attempt to read past the end of the segment.

Any large Windows application is likely to contain a few latent bugs like this. Fortunately, they are a lot easier to track down in protected mode than they are in real mode. Instead of some mysterious crash, you get a protection-violation message. If you're running with CodeView, it will even stop on the offending line in the source code.

A potentially stickier problem occurs with programs that need to execute code in a data segment. Don't throw those bricks just yet; I'm not advocating dirty programming techniques. Most Windows applications don't do anything like this, but imagine an interactive compiler running under Windows. It would have to write into a data segment to compile its code and then somehow execute that code. In fact, the display drivers provided with Windows do just that: Many of the graphics output calls, such as `BitBlt`, analyze the operation being requested and compile a special-purpose subroutine on the stack for that particular call. This may seem like a bizarre technique, but it's quite common in graphics subsystems for efficiency. The problem is that this is one of the things protected mode protects you from doing: A segment may be execute-only, execute/read, or read/write, but there is no such thing as a segment you can write to and execute code in.

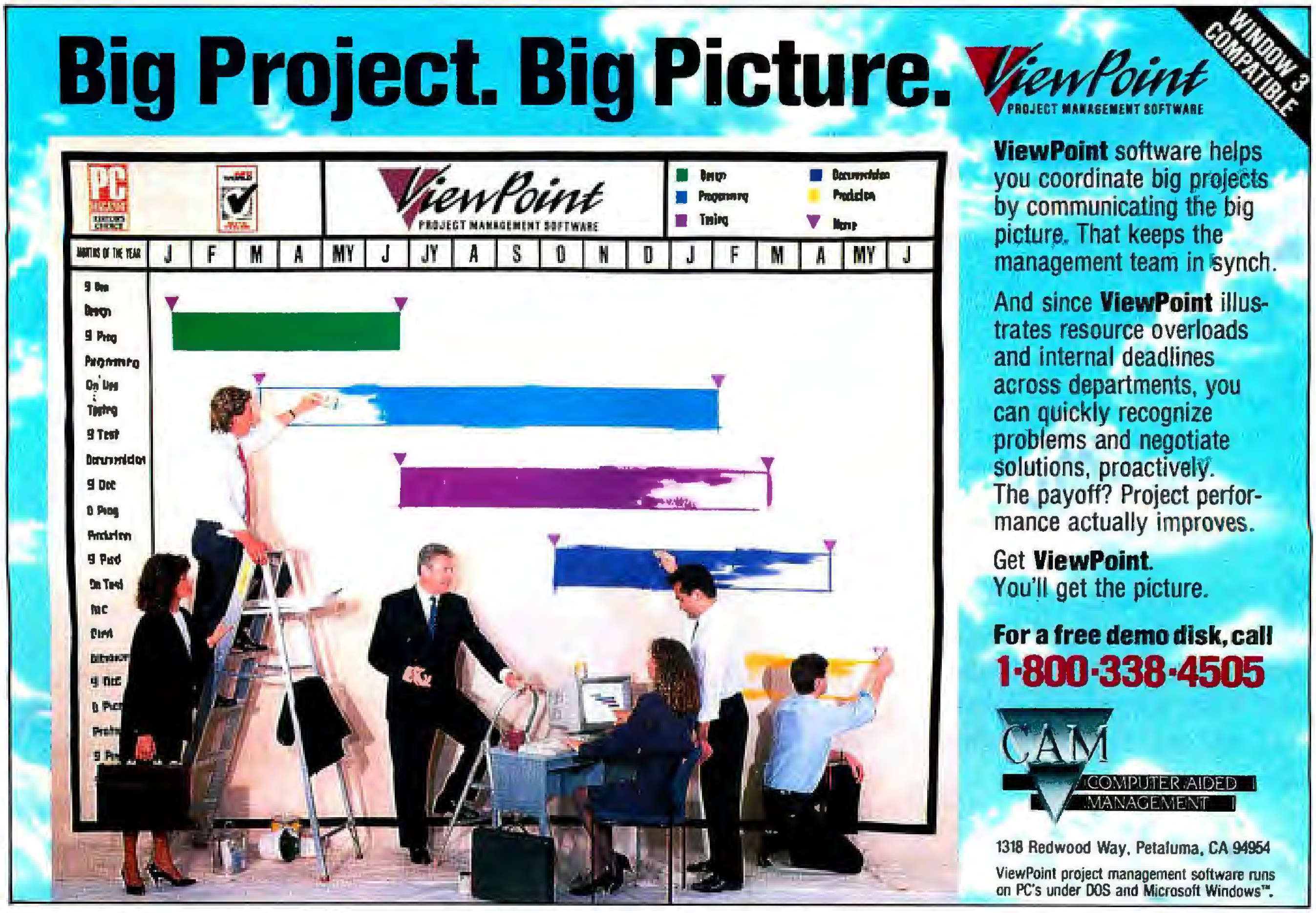
Stretching the Rules

Fortunately, Windows lets you cheat. There's nothing preventing an operating system from creating two selectors with different attributes that point to the same physical memory. Windows provides a call that lets you do just that: create a code-segment alias selector for a data segment. It's also possible to create a data segment alias for a code segment, but this isn't officially supported because it may not work in other environments, like OS/2 2.0. With these tools in hand, you can accomplish things that protected mode normally does not allow. Of course, safety goggles are recommended in case the chips start flying.

This kind of facility gives a clue to the philosophy of Windows' implementation of protected mode. The intent is to provide access to more memory, not to prevent programmers from writing any particular kind of code. Memory protection is provided to keep you from accidentally stepping on the wrong parts of memory, but when you find that you need to break the rules, you can.

Another thing that's tough to do in protected mode is communicating with real mode. Many DOS applications work in conjunction with TSR programs that do part of their work. For example, to use Intel's Connection CoProcessor fax/modem card, you load in a device driver

continued



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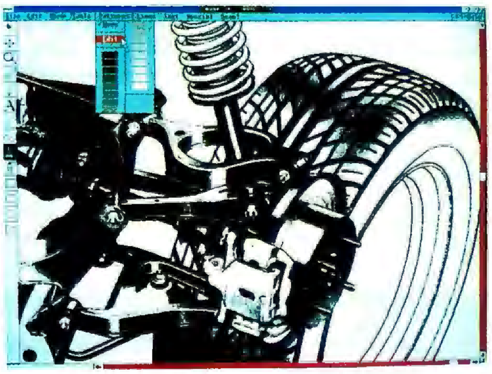

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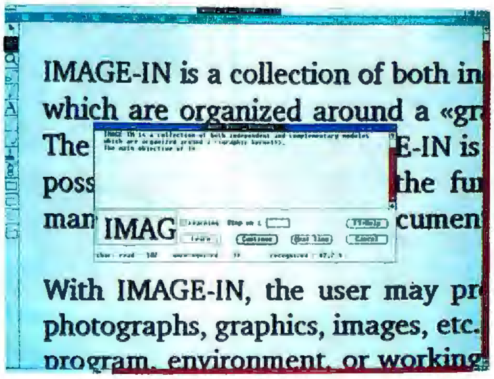

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and a TSR that manages background communications and provides the Communicating Application Specification interface. DOS applications are then able to send and receive faxes, files, and E-mail through CAS by making INT 2Fh calls. And there's the rub. Real-mode interrupts don't map directly into protected-mode interrupts, and even if they did, protected-mode selectors and real-mode segment addresses aren't interchangeable. Without some assistance, it would be hard for a protected-mode Windows application to make CAS calls.

Here again, Windows provides ways around these limitations. You can allocate memory within the real-mode address space and receive both a segment address and a selector for it. The segment address works in real mode, and the selector works in protected mode. Or, if you already have a particular physical address that you need to access from protected mode, you can create a selector that points to it. Then, to tie things together, you can simulate a real-mode interrupt or far call from protected mode. (For the particular case of INT 21h DOS services, life is easier: Windows intercepts INT 21h and makes all the normal file I/O and other calls work transparently with selectors instead of with segment addresses.)

Windows, DOS Extenders, and DPMI

Oddly enough, most of these special interfacing services aren't offered through the normal Windows function-call API. Instead, there's a separate interface that is called via INT 31h, the DOS Protected Mode Interface.

DPMI provides a variety of memory and selector management services, only a few of which are actually used by Windows applications that need to communicate with real mode. The rest of the services are there to allow non-Windows programs using DOS extenders to work properly under Windows.

With Windows itself running in protected mode and generally taking over the management of selectors and memory, there's a problem when a DOS extender tries to manage protected-mode operations itself. With DPMI, a DOS extender can check to see whether it's running under Windows or another DPMI system. If so, the DOS extender can make DPMI calls perform the memory operations it needs. Otherwise, the DOS extender can use whatever methods it uses when it has full control of the machine.

Windows itself uses a kind of DOS extender when it runs in its protected modes: standard and 386 enhanced. The name of one of the Windows files, DOSX.EXE, hints at this. To run Windows in real mode, WIN.COM simply fires up KERNEL.EXE, which in turn loads in the rest of Windows. But in standard mode, WIN.COM runs DOSX.EXE, the Windows DOS extender. DOSX.EXE takes control of the machine to provide the DPMI protected-mode services, and then it starts up KRNL286.EXE, the standard-mode version of the kernel. KRNL286.EXE actually makes INT 31h DPMI calls into DOSX.EXE to allocate selectors and perform other protected-mode mangement functions, such as switching back and forth to real mode. This is all done in 286 protected mode with 16-bit offsets, so it's compatible with either a 286 or a 386.

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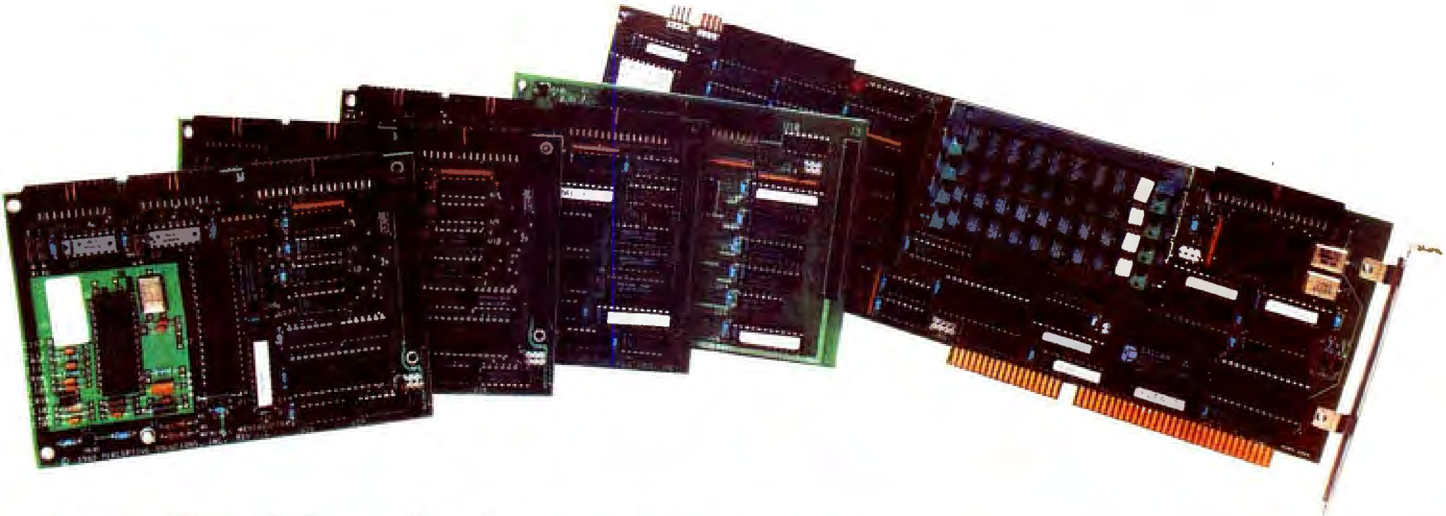

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The 386 enhanced mode is quite a bit more complicated. WIN.COM starts WIN386.EXE, the Windows/386 virtual machine manager. As its name implies, this program uses the virtual 8086 capability of the 386 (and i486) processors to create one or more virtual machines. To the program running inside it, a virtual machine looks just like a physical machine. But it's a fake.

A virtual machine control program can trap any hardware references it wishes, fooling the program that is running in the virtual machine into thinking it is talking to some real hardware when, in fact, it isn't. This is how Windows in 386 enhanced mode pulls off its trick of running DOS applications inside a window even when those applications write directly to the screen. Windows simply maps ordinary memory into the DOS application's address space where it expects to see screen memory. When the application writes to that memory, Windows then repaints its window appropriately. If you switch the DOS application to run in full-screen mode, then the application gets direct access to the screen memory.

386-Specific Windows Features

Previous versions of Windows/386 have created virtual machines all along. The new twist in Windows 3.0 is that the virtual machines are no longer limited to 8086 real mode. Instead, they now have two portions: the real-mode portion and an optional protected-mode portion. After WIN386.EXE creates its first virtual machine, it starts up KRNL386.EXE, which then sets things up so Windows applications can run in the protected-mode portion of that first virtual machine.

WIN386.EXE also uses yet another layer of memory-address indirection, the *page table*, to provide a virtual address space much larger than physical memory. It swaps 4K-byte pages in and out from a swap file on disk as needed. This kind of swapping is much more efficient than any scheme based on swapping out variable-length segments, simply because it's so much easier to manage the disk space when all the objects written are the same size.

It's interesting to note that even though Windows applications, and most of Windows itself, run in the 16-bit segmented memory model, the WIN386.EXE control program and the virtual device drivers that it uses run in a single flat-model 32-bit segment.

Microsoft has experimented with the idea of running Windows applications in the flat model, but for the time being the company is sticking with the 16-bit segmented model. One consideration here was the desire to have Windows applications run in both real and protected mode, and sticking with 16-bit segments helps provide that compatibility. It is possible for a Windows application to go to some extra work and have parts of its code run in true 32-bit segments, but the simplicity of the flat model is still beyond Windows' reach.

Perhaps the flat model will show up in a future version of Windows—or maybe not, since it's in OS/2 release 2.0. With the greatly increased power of Windows 3.0, Microsoft and IBM may think they have to hold back a few carrots to keep us interested in OS/2. ■

Michael Geary is an author and programmer based in Los Gatos, California. You can reach him on BIX as "geary."

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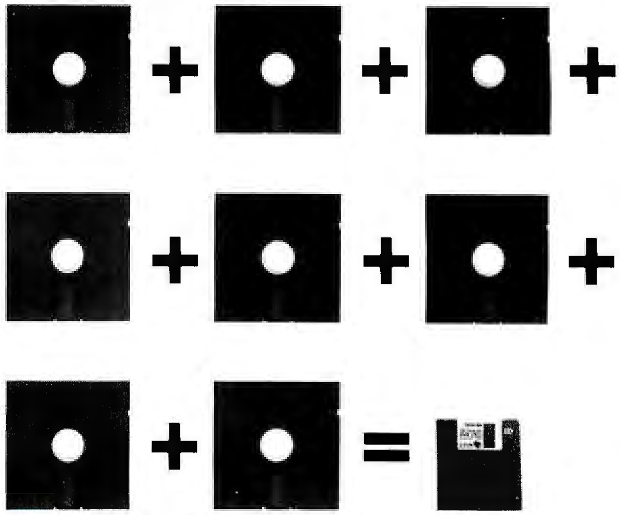

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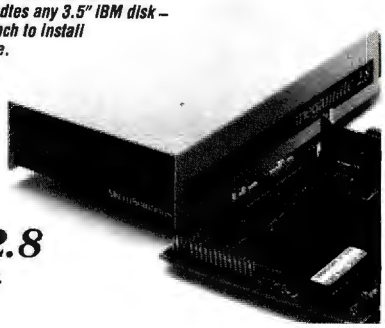

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The QMS-PS 410 laser printer knows PostScript when it sees it

Alan Joch

Now that workgroups in many companies are exhibiting more openness than ever in mixing PCs and Macintoshes, QMS is doing its part for printer perestroika with a sporty 4-page-per-minute PostScript laser printer called the QMS-PS 410.

This trimmed-down version of the company's existing PostScript printers comes with a few twists that set it apart from Hewlett-Packard's LaserJet IIP and other competitors. The first twist is a 16.67-MHz 68020 processor that helps the 410 turn out PostScript graphics files with impressive speed. The second twist hides on the back of the 410, namely the LocalTalk port that sits beside the usual serial and parallel connectors (see the figure on page 148).

These features are not new to laser printers. But in this case, they come standard along with 45 Adobe fonts and 2 megabytes of RAM on a printer priced at $2795 (this and all other quoted prices are tentative as of press time). That's eye to eye with the $2930 cost of a similarly equipped IIP (with an extra 512K bytes of RAM, but without a LocalTalk connector).

Automatic Emulation

But QMS does more than just supply an AppleTalk port. The 410's emulation sensing processor (marketed under the clever acronym ESP) makes multiplatform printing easy. The processor lets the printer automatically switch emulations depending on what kinds of files you're sending. This means that you and a coworker can simultaneously send a Hewlett-Packard Printer Command Language (Level 4) file and a PostScript file without changing hardware switches or including file headers. Instead, ESP code reads the first 256 bits of data coming in, determines the proper emulation, and configures itself on the fly. In addition to PostScript and PCL, the 410 will automatically switch to Hewlett-Packard Graphics Language 7475A plotter emulation if you're using the optional font card ($199).

WordPerfect, Ventura Publisher, Aldus PageMaker, Microsoft Word, Lotus 1-2-3, Excel, and WingZ, among others, work successfully with the 410's emulation switching mode, according to QMS. If an application doesn't provide command sequences at the beginning of a file, ESP cannot determine the proper emulation. In these cases, you can manually set the proper emulation with the 410's utility software.

I tested the automatic emulator by sending a 47-page ASCII text file from my PC through a parallel cable, while a coworker sent a 20-page PostScript text file from a Mac through the LocalTalk connection. The 410 printed the PostScript file and without a hitch automatically processed the PCL text.

Expanded Utility

The 410 also debuts an expanded PS Executive, the utility that QMS ships with its PostScript printers. The new version consists of point-and-click menus that guide you through host and printer setup. QMS designers rely on the utility so much, they gave the 410 a minimalistic control panel: You will find a button to put the machine on- or off-line, another button to start a print test, and that's it. If you want to change print orientation from landscape to portrait or choose a new PostScript font, look to the Executive. AppleTalk users name individual

continued

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The QMS-PS 410 offers two standard features not normally found in 4-page-per-minute laser printers: a speedy 68020 processor and a built-in LocalTalk port.

PHOTOGRAPHY: PAUL AVIS © 1990

Apple Announces New Laser Printers

Jeffrey Bertolucci

Apple's newest PostScript laser printer, the Personal LaserWriter NT (see the photo), is the company's long-awaited offering in the hotly contested low-end portion of the PostScript-compatible laser printer market. At a quoted speed of 4 pages per minute, the new 300-dot-per-inch LaserWriter is slower than Apple's previous PostScript printers, but it also carries a price tag that can compete well with that of any other low-cost PostScript printer.

The Personal LaserWriter NT (identical in appearance to the SC) provides 4-page-per-minute PostScript capability at a reasonable cost.

The NT is part of Apple's new Personal LaserWriter family, the company's first new laser printer family since the introduction of the LaserWriter II in January 1988. Apple will continue to sell its older PostScript printers, the LaserWriter IINT and IINTX. These printers, with higher speeds and price tags, will be targeted at the high-end market. By contrast, the NT is designed for small workgroups.

In terms of appearance, the NT has more in common with Hewlett-Packard's LaserJet IIP and other recently introduced low-end laser printers than it does with the much bulkier and heavier LaserWriter II. First, the NT weighs 32 pounds—down from 47 pounds for the LaserWriter II. Its dimensions are roughly two-thirds the size of those of the LaserWriter II.

Designed to fit nicely against a wall or in the corner of an office, the NT comes with two front-loading paper trays, which you can fold up when you are not using them. Paper output is on top of the machine, with a user-selectable face-up or face-down option.

The printer has two paper trays: The larger one holds up to 250 sheets of paper, while the smaller multipurpose tray is designed for envelopes, labels, letterheads, and card stock. This latter tray can handle up to 50 sheets or five envelopes. An optional envelope cassette has a capacity of 15 envelopes.

The new PostScript printer features a 12-MHz 68000 CPU, 2 megabytes of ROM (which contains the PostScript interpreter), 2 MB of RAM (upgradable to 8 MB), an Apple LocalTalk interface, and an RS-232C serial interface. Replacing DIP switches is a "push wheel" rotary switch for selecting emulation modes, including PostScript, LaserJet Plus, and Diablo 360.

As in all LaserWriters, LocalTalk networking capabilities are *built* into the NT. DOS computers can also print to the NT, provided they have a LocalTalk PC peripheral card. Computers using Unix must use the TranScript utility (available from Adobe) to convert files to PostScript format for printing on the NT.

The NT comes with 12 fonts: ITC Avant Garde, ITC Bookman, Courier, Helvetica, Helvetica Narrow, New Century Schoolbook, Palatino, Symbol, Times, ITC Zapf Chancery, ITC Zapf Dingbats, and IBM PC Graphics Extended Character Set, which is a new font for LaserWriters.

Once they are available, the NT will also be compatible with System 7.0 and TrueType fonts. Its 300-dpi Canon P-110 print engine has a rated life of 150,000 pages.

At press time, the NT had a list price of approximately $3300. This would translate into a street price of about $2300. This is somewhat higher than many of its competitors, but the new printer offers 2 MB of RAM, a genuine PostScript interpreter, and a LocalTalk interface. Again, it's the same old Apple story: slightly higher prices for equipment offering slightly better features and performance.

network printers through the utility.

The Executive can run as a TSR program so you can access it easily for print jobs. Quick point-and-click menus help you choose files to print. Press F2, and a window displays your current drive directory. F3 calls up a prompt that lets you change drives. To choose a file, scroll down to it with an arrow key, mark the file with F5, and press Return, and a print setup menu appears with the filename and the current page makeup settings. Press F7, and the print job begins.

Faster Canon

The 410 uses Canon's LBP-LX engine, the same 300-dot-per-inch motor that drives the IIP. But the IIP runs only a 10-MHz 68000 processor, compared to the 410's 16.67-MHz 68020. As with all Canon engines, the LBP-LX optical toner cartridge is a single unit that you can neatly replace in seconds. QMS pegs cartridge life at 3500 pages; replacements cost $95. The printer's monthly duty cycle tops out at 6000 pages.

To test speed, I printed a 49K-byte PostScript graphics file on the *410* and two other PostScript printers in the BYTE Lab. The Apple LaserWriter IINT required 84.21 seconds from the time I issued the print command until the entire sheet of paper hit the output tray. Texas Instruments' MicroLaser performed the same test in 71.32 seconds, while the 410 took only 55.48 seconds.

Keep in mind that the 410 competed under a handicap with its 4-ppm engine. A 6- or 8-ppm motor combined with the 410's fast processor would have pro-

 PHOTOGRAPHY: APPLE COMPUTER, INC. © 1990

At the same time that it introduced the NT, Apple also introduced a new low-end laser printer. The Personal LaserWriter SC is Apple's offering for Macintosh users who don't need PostScript. Instead, the SC relies on QuickDraw, the Mac's set of text and graphics routines. The new printer will replace the LaserWriter IISC, which is currently the low end of the LaserWriter II series. Like the older printer, the SC is geared toward those individual users with simple text and graphics printing tasks.

Externally, the SC is almost identical to the more expensive NT. It uses the same print engine and has the same physical characteristics. But the SC comes with only the four fonts used most often: Courier, Helvetica, Symbol, and Times. It also uses a slightly slower Motorola 8-MHz 68000 CPU, and it includes only 1 MB of RAM, 64K bytes of ROM, and a SCSI port. The SC's SCSI port provides for high-speed data transfer and lets you daisy chain as many as six additional SCSI devices to your system. One of the SC's nicest features is that you can upgrade it to the NT version simply by replacing the controller board (pricing not available yet).

Apple sees its bare-bones $2000 SC competing head to head against the 4-ppm IIP (retail price, $1495). The SC costs more, but it comes standard with 1 MB of memory as compared to 512K bytes for the IIP. Certainly the extra memory is important for anyone planning to use the SC to print graphics.

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duced even faster results. A quicker engine, however, would have priced it out of the low-end PostScript market.

Similarly, the 410 printed the 1- and 15-page text files used in our LaserJet IIP review (February BYTE) in an average of 40.13 seconds and 4 minutes, 11 seconds, respectively. The IIP logged slightly faster times of 36.7 seconds and 3 minutes, 57 seconds.

Text output from the 410 appeared dark and sharply defined, with no stray

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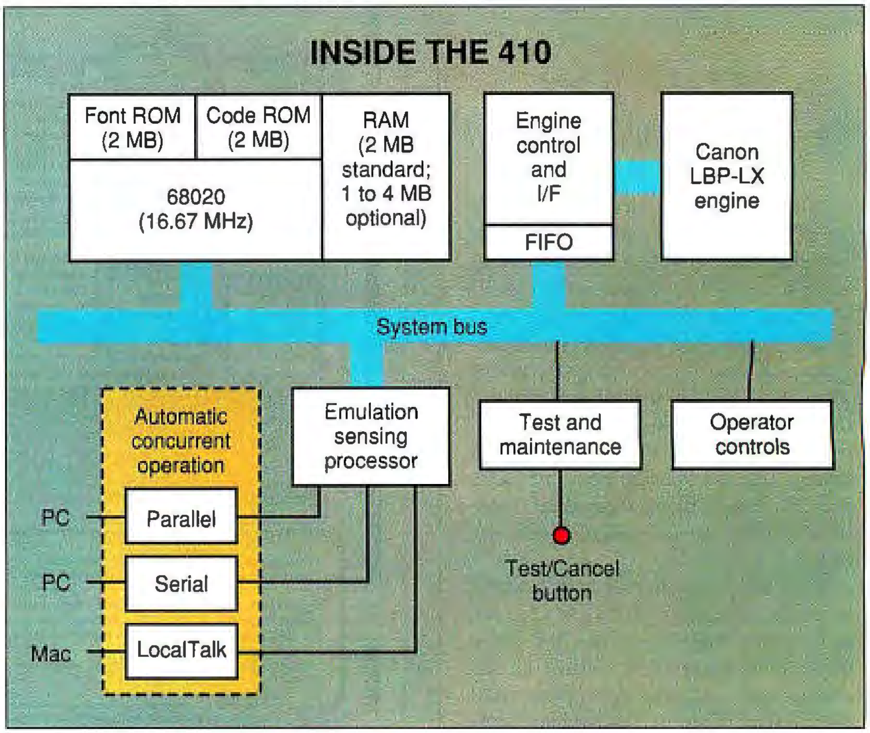

The emulation sensing processor automatically determines if incoming print jobs require Printer Command Language, PostScript, or (optionally) Hewlett-Packard Graphics Language emulation.

dots or swatches of toner. The graphics images were equally clear: Areas of 100 percent black looked solid, while even the lighter grays showed nice definition.

45 Fonts and Counting

The 45 controller-resident Adobe fonts come with Adobe Type Manager font scaling. Each font can be scaled from 4 points up to paper-size limits and rotated in any position, in 1-degree increments. You can add additional Adobe fonts using credit-card-size cards ($199 each) that slip into two front-panel slots.

The 410 accommodates standard letter and legal paper sizes, as well as 7¼-by 10½-inch executive format and A4 and B5 pages. A small 50-sheet multipurpose tray comes standard with the printer. As an option, you can add a 250-sheet cassette ($195). If you create a steady stream of envelopes, the $79 envelope-tray option may be worth considering. It and the 250-sheet tray attach to the printer's undercarriage. You can choose between two output paths: face-down, with up to 50 sheets collecting in a bin scooped out in the top of the printer, or face-up, in a 20-sheet tray that attaches to the back and which QMS recommends for heavy stock and envelopes.

The 410's footprint matches other personal laser printers' at 26.1 by 13.6 by 7.5 inches. Its 52-decibel noise rating is higher than the IIP's specifications, but my ears didn't hear a difference.

The standard 2 MB of memory can be upgraded to 6 MB in increments of 1, 2, and 4 MB. RAM daughtercards—available for $480, $780, and $1280, respectively—slide into slots in the back of the unit.

Grass-Roots PostScript

By pricing the 410 low enough to undersell some non-PostScript laser printers, QMS says that it's out to make PostScript a mainstream technology. Based on my initial look at the 410's performance, QMS appears to be headed for success.

This printer may take PostScript further away from the exclusive domain of desktop publishers and professional print shops, especially for those in mixed PC and Mac environments. It could spawn a grass-roots movement using PostScript for everything from white papers and newsletters to informal memos and dunning reports. The question is one of temperance. Are we really ready for scaled fonts, collections of typefaces, and eye-catching graphics on *every* page that we read? ■

Alan Joch is a BYTE technical editor. You can reach him on BIX as "ajoch."

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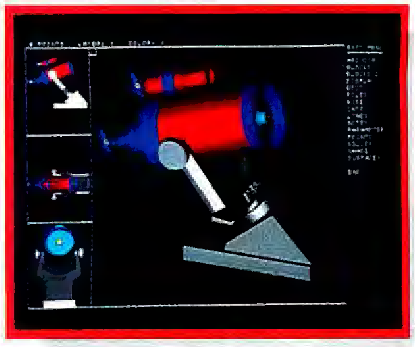

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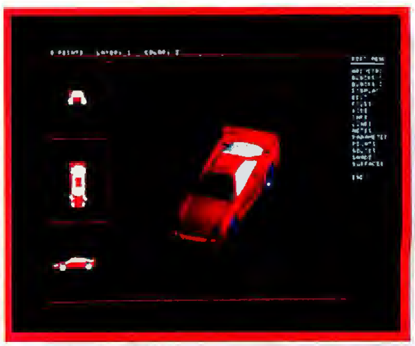

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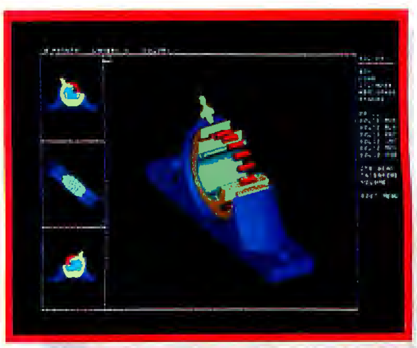

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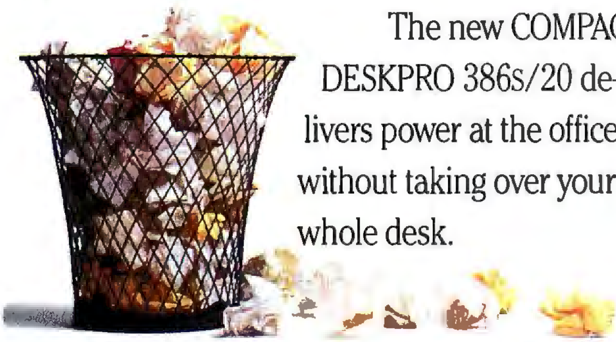

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386SX PCs: Heirs to the Low End

386SXes offer an inexpensive entrée to 386-specific applications

Rick Grehan, Steve Apiki, and Rob Mitchell

Whether or not you see 386SX systems as a legitimate alternative to full-blown 386DX systems, you will probably agree that aggressive pricing has firmly established the SX architecture at the low end of the market. The 386SX has claimed its niche as the low-cost, foot-in-the-door machine for those who anticipate needing 386 power.

The SX architecture has its drawbacks. The 386SX's 16-bit external data path is slower than the 32-bit path of an equivalent 386DX CPU. But unlike the 286-based systems against which it competes, the SX inherits the 386's protected and virtual 8086 modes and internal 32-bit processing.

Virtually every manufacturer offers a 16-MHz 386SX system for hundreds of dollars less than the 20-MHz 386DX. And dropping SX prices have put these machines in direct competition with many 286-based systems.

This month, the BYTE Lab staff evaluates 22 16-MHz 386SX systems (see the table). We asked manufacturers to supply a typical configuration: 2 megabytes of system memory, a 40-MB hard disk drive, one floppy disk drive, and a color VGA monitor and adapter. When manufacturers offered full-size and compact models, we opted for the latter. We also asked each manufacturer to include an 80387SX math coprocessor, but we did not include the chip price in the suggested list prices, because not all manufacturers offer one as an option.

We include list prices in our comparisons, but keep in mind that street prices vary; mail-order systems sell at list, while systems sold through dealers typically carry a 20 percent to 30 percent discount.

This Product Focus marks the debut of BYTE's new DOS benchmarks (see the text box "BYTE's New Benchmarks: New Looks, New Numbers" on page 158); you'll find the results in the figure. More qualitative testing included calling each company's technical-support department, whenever possible, to get a feel for its responsiveness to common user questions.

We also tested two SX machines with a twist: Dell's 20-MHz 320LX, the first production machine of its type that BYTE has tested, and Computer Peripherals' Goupil Golf, a Franco-American portable that offers more than just good looks (see the text box "386SX Alternatives" on page 162).

The Big Question

Should you buy a current SX system, wait for the next generation of 20-MHz SXs, settle for a 286 system, or cough up the cash for a 386DX? With SX prices so low, it's safe to say that if you've got your eye on a comparably equipped 12-MHz AT clone, you should rethink the purchase. In addition to the obvious clock speed difference, the SX's better memory management, superior coprocessor, and extended instruction set guarantee that tomorrow's software won't outstrip your hardware.

Against higher-end machines, the answers are less clear. The 20-MHz SX machines compete most directly with 20-MHz 386DX machines. Both require more costly memory architectures to maintain zero-wait-state operation, and neither currently has a better price/performance ratio than the best of these 16-MHz 386SXs. For Unix or OS/2 use, a 16-MHz SX machine may be inadequate. But for users of DOS, Windows, or DOS extended applications, an SX machine offers a reasonably priced alternative to the full-blown DX.

Variations on a Theme

The standard components in most machines varied little. Each included a 101-key IBM Enhanced-type AT keyboard, one or two floppy disk drives, and at least one serial and one parallel port. All the systems ran the expansion bus at or near 8 MHz. And except for the Ultra-Comp machine, each system earned an FCC Class-B rating.

Space is at a premium in the compact models we tested, so many manufacturers have integrated video and disk drive controllers into the system board. Several have reduced the number of expansion slots; many accept boards horizontally to reduce the chassis height.

Most of the systems use the increasingly popular Intelligent Drive Electronics disk interface. Relatively inexpensive, IDE technology incorporates the controller with the hard disk drive, leaving only the interface circuitry for the motherboard or add-in board.

continued

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386SX SYSTEMS: FEATURES SUMMARY

Many of the systems reviewed use a similar mix of components at widely varying prices. Most manufacturers opted for IDE controller technology to save space. Quantum's ProDrive, an IDE device used in machines from AT&T, Hewlett-Packard, and Micro Express, made a big difference on the low-level disk tests and gave the systems a substantial boost in the applications suite (●=yes; ○=no).

Product	List price[1]	Case size	Chip set	ROM BIOS	ROM setup	Memory						Hard disk drive	Avg. seek time (ms)
						Shadow system/ video BIOS	Maximum[2] on-board (MB)	Package[3]	Speed (ns)	Type	Interleave		
Acer 1100/SX	$3560	Compact	Acer	Award 3.03A SX	●	●	8	SIMM	100	RAS/CAS	●	Conner CP-344	29
Acma 386 SX	$2013	Standard	Intel	Award 3.04(P24)	●	●	8	SIMM	100	Page-mode	●	Seagate[6] ST151	24
Arche Rival SX	$3330	Standard	Faraday	Phoenix 1.10.00	●	●	8	SIMM	100	Page-mode	●	Seagate ST4077R	28
AT&T 6386/SX	$4784	Compact	Intel	Phoenix 1.10 16.E1B	●	●	8	SIMM[7]	100	Page-mode	●	Quantum ProDrive	19
Club American 316/SX	$1986	Standard	Intel	AMI Rev-F1-36	●	○	2	DIP[8]	80	Page-mode	●	Toshiba MK134FA-I	25
CompuAdd 316S	$2272	Compact	Discrete Logic	Phoenix 1.10.00	●	●	4	SIMM	80	Page-mode	○	WD 93044-A	28
CSR 386/SX-16	$2538	Standard	C&T NEAT-SX	AMI EMSX-1131	●	●	8	SIP DIP	80	Page-mode	●	Toshiba MK134FA-I	22
Dell 316SX	$2699	Compact	Western Digital	Phoenix 1.10 A00	●	●	8	SIMM	100	Page-mode	●	Seagate ST157A2	29
DTK Peer\1660	$1814[10]	Compact	C&T NEAT-SX	DTK	●	●	5	DIP SIMM	80	RAS/CAS	●	WD 93044-A	28
Epson Equity 386SX	$4536	Compact	Epson	N/A	○	○	14	SIMM	70	RAS/CAS	○	Conner CP-344	29
Everex Step 386is	$4646[11]	Standard	Discrete Logic	AMI Rev-F45-35	●	○	4	DIP	100	RAS/CAS	○	Imprimis	18
Hewlett-Packard Vectra QS/16S	$5147	Compact	C&T NEAT-SX	HP/Phoenix F.02.03	○	●	8	SIMM	100	Page-mode	●	Quantum ProDrive	19
Hyundai Super-386s	$3035[13]	Compact	Discrete Logic	Phoenix S 1.10 05	●	○	8	SIMM	80	Page-mode	○	Conner CP-344	29
Micro Express ME 386 SX/SL	$1945	Compact	VLSI	Quadtel VL82C02	●	●	4	SIMM	80	Page-mode	●	Quantum ProDrive	19
NEC PowerMate SX Plus	$3898	Compact	NEC	Phoenix 1.10.05	○	●	10	DIP	100	Page-mode	●	NEC APC-H225F	28
Samsung SD700	$3097[14]	Compact	Discrete Logic	Phoenix 1.10.05b	●	●	8	SIMM	100	Page-mode	○	None	*
Tandy 4016SX	$3877	Compact	Discrete Logic	Phoenix 1.10.00	○	●	4	SIMM	100	Page-mode	●	Smartdrive	28
Tatung TCS-8800	$3195	Standard	Intel	Phoenix 1.10.03	●	●	8	SIMM	100	Page-mode	●	Seagate ST251-1	28
Ultra-Comp Ultra 386SX Appeal	$1995	Standard	C&T NEAT-SX	AMI EMSX-1131	●	●	8	SIP DIP	100	Page-mode	●	Seagate ST251-1	28
Wang PC350/16S	$5130	Compact	C&T NEAT-SX	Phoenix 1.10.01	○	●	8	SIMM	100	Page-mode	●	Seagate ST157A	28
Zenith Z-386SX	$4998	Compact	Faraday	Zenith	●	●	8	SIMM	85	RAS/CAS	○[15]	Conner CP-344	29
Zeos 386/SX	$2175	Standard	VLSI	AMI DVLX-6099	●	●	4	DIP	70	RAS/CAS	○[16]	Conner CP-3044	25
Dell 320LX	$3399	Standard	Intel	Phoenix 1.10 A00	●	●	8	SIMM	80	Page-mode	●	Seagate ST157A	29
CPI Goupil Golf	$6495[13]	Compact	Goupil	Goupil 01	●	●	16	SIMM	100	RAS/CAS	○	Conner CP-344	29

N/A = Information not available.
* = Not applicable.
RAS/CAS = Row-address strobe/column-address strobe.
[1] Unless otherwise noted, price includes 2 MB of system memory, VGA adapter and monitor, 40-MB hard disk drive, one parallel and one serial port, and a 101-key keyboard.

[2] Maximum on-board memory is memory that can be installed directly on the motherboard.
[3] Unless otherwise noted, all systems accept either 256K-byte or 1-Mb parts.
[4] Total shown first; number available in tested machine shown second.
[5] Unless otherwise noted, all VGA adapters come with 256K bytes of RAM.
[6] Later units (not tested) use Toshiba drive.
[7] 1-Mb SIMMS only.

386SX SYSTEMS: FEATURES SUMMARY

Controller	Floppy disk capacity (MB)	Drive bays[4]	Expansion slots (8-/16-bit)	Serial ports	Other ports	VGA controller[5]	Card width	Power supply (W)	Bundled software	Distribution channel	Warranty	On-site service	Telephone support
Integrated	1.2	4/0	0/4	9-pin, 25-pin	Mouse	Integrated	*	145	DOS/GWBASIC, utilities, MS Windows	Dealer	1 year	4 months	No
Data Tech	1.2	1/0	2/3	9-pin, 25-pin	Game	Acma	16-bit	200	Utilities	Mail Order	1 year parts, 2 years labor	Option	Toll-free
Integrated	1.2	1/0	1/6	9-pin, 25-pin	None	Arche VGA-C	8-bit	200	DOS 3.30, GWBASIC	Dealer	2 years	Option	Toll-free
Integrated	1.44	1/0	1/3	9-pin, 25-pin	Mouse	Integrated	*	145	Utilities	Dealer, direct	1 year	Option	Toll-free
Seagate	1.2	2/0	0/6	9-pin	None	Club	16-bit	200	None	Mail order	1 year	Option	Toll
Integrated	1.2	1/0	2/1	9-pin, 25-pin	None	CompuAdd[9]	16-bit	150	Utilities	Dealer, mail order	1 year	Option	Toll-free
WD-1006	1.2	3/0	2/3	9-pin	Mouse	Headland[9]	16-bit	200	Setup, VGA utils.	Dealer	2 years	1 year	Toll
Integrated	1.2	None	0/3	2 9-pin	None	Integrated	*	85	EMS driver, setup, utils.	Mail order	1 year	1 year	Toll-free
Integrated	1.2	4/2	2/2	2 9-pin	Mouse	Trident	16-bit	150	EMS driver, mouse driver	Dealer	1 year	No	Toll
Integrated	1.44	1/0	1/1	9-pin	Mouse	Epson	16-bit	140	Ref. disk, DOS 4.01	Dealer	1 year	Option	Toll
Data Tech	1.2, 1.44	None	1/4	9-pin	None	Everex	16-bit	200	Setup, utility	Dealer	1 year	No	Toll
HP	1.2	3/2	1/4	9-pin	HP-HIL[12]	HP	16-bit	134	EMS driver, setup, util., DOS shell	Dealer	1 year	Option	Option
Integrated	1.2	1/0	1/3	9-pin	Game	ATI VGA-Wonder	16-bit	135	DOS/GWBASIC, utilities	Dealer	18 months	Option	No
Integrated	1.2	0/1	2/3	9-pin	None	Integrated	*	200	Utilities	Mail order	15 months	No	Toll-free
WD-1006	1.2	1/0	0/3	9-pin	Mouse	NEC	16-bit	110	DOS/GWBASIC, MS Windows	Dealer	1 year	Option	Toll
Integrated	1.2	1/0	0/4	9-pin, 25-pin	None	Renaissance	8-bit	135	DOS 3.30, GWBASIC	Dealer	1 year	Option	Toll-free
Tandy	1.44	1/1	0/3	9-pin	Mouse	Integrated	*	100	Utilities	Dealer	1 year	Option	Toll
WD-1006	1.2, 1.44	0/1	2/2	9-pin, 25-pin	None	Paradise	16-bit	180	Setup, utils., DOS 3.30	Dealer	1 year	Option	Toll-free
Adaptec	1.2, 1.44	2/0	2/3	9-pin, 25-pin	Game	Genoa	16-bit	200	Disk manager, utilities	Mail order	1 year	Option	Toll-free
Integrated	1.2	1/0	1/4	2 9-pin	None	Wang	8-bit	145	EMS driver, setup	Dealer, direct	1 year	No	Toll-free
Integrated	1.44	1/0	0/4	2 9-pin	None	Western Digital	16-bit	120	DOS 4.01, MS Windows	Dealer	1 year	Option	No
Data Tech	1.2	3/1	1/4	9-pin, 25-pin	Game	Western Digital	16-bit	200	DOS, EMS driver, utilities	Mail order	1 year	Option	Toll-free
Integrated	1.2	3/1	2/5	2 9-pin	None	Integrated	*	200	EMS Driver, utilities	Mail order	1 year	1 year	Toll-free
Integrated	1.44	0	2/1	25-pin	None	Integrated	*	40	DOS 4.01, GWBASIC	Dealer	1 year	Option	Toll-free

[8] 256K-byte DIPs only.
[9] 512K bytes of RAM standard.
[10] No monitor included.
[11] Price includes an 85-MB ESDI drive.
[12] Hewlett-Packard Human Interface Loop.
[13] Price for 1-MB system; 2-MB system not available.
[14] Price does not include a hard disk drive.
[15] System memory is cached.
[16] Optional for slower memory.

ACER 1100/SX

The Acer 1100/SX owes its low profile to its vertically mounted I/O bus and its ability to cram as much on the motherboard as possible: two serial ports, a parallel port, VGA circuitry, and a hard/floppy disk drive controller. As configured, our test system still had all four of its 16-bit slots open.

We liked Acer's open concept approach to mounting the disk drives. Most systems pack components so tightly that adding or removing drives or cables becomes a Houdini act. Acer makes its hard and floppy disk drives and their dressings easily accessible.

We had mixed feelings about the vertically mounted I/O bus, a design used in several other low-profile systems that we tested. Although it saves a few inches in height, installing I/O boards into a riser card that in turn plugs into the motherboard could put undue stress on the edge connectors.

The 1100/SX turned in an acceptable performance overall in the low-level and application test, and it performed particularly well in the low-level video benchmarks. If you're short on desk space and like to do your own upgrades, the 1100/SX may be your answer.

ACMA 386 SX

This full-size system places all its I/O interfaces on adapter boards. In its least-expensive configuration ($995), the Acma 386 SX comes with a dual hard/floppy disk drive controller card and a multi-I/O card (two serial ports, one parallel port, and a game port). You also get 1 MB on the motherboard and all the standard critical options. Our test system weighed in at $2013 and had three 16-bit and two 8-bit slots free.

We prefer that a machine have a reset switch; Acma puts its right up front next to an 8-/16-MHz turbo switch. The 386 SX performed quite well, and the price for a bare-bones system is attractive, especially if you already have an IBM PC system to retire but you want to keep the I/O boards in service.

ARCHE RIVAL SX

The Arche Rival SX is another standard-footprint system that puts all its I/O on adapter cards. After you have filled up slots for the basics—serial port, parallel port, video card, and disk drive controller—you still have three 16-bit slots and two 8-bit slots free. The Rival SX's footprint is smaller than that of a standard AT case, but many other systems are more compact and offer as many available expansion slots.

The front panel includes a reset switch and an LED indicating 8-MHz or 16-MHz operation. You set the CPU speed using a selected hot-key sequence.

The Rival SX exhibited average to above-average performance on the BYTE benchmark test. But performance isn't everything. If you're concerned about ongoing support, you may want to investigate Arche Technologies' two-year warranty, which covers the entire system. In these days of the microcomputer as commodity, a system's warranty is just as important as its MIPS rating.

AT&T 6386/SX

AT&T's 386SX looks much like any other AT&T computer; you'll recognize that saddle-oxford color scheme if you're familiar with AT&T hardware. The case is taller than those of many other machines that we tested. The extra roominess inside makes installing adapter boards or memory easier than on many of the compact machines, and just three captive screws hold the cover in place.

The system's manuals are very well done. Our machine included a user's guide, a service manual, *and* a hardware reference manual. If you're serious about protecting your computer investment, such documents are invaluable.

The keyboard slopes in a comfortable curve, and all the important peripherals—serial ports, parallel port, VGA controller, and disk drive controller—are on the Intel motherboard, leaving the machine's four expansion slots free. The system also includes a handy front-mounted reset switch.

The 6386/SX performed particularly well on our disk benchmarks. BYTE's low-level disk tests ranked the machine among the leaders in this area. The AT&T 6386/SX posted similar results in the disk-intensive database application-level tests. In other areas, the 6386/SX scores were either fair or above average, except for its disappointing video test scores.

The 6386/SX's $4784 list price may be a bit steep, but you'll pay even more for a comparably equipped Hewlett-Packard or Wang system.

CLUB AMERICAN 316/SX

The Club American 316/SX is a standard-size system that puts all its controls on the front panel: power switch, hard disk drive, LED, reset switch, and speaker switch. Club American puts the serial and parallel ports, video adapter, and hard disk drive controller on add-in boards. Two MB of DIP memory fits onto the motherboard; additional memory requires a proprietary memory card. The two memory slots accept up to 16 MB of RAM running at 16 MHz. Our test system cost just $1986.

Benchmark performance was above average on the CPU and FPU tests, but below average on the video tests. Since the base system doesn't include a video system on the motherboard, you're free to choose a better adapter.

COMPUADD 316S

CompuAdd squeezed as many expansion slots into the 316S's short $4\frac{1}{10}$-inch-high cabinet as possible. As with the Acer 1100/SX, you mount boards horizontally on an I/O-bus riser board. CompuAdd's board is two-sided, with three 16-bit slots on the left and two 8-bit slots on the right.

Installing add-in boards is a hassle. You can expect to wrestle with power supply and disk drive cables when installing 8-bit boards. Also, the 8-bit boards mount with their component sides pointing down, and getting at the lower boards requires pulling the upper ones first. Two other low-profile machines that used a two-sided riser card—the DTK Peer\1660 and the Micro Express ME 386 SX/SL—had similar problems.

Only the VGA board occupied an expansion slot in our evaluation unit. All other I/O circuitry—serial, parallel, and disk—sits on the motherboard.

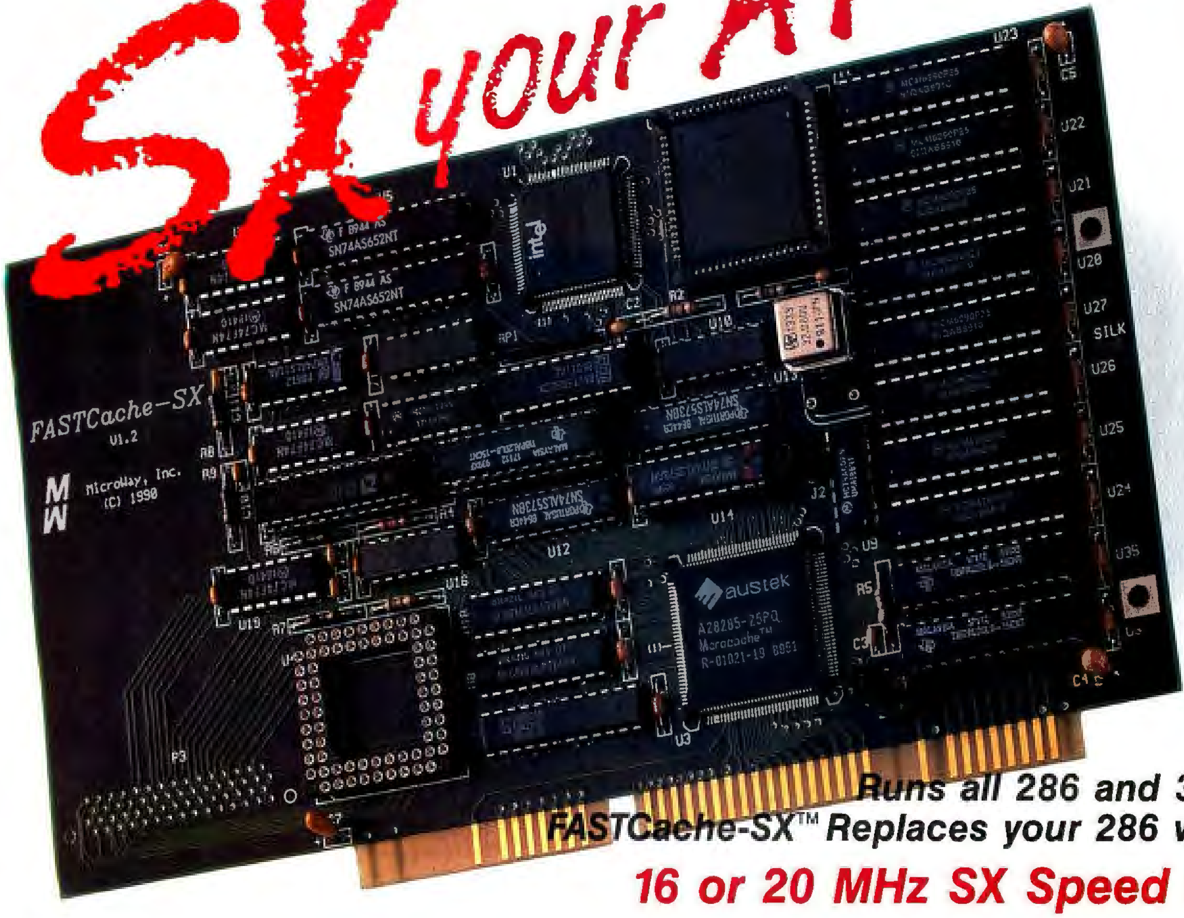
The CompuAdd 316S's below-average performance—with the exception of the low-level disk benchmarks—disappointed us. On the other hand, the machine's $2272 price is quite low.

CSR 386/SX-16

The 386/SX-16 from Computer Systems Research isn't the fastest machine we reviewed, nor is it the cheapest. But at $2538 in our standard configuration and

continued

SX your AT



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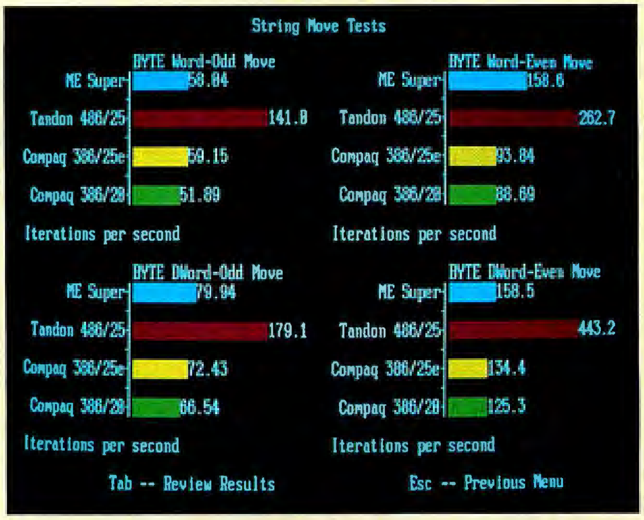
BYTE's New Benchmarks: New Looks, New Numbers

In the BYTE Lab, we've sometimes wondered if hardware and software designers ever sleep; we have certainly had our share of sleepless nights keeping up with them. The result is an overhaul of BYTE's DOS benchmark suite.



LOW-LEVEL BENCHMARKS

We kept many tests in the BYTE benchmark suite, dropped some, and modified others. First, you'll notice that we continue to partition the low-level tests into CPU, FPU, Disk I/O, and Video tests. Here is the breakdown:

CPU

We retained the world-famous Sieve of Eratosthenes. We also kept the Sort benchmark, but we trimmed it down to include only Quicksort and Shellsort algorithms. The String Move benchmark is back, as well; we kept the important even-byte-boundary / odd-byte-boundary comparisons for word- and double-word-wide moves. A newcomer in this category is the Integer Math benchmark, which, as its name implies, tests integer (in this case, 16-bit integer) addition, subtraction, multiplication, and division.

FPU

For obvious reasons, we kept the familiar floating-point (Fmath) test. Fmath is the floating-point counterpart to the Integer Math benchmark in the CPU tests; it executes a series of adds, subtracts, multiplies, and divides. Our previous iterations of the BYTE benchmarks followed this test with two tests for transcendentals; we based both on a simple Simpson's-rule integration, and many of the faster 80387s ran the tests at speeds that approached the resolution of our timing routine. We've replaced that test with a more robust benchmark that calculates the first *n* Fourier coefficients for a square wave of period 2.

We should point out here that the BYTE benchmark program is intelligent enough to recognize the coprocessor type. So, running Fmath on an 8087 will execute code that has FWAIT instructions inserted (mandatory for FPU/CPU synchronization), whereas running on an 80287 or 80387 will execute code without inserted FWAIT instructions. Also, the Fourier test has to use a convoluted algorithm built around the FPTAN instruction to calculate sines and cosines on the 8087, but the 80287 and 80387 enjoy built-in sine and cosine functions.

Disk I/O

Once again, we kept an old friend on duty: the File I/O test. However, since hard disks have been getting bigger by the day, we beefed up the test to roughly twice its original size. File I/O represents the only low-level test that includes an element of DOS in its behavior. All other tests either exercise the hardware directly or make BIOS calls.

A newcomer is the Read Throughput test, which determines how fast the hard disk system can get data off the drive and into system memory. We also improved the Disk Seek test, which now gives a more accurate picture of the drive's average seek time. We have one caveat here: All disk tests are extremely sensitive to any cache that might be on the controller, as well as the controller type—SCSI, ESDI, and so on. Our tests are no different, so be careful about drawing conclusions from the numbers without investigating the details of the disk drive and its controller.

Video

Our video tests are an improved model of our previous version. We kept both text- and graphics-based tests. We added a test for drawing rectangular regions of characters on-screen and measuring the time for the video BIOS to scroll those regions up and down. As before, the benchmarks determine what type of adapter you have and run tests for each available graphics mode.

Perhaps the most important modification to the low-level tests is the new, user-friendly front end. The menu-driven user interface makes BYTE's benchmarks attractive and easier to use. We've also added a results log that makes the benchmarks easier to run. As usual, we freely distribute the complete benchmark code—source as well as executable—upon request. You'll also find the BYTE benchmarks in the listings area of the Byte.bmarks conference on BIX.

APPLICATION BENCHMARKS

Our low-level benchmarks offer a detailed record of the elements of machine performance, but they tell only half the story. While they provide a good basis for making machine-to-machine comparisons, they supply comparatively little information on how well a system will actually perform under a complex application. It's difficult to extrapolate performance under AutoCAD, for instance, on the basis of how long a system takes to run the Sieve of Eratosthenes.

BYTE's application benchmarks attempt to fill in these information gaps. Instead of trying to simulate the instruction mix that makes up an application, we run a standard suite of tests using the most common software packages available in each application area.

We have selected seven application areas to test: word processing, desktop publishing, database management, compilers, CAD, science and engineering, and spreadsheets. For each area, we derive an application index by normalizing each test result against the results from an 8-MHz IBM PC AT and determining the geometric mean of the normalized numbers. The resulting index gives you a useful approximation of system performance in each area.

Word Processing

We time six common word processing operations using WordPerfect 5.0 and a 330K-byte text file. The first test is to load the file. In the second test, we time a search-and-replace function operating on approximately 2000 instances of the word *first*. The third test is a jump from the last page of the document to the first. The fourth test is a series of paragraph copies in which a single paragraph is inserted repeatedly into later sections of the document. The fifth is a spelling check, and the sixth and final test is to save the modified file. Word processing test results depend heavily on both memory speed and disk performance.

Desktop Publishing

We use Aldus PageMaker 3.0 for our suite of desktop publishing tests. The suite consists of three repeatable operations: flowing a large text file, changing the text style for the full document, and printing the document to disk.

Our test file is a three-column, 35-page newsletter. At the start of the test, the document contains no text, but it has graphical elements sprinkled throughout. The graphics serve as an obstacle course when flowing the 90K-byte text file.

Next, we record the time it takes to change all the text to bold. Then, in our third test, we create a PostScript representation of the test document by printing it to a disk file.

Like the word processing tests, the desktop publishing tests are about equally dependent on memory speed and disk performance. To a lesser extent, they also depend on a system's graphics-mode video performance.

Database Management

We split our database management tests between Borland's Paradox 3.0 and Ashton-Tate's dBASE IV. The database index score mostly depends on the hard disk drive, although CPU and video performances also come into play on some tests. Because Paradox 3.0 and dBASE IV use expanded memory, the speed of expanded memory operations also contributes to this index.

The Paradox test document is a 1.28-megabyte database containing names, addresses, and account information for 7000 customers. We time five operations: counting records, importing records from a dBASE document, sorting on one field, indexing, and sending the resulting database to a text file.

Our dBASE IV tests are similar, but they use a larger, 10,000-record database. The test suite consists of five operations: appending additional records, indexing the database, listing to the screen, deleting records and packing the database, and sorting the database.

Compilers

We use Microsoft C 5.1 and Borland's Turbo Pascal 5.5 to gauge a system's effectiveness at source code compilation. This is another application area that depends on both a quick CPU and a fast hard disk drive. Our C source file is Dave Betz's XLISP, which consists of 24 source files, for a total of 242K bytes of C code. We include both compile and link time in the test.

For Pascal source code, we chose Borland's MicroCalc demo spreadsheet, included with the Turbo Pascal 5.5 compiler. As with Microsoft C, we time both compilation and link times; the MicroCalc source code comprises 12 Pascal files and takes up 223K bytes on disk.

CAD

Good CAD performance depends on fast graphics and on system speed in floating-point operations. Like most other application areas, CAD benefits from good disk drive performance.

We use two packages: AutoCAD release 10 and Generic Software CADD level 3. Our AutoCAD test file is a 172K-byte three-dimensional architectural drawing. Five tests make up the suite: redrawing, panning, zooming, removing hidden lines, and regenerating the drawing.

The Generic CADD test drawing is the floor plan for a house. Generic CADD has the ability to store drawings as batch files, a series of commands that create the drawing when you launch the batch file. Our test is to time a run of the batch file that generates the floor plan.

Science and Engineering

Of the application areas represented here, the scientific and engineering tests probably depend least on disk drive speed. The critical requirements for a good showing are a fast CPU, a fast FPU, and good graphics performance.

We use three packages: Stata release 2, a statistics/analysis package from the Computing Resource Center; Mathsoft's MathCAD 2.5, an equation solver of the electronic blackboard variety; and The Mathworks' PC-Matlab 3.5f, software best suited to solving and analyzing engineering mathematics.

For each package, we time two macro scripts. The first Stata script conducts an analysis of variance on a set of test data; the second draws a series of graphs describing another set of data. MathCAD solves both a convolution problem and an iterated function problem. Both of the PC-Matlab tests run a variety of operations, including graphing, solving filter equations, and building mesh plots.

Spreadsheets

Our spreadsheet benchmark tests run under Lotus 1-2-3 release 3.0 and Microsoft Excel 2.1.

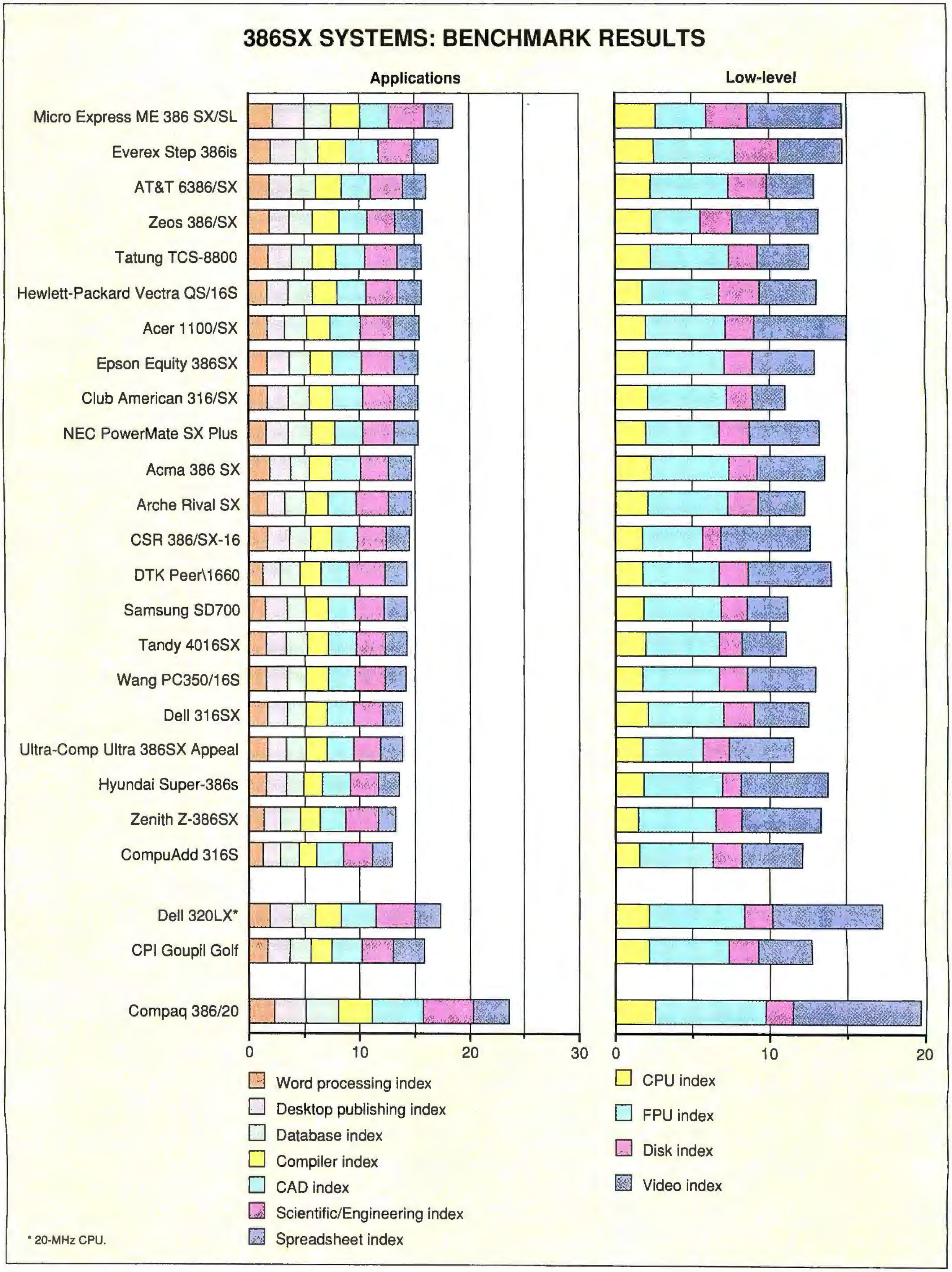
Our Excel suite loads and recalculates a 433K-byte, 10,000-cell spreadsheet based on the Savage formula. It also runs a macro that performs a binary goal seek.

Lotus 1-2-3 performs virtually the same operations on the same set of data. The only difference is the file format and the macro in the second test. We also use 1-2-3 to load, copy, and save a large block of text data.

Spreadsheets depend on fast memory, a fast hard disk drive, and good processing speed for both integer and floating-point calculations. Lotus 1-2-3 makes use of extended memory, while Excel uses expanded memory; together, the two packages test most aspects of memory speed.

Comments

All together, our upgraded low-level benchmarks and improved application tests give us a handle on most aspects of system performance under DOS. We will continue to make incremental upgrades to these benchmarks as machines get more powerful.



The BYTE DOS benchmark suite test results, ranked by cumulative application score, show that the Micro Express ME 386 SX/SL was fastest, outrunning even the 20-MHz Dell 320LX on our low-level CPU benchmarks. With the exception of the 320LX, all systems use Intel's 16-MHz 386SX CPU. For all indexes, an 8-MHz IBM PC AT = 1.

backed by a two-year warranty, the CSR 386/SX-16 offers dependability at a good price.

CSR started out in the microcomputer service business. The company has a strong bent toward service and repair; when we called for technical support, an operator routed us directly to a service technician.

The 386/SX-16 appears solidly assembled, and the full-size case and motherboard give it plenty of room for expansion. CSR's hinged keyboard dustcover may keep dust off the key contacts, but we found it so annoying that we had disconnected it within 5 minutes after unpacking the system.

The CSR 386/SX-16 includes Tatung's CM-1496 color VGA monitor, which ranked high in our BYTE Lab tests (see "A VGA on Every Desk," March BYTE).

DELL 316SX

Dell's 316SX looks like one rugged machine, and its reinforced case makes the system heavier than you'd expect. The heavy-duty image ends, however, when you see the system's wimpy 85-watt power supply. That's a surprisingly low rating when you consider the system's three available expansion slots and three drive bays.

Dell put the system's two serial ports, parallel port, VGA adapter, and floppy/hard disk drive controller on the motherboard. Readily accessible single in-line memory module (SIMM) connectors make adding memory easy. As with other compact designs, expansion boards mount horizontally into the machine.

In terms of performance, the 316SX ran with the pack on the low-level tests, scored slightly above average on CPU-intensive low-level benchmarks, and then fell behind on the application tests. Its $2699 list price is about average. The machine's documentation, however, is superb. The well-illustrated, easy-to-follow manuals should please even the computer novice.

DTK PEER\1660

You can open DTK Computer's low-profile Peer\1660 by removing a single cover screw. Inside, the system board accepts both DIP and SIMM memory, for a ceiling of 5 MB. The Peer\1660's $1814 price (sans monitor) helps compensate for its average benchmark results, but other problems hampered this system as well.

DTK's proprietary BIOS includes an infuriating ROM-based setup utility that suffers from sluggish pop-up windows and a roundabout command structure, and the system's Western Digital hard disk drive suffered from intermittent data errors. A new hard disk drive undoubtedly would have cured the latter problem.

EPSON EQUITY 386SX

At $4536, the Equity 386SX is one of the pricier units we tested. Benchmark performance was slightly less than top of the line, but the Equity 386SX shows quality in design that may make it worth the extra money for users seeking long-term reliability.

Like most compact desktop machines, the Equity system board bears little resemblance to that of the IBM AT, with which it claims compatibility. The only memory on-board is a group of single inline packages (SIPs) soldered onto the motherboard. You install additional memory on a card, included with all systems, that plugs into a proprietary motherboard connector. The I/O card also connects to the system board through a dedicated DIN connector.

The design is clean. Installing memory doesn't require handling the motherboard, and the I/O card stays away from the bus connectors. The bus connectors mount vertically, rather than horizontally, on the system board. Finally, the chip set, motherboard, VGA card, and power supply are all either Seiko or Epson parts, which should eliminate the potential for compatibility quirks between parts that come from different manufacturers.

The Equity has good growth potential. The memory card accepts up to 12 MB of RAM, for a system total of 14 MB. And the Equity supplies three externally accessible 5¼-inch half-height drive bays, more than most small-footprint designs.

EVEREX STEP 386is

The Step 386is was a top performer, finishing second only to the Micro Express system on our CPU tests. That the 386is also garnered an excellent application index didn't surprise us, since Everex supplied an 85-MB ESDI hard disk drive in lieu of the 40-MB unit that we requested. The $4646 price for our test system drops to $3911 when you substitute Everex's 40-MB hard disk drive. We can't say how the Everex would perform with its 40-MB hard disk drive, but the fast CPU and first-place FPU score promise superior overall performance even with the standard system.

Everex built the Step 386is around a modified 286 motherboard. The 386SX and 80387SX processors sit on a small daughtercard that plugs into the 286 and 80287 sockets on the system board.

The Step 386is's tall, full-footprint design has room for three half-height drives mounted in a vertical stack. The front panel features the LED display found on other Everex machines; it shows stages during the power-on self test and the current disk sector the machine is accessing.

Although the 386is is more expensive than many other machines in its class, its good performance and the reliable Everex name make this system worth considering.

HEWLETT-PACKARD VECTRA QS/16S

If you're looking for a well-constructed machine and you're willing to pay for quality, you are probably considering Hewlett-Packard's Vectra QS/16S. At $5147 in our standard configuration, the Vectra was the most expensive machine that we reviewed, although it costs $2500 less than HP's 20-MHz 386.

HP houses the 386SX processor, the 80387SX coprocessor, and all system memory on a vertical card that plugs into the motherboard. The motherboard itself is clean, containing little more than bus interface logic and BIOS ROMs. The video adapter and hard/floppy disk drive controller occupy two of the machine's six expansion slots.

Everything about the system has a rugged, solid feel. The case slides on and off cleanly. The keyboard is comfortable to the touch and uses the speaker to simulate keyclicks. The Vectra has one unusual connector—a port for HP's Human Interface Loop, or HP-HIL. The connector supports devices like HP mice and graphics tablets.

The Vectra's low-level CPU, FPU, and video benchmarks were relatively lackluster. But the Vectra's top marks on the low-level disk tests gave it a big boost in our application benchmarks, placing it sixth overall.

continued

386SX Alternatives

Dell's 320LX is the first shipping 20-MHz 386SX machine that we've tested. It's the harbinger of a new class of machines that pit the SX architecture against machines that use Intel's 20-MHz 386DX CPU. Computer Peripherals' sleekly designed Goupil Golf is a laptop/desktop hybrid that offers most of the amenities of a compact desktop model in a much smaller form. We've included benchmark results for both machines in the figure; you'll find key features described in the table.

Photo A: *The Goupil Golf (left) combines good looks and good performance in a very small box; Dell's 20-MHz 386SX machine, the 320LX, doesn't deliver the performance that we expected.*

Le Goupil—Très Chic

The Goupil Golf's uniqueness is apparent: its jet-black molded-plastic platform looks like the stand for a monitor or a digitizing tablet. You wonder for a moment if some components might be missing. Then you fold up the top, which holds a 10-inch cold-cathode backlit LCD monitor, and you realize that it's all here.

The 640- by 480-pixel VGA-compatible LCD monitor has eight shades of gray. If you don't like how the display maps colors to gray scale, a button on the display lets you rotate through alternate mappings. You can also detach the LCD monitor and plug in a standard VGA monitor.

The system unit itself measures only 12⅝ by 2½ by 14⅞ inches, but the keyboard is a no-compromise 101-key IBM Enhanced-style unit. Inside, the Goupil Golf has a 16-MHz 386SX, a socket for an 80387SX, a 3½-inch 1.44-megabyte floppy disk drive, and a 3½-inch 20-, 40-, or 100-MB Conner Peripherals Intelligent Drive Electronics hard disk drive. A PS/2-compatible mouse port sits on the right-hand side of the case, adjacent to the recessed reset button. The system comes with 640K bytes of single in-line memory module-mounted, 100-nanosecond RAM, but you can expand memory to 1, 2, or 4 MB. Two horizontally mounted 8-bit adapter slots hold half-length expansion boards.

Getting into the machine is a simple matter of removing two screws at the back and sliding the top off. From there, most components snap apart, although you need a Phillips-head screwdriver. The Goupil Golf is easier to disassemble than any of the other SX machines we tested for this product focus.

The Goupil Golf's one technical fault is its slow LCD monitor, which sometimes lagged behind the current graphics mode. On one of the low-level graphics tests, for example, one portion of the display was busily drawing in one mode while, for a second or two, another portion retained the image from a preceding screen. The effect has more to do with the nature of LCD monitors in general than the Goupil Golf in particular, and the portability that you gain easily outweighs these transient peculiarities.

The Goupil Golf placed at above average or higher in most of our tests, although it scored slightly below par in the video and Dhrystone benchmarks.

Keep in mind that the Goupil Golf is more a luggable than it is a portable. The keyboard, system unit, and LCD monitor add up to a little over 15½ pounds. Fortunately, Computer Peripherals offers an optional carrying case that lets you lug the Goupil Golf on your shoulder. Finally, we're not sure how well its plastic case will withstand travel, and the Golf is not battery-powered.

The Golf's small size allows only limited expandability. Its big drawback, however, is its price. Our test machine with 1 MB of RAM and a 40-MB hard disk drive lists for $6495—more than any of the other SX machines we tested. Ultimately, the Goupil Golf will appeal mostly to upscale users for whom style is as important as substance.

Dell Leaps to 20 MHz

Beyond its fast 20-MHz CPU, Dell's 320LX looks no different from any 16-MHz 386SX machine. Dell does not offer a compact model; our test unit measured 21 by 6½ by 16½ inches and had plenty of room for its six 16-bit I/O slots and two 8-bit slots. The video adapter occupies a slot; the I/O ports and floppy/hard disk drive controller hardware are all on the motherboard. The case also has room for five 5¼-inch half-height devices or one half-height and two full-height devices.

The 320LX's 386SX may hop along at 20 MHz, but the speedy processor clock doesn't achieve a proportional performance boost. Several 16-MHz systems that we tested outpaced the 320LX's Seagate ST157A hard disk drive. The differences appear first in the low-level disk tests and again in the database benchmarks. The 320LX also stumbled in the low-level memory-move tests. The memory-move problem also affected application tests such as the desktop publishing flow test.

In the FPU and video tests, the Dell 320LX is a clear leader. If your application requires number crunching and graphics, you should consider it.

The 320LX comes with Dell's high-quality documentation and the usual complement of utility and diagnostic software, including an EMS driver. The machine is easy to open. Inside, the layout leaves expansion slots, memory slots, and drive bays accessible.

If Dell can beef up the 320LX's memory and disk throughput, the small price difference between this machine and other 16-MHz 386SX systems would simply disappear when weighed against performance gains.

HYUNDAI SUPER-386s

Hyundai's SX is an average machine in most respects. The company sells the machine with only 1 MB of RAM; for purposes of comparison, we added $100 for an extra megabyte, for a grand total of $3135.

Opening up the Hyundai isn't particularly difficult. But when we attempted to add RAM, we couldn't find one of the three jumpers that we needed to set. We finally found it under the chassis that supported the disk drives. It's difficult to recall how many parts we had to unscrew to get to that one jumper. It's too bad that the authors of the user's guide didn't provide a motherboard diagram so we could locate the jumper more easily.

The Super-386s's ATI VGA Wonder-16 performed quite well on our low-level video benchmarks, but in most other areas, the machine lagged behind the group. The VGA Wonder-16 is the only add-in card: Hyundai incorporates the serial port, parallel port, and disk drive controller into the motherboard.

MICRO EXPRESS ME 386 SX/SL

Top benchmark performance set the compact ME 386 SX/SL apart from its competitors. The system had the highest score on our low-level CPU benchmarks, even outpacing the 20-MHz Dell 320LX. The ME 386 SX/SL's application index also easily mastered those of the other systems that we tested.

The 386 SX/SL runs the CPU and FPU at just over 16 MHz (about 16.25 MHz), slightly out of spec for the chip set and processors. Micro Express says that the slightly faster clock crystals that drive the system are easier to obtain. The people at Micro Express also claim to have designed the board for 20-MHz operation and say that they've encountered no problems running at the odd speed. Although this unusual design probably gave the CPU score a small boost, it's likely that the outstanding results owe more to the fast memory subsystem. Disk performance benefited from Micro Express's choice of a 19-millisecond Quantum ProDrive, the same unit used in the AT&T and Hewlett-Packard systems.

To attain a small footprint, Micro Express uses SIMM memory and integrates peripheral electronics such as the hard/floppy disk drive and VGA controllers on the motherboard to save space.

The machine has its weak spots: You must mount expansion cards horizontally on a riser card that plugs into the motherboard, and the two 8-bit slots, partially obstructed by power supply and controller cables, accommodate only half-length cards. The machine has room for one additional 3½-inch storage device.

For $1945, however, you may be willing to overlook these limitations. The ME 386 SX/SL delivers top performance at the lowest price—it's hard to ask more of any system.

NEC POWERMATE SX PLUS

NEC's PowerMate is an average-performing compact system with limited expandability. Our PowerMate SX Plus test system sells for $3898, which puts it in the moderately high-priced category, along with the Tandy and Epson machines.

The PowerMate has four horizontally mounted expansion slots. An additional memory slot runs at 16 MHz. The optional add-in card accepts up to 8 MB of RAM.

As you'd expect from NEC, the quality of construction is good. The power supply runs along one side of the machine rather than just in one corner, lending stability and improving airflow. An NEC Super-VGA controller sits in a special connector attached to the motherboard. Two MB is standard on the PowerMate SX Plus; NEC solders the SIP packages onto the motherboard.

SAMSUNG SD700

Samsung's compact SD700 is another average performer with an above-average price of $3097, excluding a hard disk drive. Samsung relies on its dealers to add a hard disk drive. Our system included a 42-MB MiniScribe IDE hard disk drive for testing purposes.

The SD700's system layout is similar to that of other compact units. The machine uses a riser board that accepts horizontally mounted expansion cards. The motherboard accepts up to 8 MB of SIMM-mounted RAM, and the parallel, serial, and IDE hard disk drive interface are on-board.

The Phoenix Extended Features BIOS includes ROM-based utilities such as a disk cache and an EMS driver. Our test machine was equipped with one 5½-inch half-height storage bay and four 16-bit I/O slots.

TANDY 4016SX

The Tandy 4016SX's cover is no more than a plastic carapace wrapped around an inner metallic shell. This shell completely encloses the interior of the machine; you gain access to the motherboard by folding the top open like a pair of wings. The left side opens to reveal the memory sockets and three 16-bit expansion slots. On the right side are three drive bays, configuration DIP switches, and the math coprocessor socket. The fold-open top not only serves as an electromagnetic interference/radio frequency interference shield when closed, but you can lock it shut. No one can sneak into your office and borrow your modem card when you're not in.

The basic 4016SX might carry all the peripheral devices you need. The serial, parallel, and floppy and hard disk drive interfaces, VGA controller, and even a PS/2-compatible mouse interface are on the motherboard.

Our test machine turned in mediocre performances on all our tests, showing up either in the middle or somewhere in the lower half of the pack. The $3877 price was higher than average. The Tandy 4016SX is a space saver, however, and the locking case is unique. And with Tandy's many retail outlets, locating service shouldn't be a problem for most users.

TATUNG TCS-8800

Behind its white-on-white high-tech exterior, the TCS-8800 is a workhorse that delivers good performance at a fair price. $3195 buys Tatung's version of our standard configuration, including Tatung's CM-1496 VGA monitor. This display is clear and easy on the eyes.

Other system components are more or less standards: a Western Digital MFM floppy/hard disk drive controller card, a Seagate hard disk drive, and a 16-bit Paradise VGA adapter. This configuration leaves two 8-bit and two 16-bit slots available in the full-size case. The vertically mounted expansion slots sit on a riser board that connects directly to the motherboard. You can install up to 8 MB of on-board RAM using 1-MB SIMMs.

The TCS-8800's application benchmark scores placed it in the top tier, just behind the Zeos and AT&T machines. On the low-level tests, the TCS-8800 posted strong CPU and FPU results.

continued

Advertisement

ULTRA-COMP ULTRA 386SX APPEAL

The Ultra-Comp Ultra 386SX Appeal earned slightly below-average scores on most of our benchmarks, but it's durable, backed by solid technical support, and one of the least expensive machines that we tested. One possible drawback is that the $1995 box carries only FCC Class-A certification, so it won't qualify for residential use.

The Ultra comes in a standard, full-size AT case. It has the Elite Group motherboard found in several mail-order machines, a standard Seagate hard disk drive, an Adaptec controller board, and a generic I/O board. The video system consists of two high-quality, name-brand components: a Genoa VGA card and a Sony CPD-1320 color VGA monitor.

Overall, the Ultra provides a good office computer at a fair price. Although the machine's performance in our benchmark tests was unimpressive, the Ultra's bargain basement price makes it attractive.

WANG PC350/16S

Wang's 386SX system is most comparable to Hewlett-Packard's; both are well-built, high-quality machines from first-tier manufacturers. However, the PC 350/16S also shares the Vectra's penchant for disappointing CPU performance at a premium price. The Wang PC 350/16S's list price of $5130 is only slightly less than that of the Hewlett-Packard machine.

The case cover slides easily off the PC 350/16S's chassis, and all the screw holes lined up properly during reassembly. To be sure, these are minor points, but the difference in quality between a system like this and an average clone is striking.

A highly integrated motherboard allows the PC 350/16S to fit in a small-footprint case. Wang uses Chips & Technologies' NEAT-SX chip set and builds an IDE disk drive interface and the I/O ports into the motherboard. Vertically mounted expansion slots provide average expandability for a full-size system—the test unit that we used in the Lab had five slots available.

Wang provides its customers with telephone support for software problems. However, if you have a hardware problem, that will require an on-site representative.

ZENITH Z-386SX

Zenith's 386SX system surprised us in several respects. Its adjustable nameplate rotates so that the machine appears upright whether you use it as a tower or on the desktop.

Getting into the Z-386SX is a snap. Two screws in the rear secure the lid, and you can easily undo them with your fingers. The I/O adapter cards mount horizontally into a riser board that carries the I/O slots and most of the circuitry for the floppy and hard disk drive controllers. The machine has five 16-bit slots, but the video adapter occupies one. The motherboard includes on-board serial and parallel ports.

The memory architecture includes a 16K-byte CPU cache daughtercard that plugs into the motherboard. Alas, the machine's CPU performance was abysmal. The system doesn't move memory contents around efficiently, and this hindrance also affected the application benchmarks. Only the CompuAdd 316S scored lower on the application index. But Zenith has a history of manufacturing dependable hardware with excellent software and attendant documentation, and this system is no exception.

ZEOS 386/SX

The Zeos 386/SX's good reputation, standout pricing, and excellent benchmark performance make it an obvious choice. It's a close second to the Micro Express system in price, it's near the top of the heap in performance, and the full-size case offers more room for expansion than the ME 386 SX/SL.

The Zeos 386/SX accommodates four 5¼-inch half-height drives and two 3½-inch drives—more room than in any of the other systems we reviewed. The system board accepts up to 4 MB of DIP memory. The 70-nanosecond DRAM chips installed on our machine didn't require memory interleaving to attain good performance, although interleaved operation is an option if you install slower RAM chips.

A few flaws tempered our enthusiasm for the machine. The Conner Peripherals CP3044 IDE drive and Seagate IDE interface card combination that we tested suffered from repeatable data errors during our benchmark tests. A few swaps later, we ended up with Zeos's second source for the part—a Quantum

continued

CHOOSING A MULTI-USER SYSTEM OR LOCAL AREA NETWORK

by Rod Roark

A common decision managers make when automating a business is whether to install a multiuser operating system or a LAN. Making the right choice involves evaluating the way the business operates, the daily tasks employees perform, and existing resources.

In general, multiuser systems are ideal for communication within intensely interactive workgroups, such as those found in specialized departments like accounting or sales. LANs were once the only way PC users could share information, and today are an ideal way to tie multiuser workgroups together.

Compared to LANs, multiuser systems are economical, provide faster disk access, and are easier to install, configure and maintain. They also work well when several people need to share the same high-cost peripherals, such as laser printers, check printers and plotters.

The daily demand users will put on the system is a critical factor to consider. CPU-intensive activities, such as CAD/CAM, work well in a distributed processing (LAN) environment, while disk-intensive activities, such as data entry, are well-suited to a shared processing (multiuser) system. Most businesses with more than a handful of employees are best served by a hybrid system of several multiuser workgroups tied together by a LAN.

The company's resources, including budget, current installed hardware and software, and technically-minded people, cannot be overlooked in determining the optimal system.

If the company has an existing base of PCs, but needs a way to share information, printers and other peripherals, a LAN is a good choice. If the company has more users than PCs, and needs a way to provide more processing ability inexpensively, a multiuser solution is optimal. Some multiuser operating system companies, such as The Software Link, provide options that incorporate existing XT- and PC-style computers into a multiuser system.

Because multiuser systems, particularly DOS-compatible ones, are easier to use and maintain than LANs, it is usually unnecessary for a company to hire a network administrator. Once a local consultant or dealer configures and installs the initial system, most companies are able to handle daily maintenance.

Consulting a local specialist or dealer with experience in multiuser systems and LANs is a good way to determine the best option.

Rod Roark is co-founder of The Software Link, a multiuser operating system and local area network software development company founded in 1983. Its core products, PC-MOS and LANLink 5X, have more than 100,000 users worldwide.

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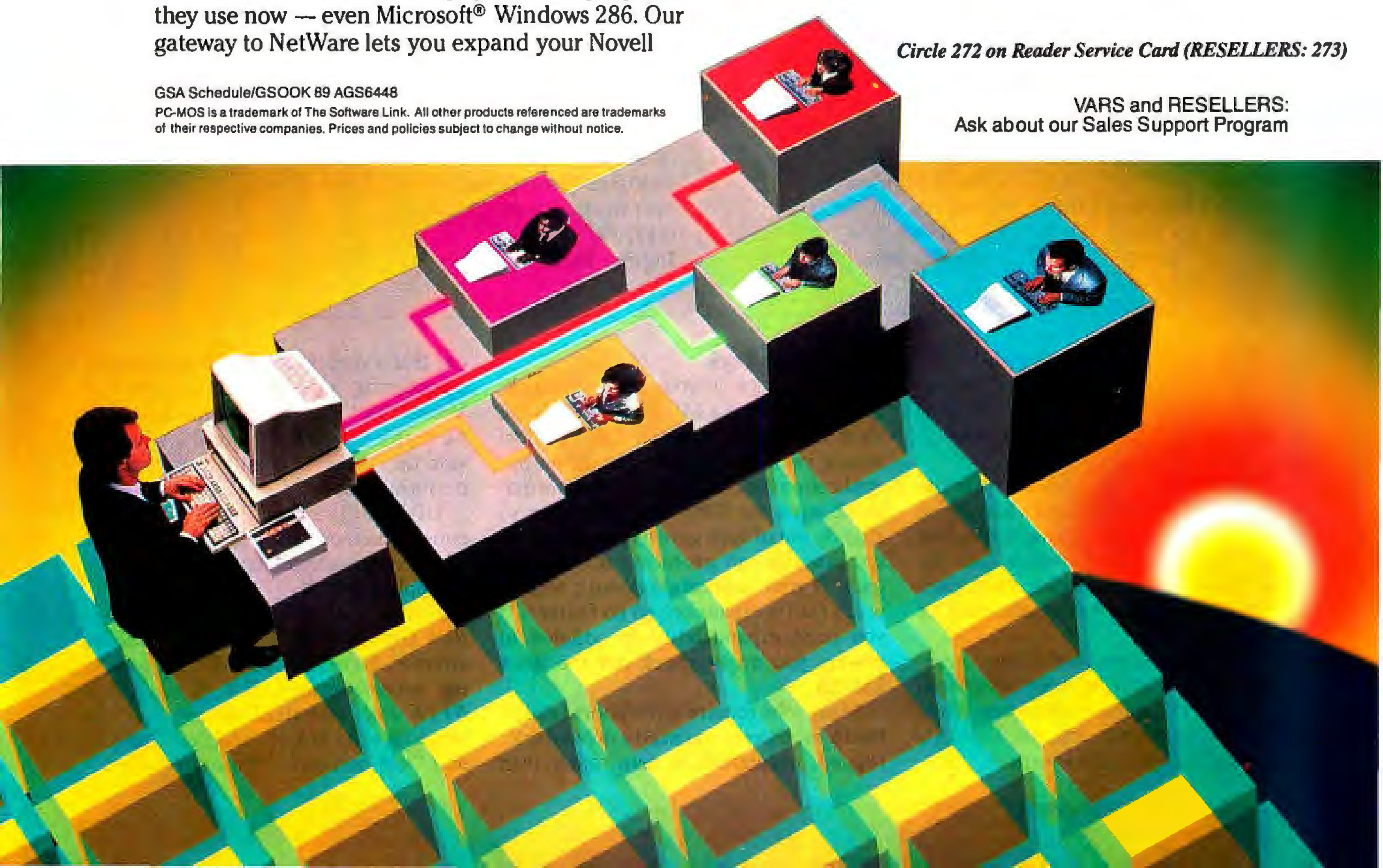

COMPANY INFORMATION

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(1100/SX)
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San Jose, CA 95131
(408) 922-0333
Inquiry 1075.

Acma
(386 SX)
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Fremont, CA 94539
(415) 623-1212
Inquiry 1076.

Arche Technologies, Inc.
(Rival SX)
48881 Kato Rd.
Fremont, CA 94539
(415) 623-8100
Inquiry 1077.

AT&T Computer Systems
(6386/SX)
100 Southgate Pkwy.
Morristown, NJ 07960
(800) 247-1212
(201) 898-8000
Inquiry 1078.

Club American Technologies, Inc.
(316/SX)
3401 West Warren Ave.
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(415) 683-6600
Inquiry 1079.

CompuAdd Corp.
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12303 Technology Blvd.
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Inquiry 1080.

Computer Peripherals, Inc.
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Newbury Park, CA 91320
(805) 499-5751
Inquiry 1081.

Computer Systems Research, Inc.
(386/SX-16)
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Secaucus, NJ 07094
(201) 617-7768
Inquiry 1082.

Dell Computer Corp.
(320LX, 316SX)
9505 Arboretum Blvd.
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(512) 338-4400
Inquiry 1083.

DTK Computer
(Peer\1660)
15711 East Valley Blvd.
City of Industry, CA 91744
(818) 333-7533
Inquiry 1084.

Epson America, Inc.
(Equity 386SX)
2780 Lomita Blvd.
Torrance, CA 90505
(213) 539-9140
Inquiry 1085.

Everex
(Step 386is)
48431 Milmont Dr.
Fremont, CA 94538
(415) 683-3734
Inquiry 1086.

Hewlett-Packard
(Vector QS/16S)
19091 Pruneridge Ave.
Cupertino, CA 95014
(800) 752-0900
Inquiry 1087.

Hyundai Electronics America
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166 Bay Pointe Pkwy.
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(408) 473-9200
Inquiry 1088.

Micro Express
(ME 386 SX/SL)
1801 Carnegie Ave.
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Inquiry 1089.

NEC Technologies, Inc.
(PowerMate SX Plus)
1414 Massachusetts Ave.
Boxborough, MA 01719
(508) 264-8000
Inquiry 1090.

Samsung
(SD700)
3655 North First St.
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Tandy Corp.
(4016SX)
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Inquiry 1092.

Tatung
(TCS-8800)
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Long Beach, CA 90810
(213) 979-7055
Inquiry 1093.

Ultra-Comp
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11988 Dorsett Rd.
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Inquiry 1094.

Wang Laboratories, Inc.
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(508) 459-5000
Inquiry 1095.

Zenith Data Systems
(Z-386SX)
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(800) 553-0331
Inquiry 1096.

Zeos International
(386/SX)
530 Fifth Ave. NW
St. Paul, MN 55112
(612) 633-4591
Inquiry 1097.

ProDrive and Data Technology DT-3767 interface card, which ran fine. Zeos replicated the problem and was working with Conner Peripherals as we went to press.

The 386/SX's large cover was extremely difficult to remove. Having to open up the case is a comparatively rare event for most system owners, but the Zeos case is ornery enough to make even infrequent case removal an occasion for dread.

In the larger scheme of things, problems like these may be worth overlooking. The drive errors were most likely unique to our system, and the 386/SX's price/performance ratio is superb.

Picks of the Pack

If performance is your only yardstick, the Micro Express ME 386 SX/SL is the clear choice. Its superior CPU performance vaulted it into first place on our application benchmark test. That the machine runs the CPU and FPU ever so slightly out of spec gave us pause, but we encountered no problems during our tests. If your application doesn't require much future expansion, go no further. If you need expandability in addition to power, you might check out the Zeos 386/SX.

Many jobs require a workhorse rather than a racehorse; you need a dependable, rugged, expandable system rather than one that's simply fast. If you want quality engineering and construction, the HP Vectra QS/16S is the best machine. But we prefer the AT&T 6386/SX, which rivals the Vectra's quality, surpasses its performance, and costs less.

Ultimately, though, you can add enough memory and disk space to most of the systems tested here to run any 32-bit application. ■

Rick Grehan is the BYTE Lab technical director. Steve Apiki is a BYTE Lab testing editor/engineer. Rob Mitchell is a BYTE Lab technical editor. You can reach them on BIX as "rick_g," "apiki," and "rob_mitchell," respectively.

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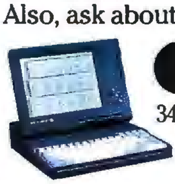

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SYSTEM

David Claiborne

REVIEW

Faster Gets Smaller

The Compaq Deskpro 386/25e does not compromise performance for a small footprint.

Compaq has built its empire by constructing small, transportable systems, and the Deskpro 386/25e demonstrates that the company still reserves its finest engineering for its compact models. At only 15⅘ inches wide by 14⅘ inches deep, this is Compaq's fastest small-footprint machine yet.

Compaq introduced its small desktop package with the Compaq 386s, one of the first 386SX machines (see "SX Appeal," November 1988 BYTE). The company upgraded the system board in 1989 to support a 20-MHz 386DX, resulting in the Deskpro 386/20e. After using both earlier machines on a regular basis, I was eager to see what benefits the new machine could provide. I found the expected performance increase, a few design improvements, and Compaq's continuing policy of charging a premium price for its reputation for quality and reliability.

Power-Packed

The Deskpro 386/25e packs all the latest computing enhancements into the standard e-series housing. Its most notable feature is a highly integrated system board. The board includes the Intel 25-MHz 386 processor, a socket for a 25-MHz 80387 or Weitek WTL3167 math coprocessor, 4 megabytes of 100-nanosecond system memory, and an Intel 82385 memory management unit with a 32K-byte 25-ns static RAM cache. Also on the board are an Intelligent Drive Electronics (IDE) controller interface that supports up to two hard disk drives; a 16-bit VGA video controller; and serial and parallel ports, a PS/2 mouse port, and a keyboard connector.

Despite the Deskpro 386/25e's small size, the compact system board provides plenty of room for expansion. You can expand the system memory to 16 MB using Compaq's proprietary 32-bit memory board. In addition, the unit has four 16-bit Industry Standard Architecture expansion slots, all of which are available in the base machine. The ISA bus runs at 8.33 MHz; this is slightly faster than the ISA-standard 8 MHz, but it didn't cause any compatibility problems during my testing.

Compaq markets the 386/25e in three configurations. The base configuration, the Model 1, has no hard disk drive and costs $6499. The Model 60 ($7699) and the Model 120 ($8499) add 60-MB and 120-MB hard disk drives, respectively. Both drives are fast (with 19-millisecond average access times) and feature IDE controllers that connect directly to the system board.

A 5¼-inch 1.2-MB floppy disk drive is standard with all units. Storage options include five IDE hard disk drives that range from 40 MB to 210 MB, and a 310-MB ESDI hard disk drive that requires a separate controller card. For backups, you can opt for a 60-, 120-, or 250-MB tape drive.

My Model 120 test machine included a 4-MB RAM upgrade board ($2599), a 25-MHz 80387 math chip ($1399), a 3½-inch 1.44-MB floppy disk drive ($275), a 150-/250-MB tape backup system ($1999), a color VGA monitor ($699), a 2400-bps modem ($399), and MS-DOS 4.01 ($150), for a grand total of $16,019.

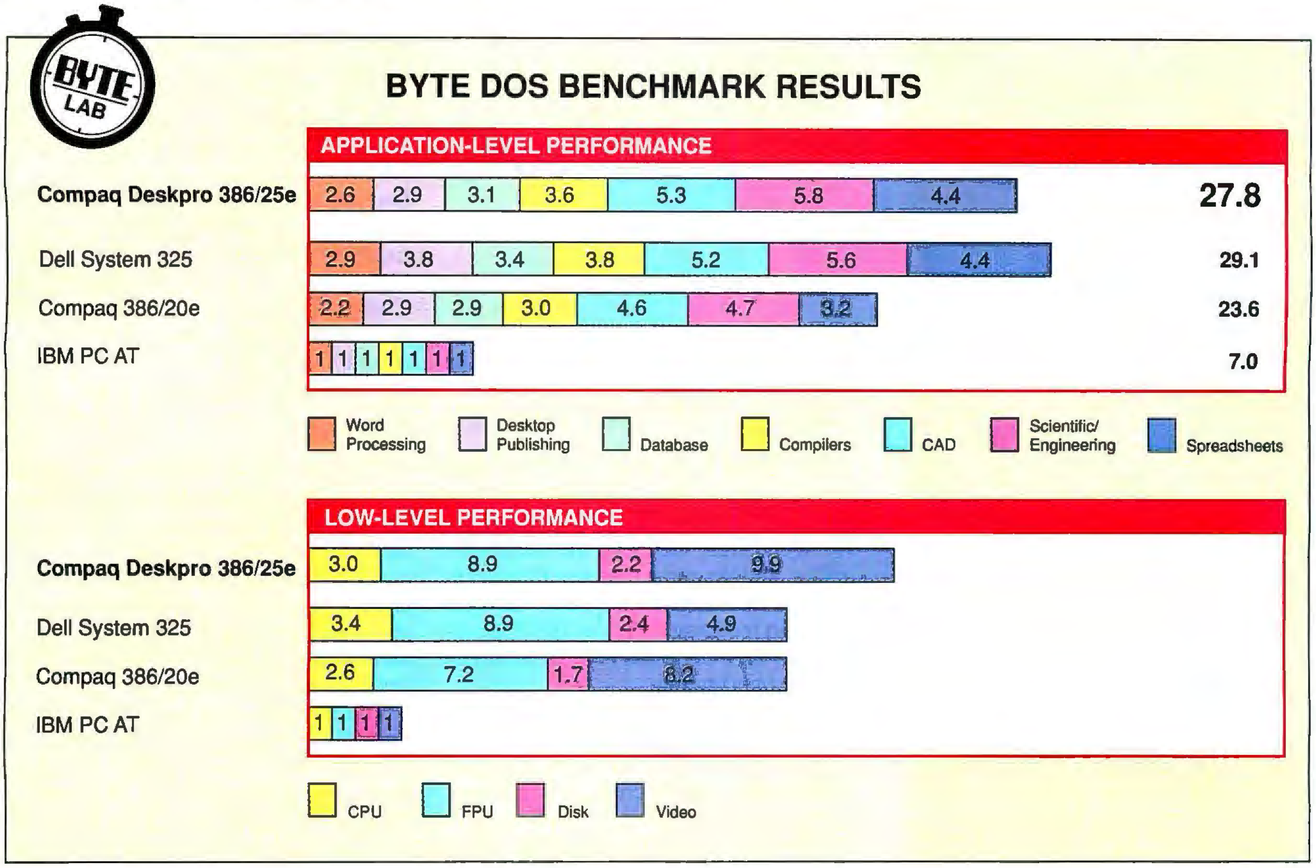
Good Looks

The Deskpro has a very clean appearance. The back panel has the five external ports (video, serial, parallel, keyboard, and mouse), a case keylock, an AC power connector, and four expansion slots. The keyboard is a standard Compaq unit that follows the IBM Enhanced 101-key layout.

To remove the case, you loosen three thumbscrews. Opening the case reveals Compaq's engineering and design expertise. The 140-watt power supply is a long, narrow box on the right side of the unit that runs from the on/off switch in the front to the AC connector in the back. The storage bay frame—a metal trough containing three disk drive bays—sits in the middle of the unit. An internal hard disk drive mounts sideways across the back of the trough. The four expansion slots and the Compaq memory board fill the vertical space in the left side of the case.

The system board lies under the expansion slots and the storage trough. The

continued



CONVENTIONAL BENCHMARKS

	LINPACK (single)	Dhrystones
Compaq 386/25e	0.210800	10193.90
Dell System 325	0.211900	10237.60
Compaq 386/20e	0.169700	8449.70
IBM PC AT	0.021050	2317.90

For more information on all the BYTE benchmarks, see "BYTE's New Benchmarks: New Looks, New Numbers" on page 158.

Indexes show relative performance; for each individual index, an 8-MHz IBM PC AT running MS-DOS 3.30 = 1. Comprehensive benchmark results for all tested machines are available on request.

The BYTE low-level benchmark suite identifies performance differences between machines at the hardware level; the application benchmarks evaluate real-world performance by running a standard test suite using commercially available applications. Application indexes include tests using the following programs: Word processing: WordPerfect 5.0; Desktop Publishing: Aldus PageMaker 3.0; Database: Borland Paradox 3.0 and Ashton-Tate dBASE IV; Compilers: Microsoft C 5.1 and Turbo Pascal 5.5; CAD: AutoCAD release 10 and Generic CADD level 3 1.1.5; Scientific/Engineering: Stata release 2, MathCAD 2.5, and PC-Matlab 3.5f; and Spreadsheets: Lotus 1-2-3 release 3.0 and Microsoft Excel 2.1.

The Dhrystone and LINPACK benchmarks are conventional measures of machine performance. Both tests depend on the compiler used in their development. Dhrystones most accurately reflect integer performance; the LINPACK test measures floating-point speed.

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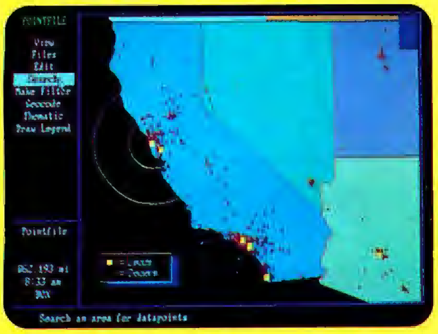

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Compaq Deskpro 386/25e Model 120

Company
Compaq Computer Corp.
20555 SH 249
Houston, TX 77070
(713) 370-0670

Components
Processor: 25-MHz Intel 386; 25-MHz Intel 80387 coprocessor
Memory: 8 MB of 100-ns DRAM soldered on 32-bit daughterboard, expandable to 16 MB; 32K bytes of 25-ns cache SRAM
Mass storage: 120-MB 19-ms Conner Peripherals IDE hard disk drive; Citizen 3½-inch 1.44-MB and Canon Electronics 5¼-inch 1.2-MB floppy disk drives
Display: 16-bit VGA controller on motherboard; 14-inch VGA color monitor
Keyboard: IBM Enhanced 101-key
I/O interfaces: 9-pin serial port; 25-pin parallel port; PS/2 mouse port; 9-pin video port; keyboard connector

Price
As reviewed: $16,019

Inquiry 854.

entire board is robotically assembled with surface-mount components; the only socketed items are the processors (386, 80387, and 82385) and the ROM BIOS chips.

The board is divided into functional areas by short metal fences to reduce RFI. The VGA controller components are in one area; the CPU, the cache controller, and the cache memory fit into another. Surprisingly, in spite of the care shown in reducing RFI, the 386/25e carries only an FCC Class A (i.e., commercial use only) rating.

The 4 MB of system memory resides on a daughterboard that plugs into two connectors on the motherboard. Compaq continues to use discrete DIP memory chips, and it has soldered all 36 chips to the daughterboard, so replacing defective RAM is strictly a repair-shop operation. Compaq also uses discrete soldered chips on its memory-expansion card and associated modules.

An Eye for Detail

The documentation for the Deskpro includes a system overview, a guide to setting up the Deskpro, and instructions on Compaq's user programs. The manuals provide clear explanations and illustrations, but they lack technical depth. (A set of technical reference manuals will set you back an additional $149.) Other amenities include diagnostics and utilities disks.

I tested the 386/25e with a variety of everyday applications, including Microsoft Word 5.0, Lotus 1-2-3 release 2.2, Datastorm Technologies' Procomm 2.4, Borland's Paradox 386 2.0, and an assortment of utility programs (e.g., Fastback Plus, 386Max, and System Sleuth). I encountered no problems with any of them.

I also tested the system with a Microsoft PS/2 mouse, a Hayes 1200B modem, an Intel AboveBoard Plus 8 memory board, and a Dataproducts LZR 650 laser printer. All these devices worked fine.

As for performance, the Deskpro 386/25e is on a par with other 25-MHz 386 machines equipped with a CPU cache. As expected, the machine is about 25 percent faster than the Deskpro 386/20e. It performed about the same as a comparably equipped Dell System 325 in most of the benchmark tests.

Buying a Cadillac

With the Deskpro 386/25e, Compaq continues to pursue a course of providing a high-quality machine at a high price. Compaq computers have replaced IBM's at the top of the price heap, and with such a hefty premium over competing machines, many companies will find it hard to justify putting a Compaq on every desk.

Compaq provides customer support only through its dealers, but it makes sure that its representatives are competent and up to date by providing maintenance classes, thorough documentation, and overnight parts shipping. The company recently began providing maintenance manuals and quarterly updates to dealers on CD-ROMs.

The Deskpro 386/25e is a well-engineered, compact machine that sacrifices no performance for its size. On the other hand, the unit spares the end user no costs in obtaining that performance. It's without question the most expensive computer in its class. BYTE has tested other machines that provide excellent performance and compatibility and cost thousands of dollars less. But those who find the Compaq moniker worth the premium certainly won't go wrong with the 386/25e. ■

David Claiborne is a computer consultant and freelance writer based in Highland, Maryland. You can reach him on BIX c/o "editors."

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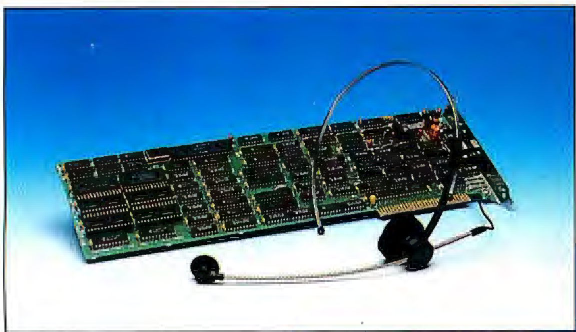
Circle 17 on Reader Service Card (RESELLERS: 18)

Don Crabb

REVIEW

Voice Recognition for a Song



◀ *Command Corp.'s Bug enables CAD users to replace complicated keyboard commands with spoken macros.*

Voice Master lets you use speech as an interface to a variety of menu-driven applications. ▶

Graphical user interfaces are becoming the PC interfaces of choice because they help make complicated software easier to use. But what about voice input? If picture-based systems are easy to use, shouldn't speech-recognition interfaces be even more efficient? Covox and Command Corp. are among a growing number of companies answering "yes" to that question. These two firms have recently introduced some of the first under-$1000 voice-recognition products to hit the market.

Covox's Voice Master Key System II ($219.95) consists of software and an external box that connects to your PC through a parallel printer port for use with general-purpose software applications. Command Corp.'s Bug (starting at $799) includes an 8-/16-bit, full-size XT-/AT-compatible card and software for CAD users. Both devices have microphone headsets that let you speak commands to the voice-recognition circuitry.

I tested both systems using DOS 3.3 and 4.1, plus AutoCAD, Turbo Pascal, Microsoft Word, Lotus 1-2-3, Symantec Q&A and GrandView, Traveling Software's ViewLink, Lotus Magellan, FoxBase, and AutoDesk Animator. Both products worked with all the software and command structures. As far as the applications were concerned, the commands issued by both systems came through a standard keyboard or mouse.

However, the training time for both the Bug and Voice Master was tedious. And in the end, I found that productivity does not increase all that much with voice-controllable commands, especially since I had already invested considerable time learning a program's command structure or menu layout. Adding more command layers to that complexity was not a productivity win. AutoCAD was a notable exception, however, as were ViewLink, Word, and Magellan.

You'll waste any benefits of these systems if you create templates for commands that you can type easily or select from a menu. But if you pick a more complicated and often repeated set of commands (like regenerating a drawing in a CAD program), place it in a macro, and reference it with a voice template, these systems can save you some time.

Bugging AutoCAD

Compared to the Voice Master, the Bug is a high-performance system designed for one purpose—boosting the productivity of CAD packages, especially AutoCAD. The Bug does this by allowing you to control repetitive design commands with your voice.

The Bug's card includes a 25-MHz, 6-million-instruction-per-second microprocessor and on-board RAM. The basic Bug, which recognizes 100 different commands, costs $799; a more sophisticated version that remembers 650 commands sells for $1195. A noise-canceling microphone is available as a $109 option for the base system; it comes standard with the larger system.

The system comes with starter voice lexicons for several popular CAD packages, including AutoCAD, and software that lets you define your own lexicon (called the Dynamic Lexicon) that will work with other DOS applications. The software can process up to 100 different commands, all of which work from the built-in RAM. You can expand the RAM on the Bug so that it can remember 200 to 350 commands; if you let the system access your hard disk, it can call on even more voice commands. The manual does not specify a command limit when the disk is used for command storage.

You control the Bug with a headset microphone that plugs into the board. You train the Bug to recognize the word "microphone" by repeating the word three times. This command then acts as a software on/off switch.

Although I ran non-CAD applications, the Bug's raison d'être is CAD work, so that's how I tested it. I ran AutoCAD 386 on my Everex Step 386/25, with 8 megabytes of RAM, a 300-MB hard disk drive, and a VGA monitor.

Each Bug lexicon can have up to 100 commands in active recognition mode (they are downloaded to the Bug when you start up), with any 54 of those commands active at a given moment. You can have as many lexicons stored on disk as you want, so you can create custom lexicons for each application or for each part of a complicated application.

Each voice command can represent up to 64 separate keystrokes, plus information about which other command sets should be enabled or disabled when the command is recognized. This way, you can build a hierarchy of voice-command lexicons that are dependent on each other. Each command name can be a single word or several words.

Calling Voice Master

Voice Master is a less sophisticated device that primarily lets you explore voice recognition as a general interface adjunct to command-driven and menu-driven screen systems. Its simpler circuitry is more prone to making voice-matching mistakes than the Bug's is, but it does include more general-purpose sound and voice manipulation features.

Voice Master's desktop utility software, Voice Master Key (VMKey) runs either as a TSR program occupying 64K bytes of RAM or as an EMS version that requires 6K bytes of RAM. I tested the TSR, which supports the Voice Master external digitizer unit. Besides VMKey,

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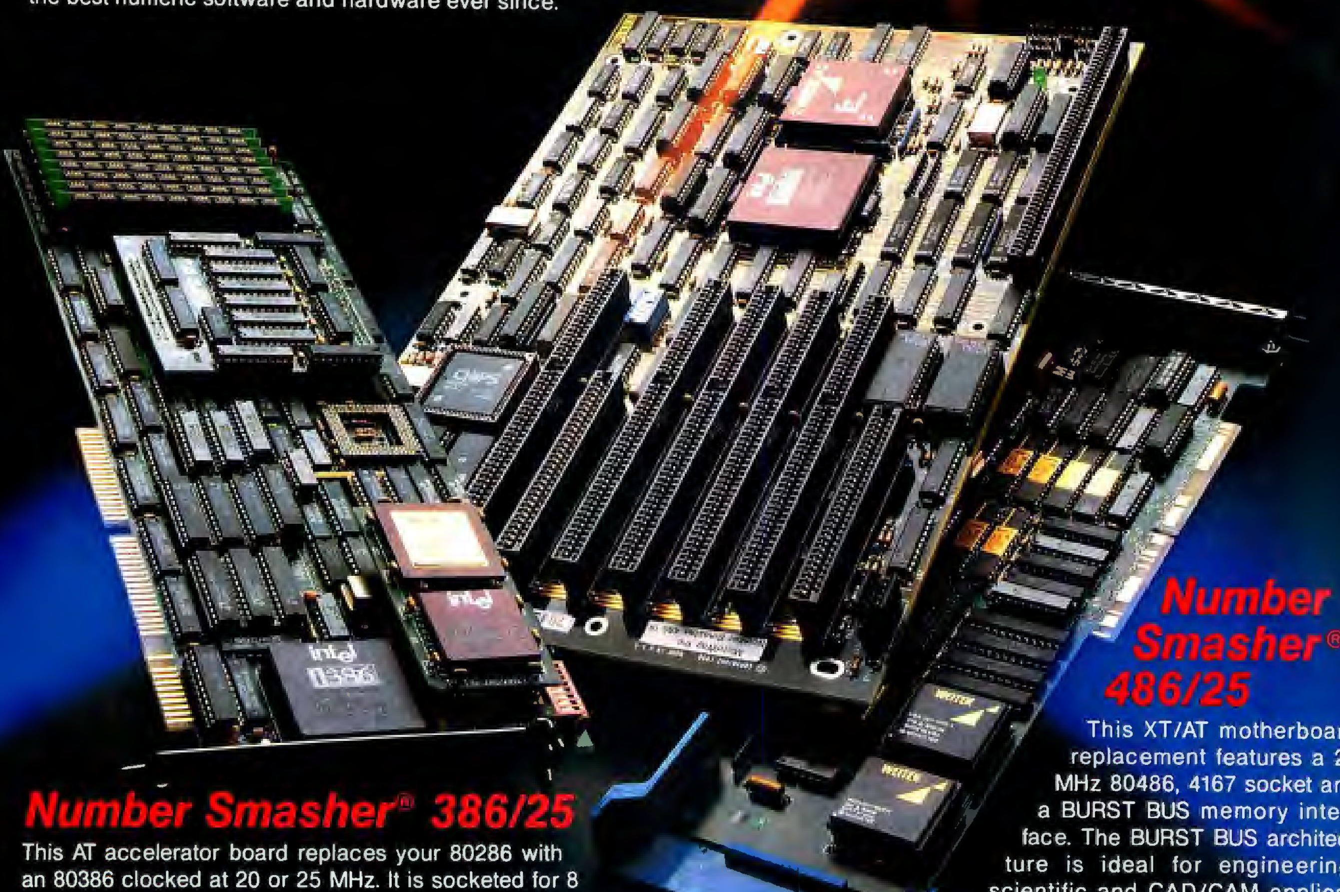

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Megawhetstones	5.9	13.0
Megawhetscales	4.1	9.9

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675 Conger St.
Eugene, OR 97402
(503) 342-1271

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Software Needed
MS-DOS 2.11 or higher

Price
As tested: $219.95

Inquiry 852.

Bug Voice Command System

Company
Command Corp., Inc.
3675 Crestwood Pkwy.
Duluth, GA 30136
(404) 925-7950

Hardware Needed
IBM PC, XT, AT, or compatible; a hard disk drive is recommended

Software Needed
MS-DOS 2.0 or higher

Price
As tested: $799

Inquiry 851.

the program also includes a graphics oscilloscope, a configuration program to pack 8-bit pulse-code-modulated files into 3-bit compressed format, a voice-and-sound recording program with adjustable compression and digitized sampling rates, and a voice-and-sound playback program, as well as other drivers that support different encoded speech systems.

I tested the Voice Master on an IBM AT with 4 MB of RAM, a 30-MB hard disk drive, and a VGA monitor. I also tested the unit using the Everex system.

In both cases I connected the 7- by 3-inch box to the computer's parallel port using the supplied cable. (The Voice Master includes a pass-through printer port to replace this port, should you need to reconnect a printer.) The documentation does not detail the box's circuitry, except to mention that it contains 8-bit A/D converters with adjustable sampling rates (the maximum rate is 20 MHz). The Voice Master comes with an external AC adapter, which you connect to the power port on the rear panel.

VMKey lets you train the Voice Master to recognize up to 64 different words, each of which can be linked to simple commands or complicated macros, depending on your needs. VMKey also provides voice playback, so you can annotate your work with recorded messages, making it an excellent on-line help aid.

Voice-Recognition Training

Both Voice Master and the Bug required similar training steps to "learn" my voice. Each time I fired up Voice Master, it automatically calibrated itself by measuring background noise. I spoke the

continued

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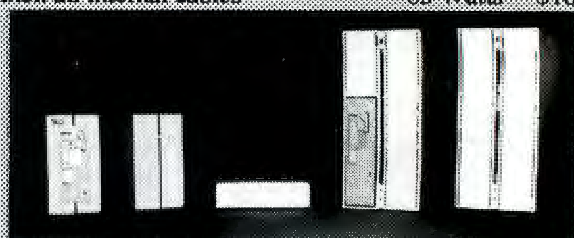

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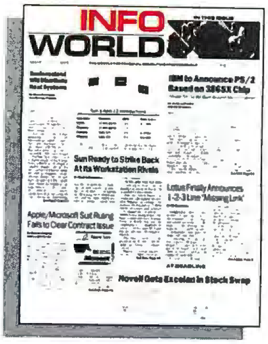

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new command three times, and the Voice Master built a template—essentially a voice print—of that word. The system stored each command template on disk. When I exited the training mode and used these commands, VMKey compared my words to its stored templates and executed the macro assigned to that template. But if you pick similar words, like "president" and "precedent," be prepared for recognition problems.

Voice Master also had trouble in noisy situations, especially when I was working in a room with an oscillating fan or background music. During my testing period, I developed a head cold, which also caused the Voice Master some problems in recognizing the voice templates I had created in my normal voice.

The Bug's Dynamic Lexicon made it easier to train than the Voice Master. And the command structure and macros that I created with the Bug were far more sophisticated than the ones I could create with the Voice Master. The Bug suffered far fewer voice-matching problems.

In either case, these voice-training procedures could cause serious problems in offices where voices carry across partitions. Your officemates might not appreciate hearing you repeat "Paste" or "Cut" or "Redraw" over and over. You may also find that the general office din confuses your system's voice-recognition capability. However, in my private office, with the door shut, I had no such problems with either device.

A Final Word

The Voice Master is an intriguing device for exploring voice recognition and voice playback, but don't expect a big productivity gain. Also, keep in mind that it's strictly a software-driven A/D converter and does not contain its own microprocessor. This is a serious limitation, especially for CAD, where you can't afford to waste processor time and memory on voice-template matching.

The Bug lived up to its promise of higher performance. I trained and executed voice commands faster on my Everex Step 386/25 with the Bug than with the Voice Master. In addition, the Bug was much better suited for controlling a complicated application like AutoCAD, especially with its sample lexicons. For voice recognition in professional applications like CAD, I'd choose the Bug over the Voice Master. The Bug's $799 price isn't cheap, but it's not a king's ransom in CAD environments.

Still, neither of these products ushers in the time when voice recognition will make sense for most PC users. At best, they can enhance productivity in specific chores. They offer only command recognition; they can't be used for those most tedious of computer chores, data input and verification. Affordable voice-recognition and synthesis systems for data input and verification exist mostly in university and corporate research labs, while the search for better natural-language-processing algorithms continues.

The fanciful voice technology in Arthur C. Clarke's *2001: A Space Odyssey* ("Open the pod bay door, HAL." "I can't do that, Dave. . . .") is not impossible; it's just not commercially viable today. Voice Master and the Bug are definitely not HALs. Then again, they don't cost billions of dollars, either. ■

Don Crabb is the director of laboratories and a senior lecturer for the University of Chicago computer science department. He is also a contributing editor for BYTE. He can be reached on BIX as "decrabb."

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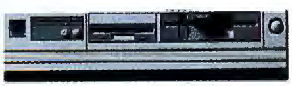

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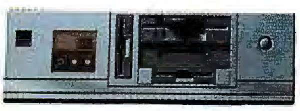

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For benchmark scores on hard drives, see "Pure Power" pages
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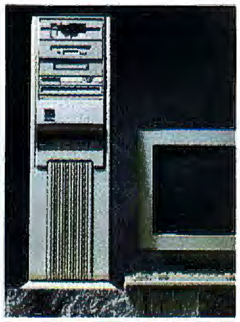

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SVGA/Color*	$970	$1070	$1250	$1390	$1840
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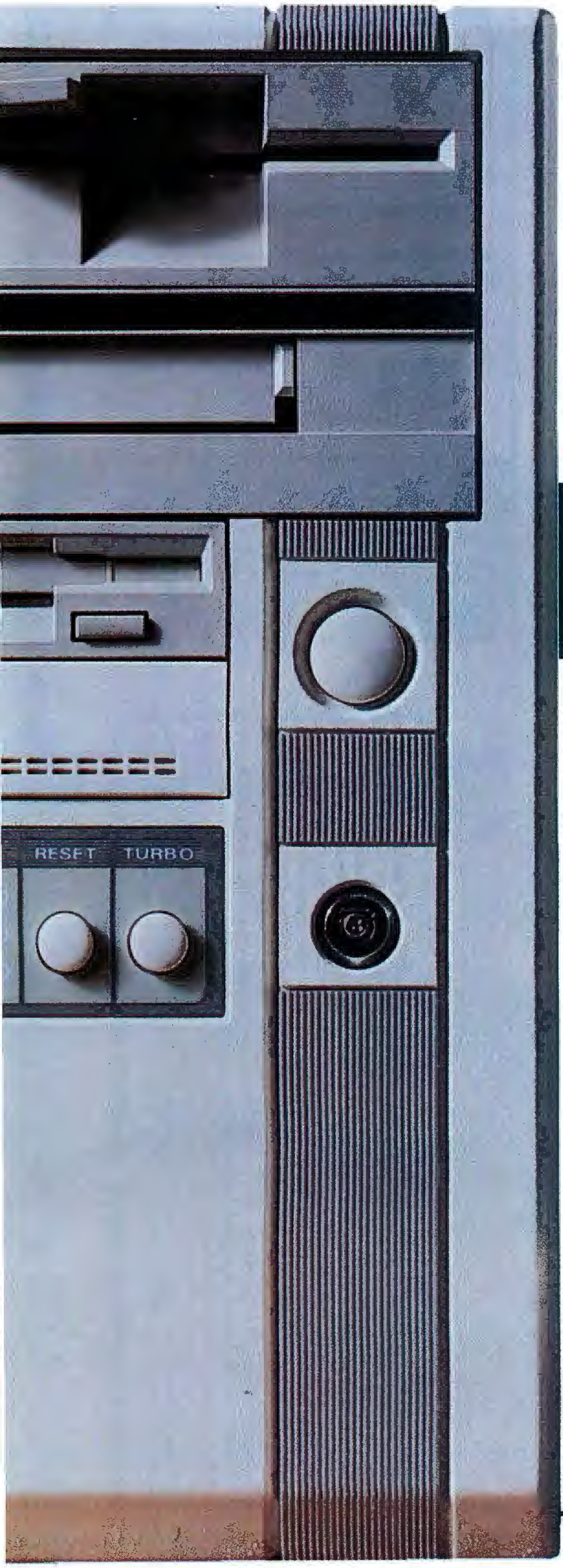

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VGA-Mono	$730	$910	$1050	$1500	$2050	$2840
VGA-Color	$960	$1140	$1280	$1730	$2280	$3070
SVGA/Color*	$1070	$1250	$1390	$1840	$2390	$3180
Portable VGA	$2670	NA	$2990	$3440	NA	NA

For benchmark scores on hard drives, see "Pure Power" page
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VGA-Color	$1140	$1280	$1730	$2280	$3070
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For benchmark scores on hard drives, see opposite page.
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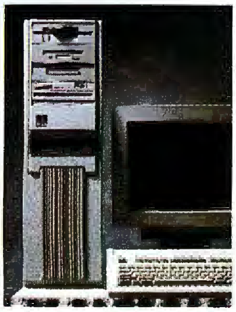

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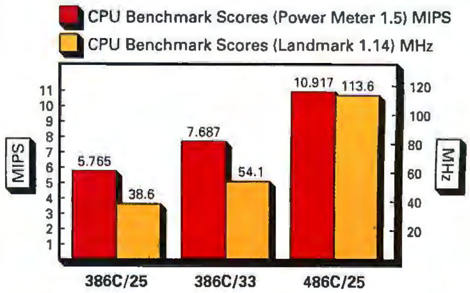
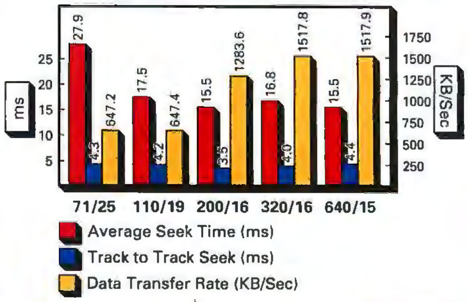
Mono	$550	$730	$870	$1320	$1870	$2660
VGA-Mono	$730	$910	$1050	$1500	$2050	$2840
VGA-Color	$960	$1140	$1280	$1730	$2280	$3070
SVGA/Color*	$1070	$1250	$1390	$1840	$2390	$3180
Portable VGA	$2670	NA	$2990	$3440	NA	NA

* SVGA 1024 x 768 interlaced



Disk Drive Benchmark Scores (Core test 2.8)



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REVIEW

A Paradox for LANs and C

Every new project that a programmer undertakes involves a crucial decision: What tools do you use? It would simplify things greatly if one language or application environment was suitable for every need, but that has never been true. The latest generation of PC database managers has included advanced programming languages that are bound tightly to the operations that the DBMS can perform, but even the best of these is not suited for compute-intensive tasks. C, on the other hand, is not as task-specific as DBMS languages, and code produced with it is seldom as easy to maintain.

Luckily, it's not necessary for programmers to forsake the benefits of one language in favor of the other; the two can be combined. One such blending of C speed and DBMS functionality is embodied in Borland's Paradox Engine.

The Paradox Engine is a set of C libraries that provide access to databases created with Borland's Paradox database manager. The engine operates with either Turbo C or Microsoft C and produces large-model, stand-alone DOS executable programs.

Roughing It

To understand the Paradox Engine, it is useful to compare the Engine's functions to the Paradox Application Language and the Paradox workspace. If you are familiar with Paradox, you already know that it follows the relational model, placing the results of operations, such as queries and deletions, in tables. Additionally, Paradox associates several objects with each table (e.g., forms and reports). PAL gives programmers easy access to these objects. To build table editing into a PAL program, for instance, you simply attach a predesigned form layout to the table. Paradox takes care of details such as cursor movement and updating calculated fields.

The Engine, on the other hand, uses a low-level, programming-intensive approach. Its functions are restricted to table operations—you cannot use or modify Paradox forms, reports, or queries from a C program. The Engine will maintain associations between a table and its object members during table operations such as copy and rename; except for index functions, this is the limit of object-oriented control.

If you want to design forms or reports that work around Paradox's limitations, you must design them from the ground up. Everything Paradox did for you, you must now do by hand. This overhead is substantial. For example, to read a field from within Paradox, you simply open the table (`View`), move to the record, and read the field. The PAL program might look something like this:

```
View "Test"
Locate "123"
ReadVal = [Read Me]
```

The Engine requires many more steps: open the table, establish a record buffer, place a value in the buffer, move to the matching record, read the record into the buffer, locate the field, and, finally, transfer the field value. The Paradox Engine code for the above operation would translate roughly to this:

```
TABLEHANDLE thTest;
RECORDHANDLE rhTest;
FIELDHANDLE fhTest;
short ReadVal;

/* View Test */
PXTblOpen ("Test",&thTest,0,0);
PXRecBufOpen (thTest, &rhTest);

/* Locate "123" */
PXFldHandle
  (thTest,"Key",&fhTest);
PXPutAlpha (rhTest,fhTest,"123");
PXSrchFld (thTest,rhTest,
  fhTest,SEARCHFIRST);

/* ReadVal = [Read Me] */
PXRecGet (thTest,rhTest);
PXFldHandle (thTest,"Read
  Me",&fhTest);
PXGetShort
  (rhTest,fhTest,&ReadVal);
```

Reading About It

The Engine functions are well named, making them easy to learn and remember. I found that after a few hours of programming, I seldom referred to the manual. But when I did, I discovered that it was well organized for reference work. The 74 functions are listed alphabetically in 11 groups at the head of the reference section, with individual descriptions following. The names begin with a general description, so functions tend to be grouped alphabetically by level (e.g., `PXTblCopy`, `PXTblCreate`).

The introductory chapters are clearly written and explain concepts at a fairly basic level. And you will find several easy-to-read programming examples, all of which are also included on disk. Even beginning C programmers should be able to use the Engine effectively.

Revving It Up

I tested the Engine on a PS/2 Model 80-111 with 4 megabytes of RAM and a Token Ring network adapter. The Model 80 was configured as a redirector using the IBM PC LAN Program 1.3. The local drives were cached using the IBM-Cache with 768K bytes. I configured the system for 1.5 MB of emulated EMS memory and 72K bytes of extended RAM. Paradox 3.0, which I used for comparative benchmarks, uses EMS, but the Paradox Engine does not. The network server I used was an IBM AT with an Inboard 386 and 6.5 MB of memory. I ran the performance tests with the IBM PC LAN Program 1.3 (3 MB of disk cache) and the IBM OS/2 Extended Edition Server 1.0 (128K bytes of disk cache).

To get a feel for the Engine's features, I designed a custom report for a multi-table invoicing program. The report used five tables: four with 1-to-1 relations and one with 1-to-many. I used single record locks for the 1-to-1 relations and a full table lock on the multirecord table that contained "items ordered."

In addition to the typical tasks of searching for matching keys and reading records, the program modified a status field. Unfortunately, the Engine does not enforce Paradox-defined validity checks. `PXRecAppend` should at least return an error code, if not invalidate the operation entirely. Some of the more

continued

Paradox Engine 1.0

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important checks are performed, however. For example, `PXRecAppend` will fail if a duplicate key is presented. You can use `PXRecUpdate` to override an existing key.

Paradox on LANs and C

Unlike Paradox, the Engine does not automatically apply locks when you are using a network. So, network programming requires additional overhead.

The Engine also requires initialization and finalization. On networks, the initialization call establishes the type of network, user name (which defaults to the log-on name, if none is provided), and path to the PARADOX.NET file. Unfortunately, the Engine cannot read this information from the Paradox network configuration files if Paradox is installed on the machine. So, you must either hard-code network information, prompt the user, or write your own configuration program and files.

The network locks worked properly but seemed a bit unintuitive. For example, to lock a single record for modification, you must issue both a prevent-write lock and a record lock. Also note that since the Engine cannot use forms, it will be locked out of tables used by another machine in multitable coedit mode.

On the positive side, the Engine supports a useful feature not found in Paradox. You can open a table using any secondary index, and the table's rows can be extracted in index order. In fact, you can open the same table with several secondary indexes, each presented in a different order. For example, you can view invoices in invoice-number order while another user (or even a different routine in your own program) views the invoices in client-number order.

The Eight-Cylinder Database Engine

The Engine routines give you the tools to build custom features not included in Paradox. Not only can you design special reports and entry forms, but you can also add device control routines for data entry or export via bar code readers, modem, or other specialized equipment.

In addition to these gains, there is one that perhaps overrides all the others: performance. I wrote four short amortization programs to test the Engine's performance: two in PAL and two in C. One program from each set uses edit mode (full table lock), and the other uses coedit mode (single record lock). The programs start with a 361-record table. The first record holds the loan date and an $85,000 balance. The remaining records include the payment dates and amounts based on an annual interest rate of 10 percent.

The test programs fill in the amortization schedule with the amount of principal and interest paid and the remaining balance. This is an interesting test for a database, because the calculations for each record depend on the results from the previous record—a normal Paradox query cannot make the calculations.

I ran trials on the Model 80's local drive and two network configurations. See the table for the results. The Engine can run considerably faster than an equivalent PAL program, but note the slower Engine times for network edit mode. When Paradox places a full lock on a table, it buffers changes in memory and the local drive until edit mode ends. However, the Engine will write each

continued

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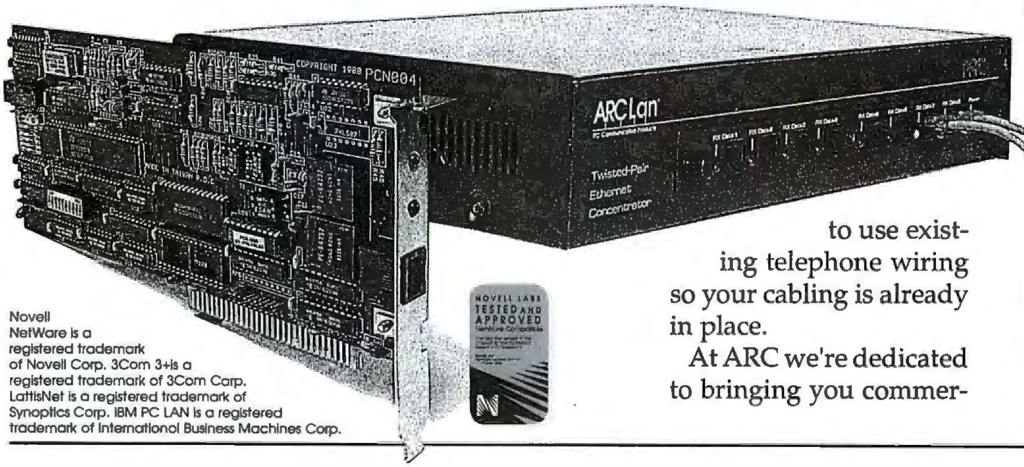

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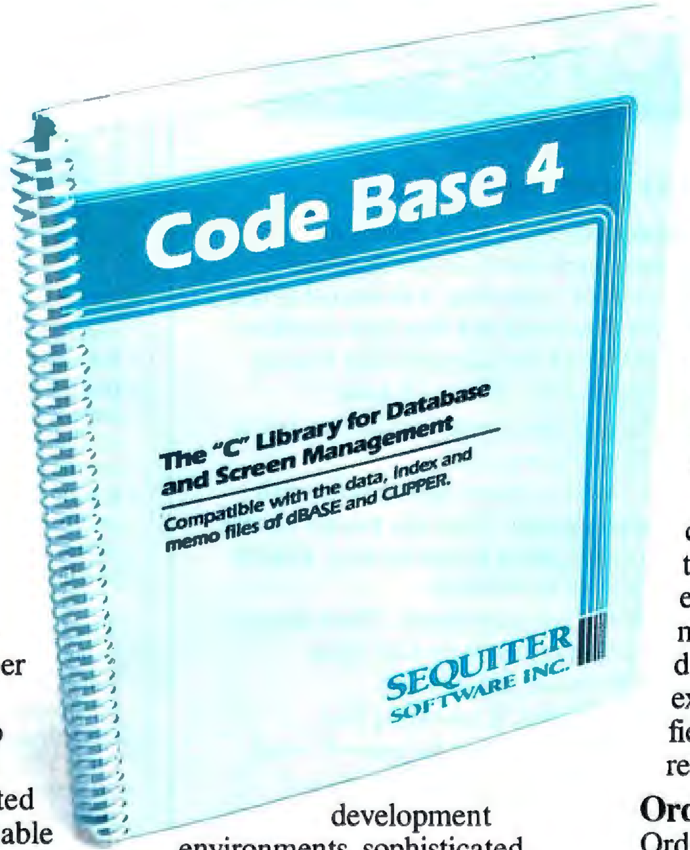

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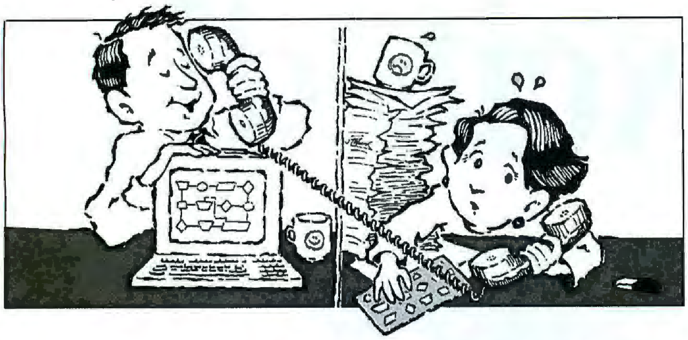

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SPEEDY ENGINE

The Paradox Engine runs considerably faster than an equivalent PAL program, but note the slower Engine times for network edit mode. The times here are from running a test program that prepares a one-year amortization using data from a Paradox database (times are in minutes:seconds).

	PAL	Engine
Local drive		
Record (edit) lock	0:45.6	0:09.1
Table (coedit) lock	0:38.8	0:11.5
PC LAN network		
Record (edit) lock	1:08.2	2:06.3
Table (coedit) lock	4:48.5	3:06.4
OS/2 Extended Edition server		
Record (edit) lock	1:12.9	1:27.3
Table (coedit) lock	4:19.6	2:16.4

record to the network as it is modified—the increased load on the network impairs performance. Of course, I could have written my own buffering routines at the expense of more programming overhead and complexity, but it serves as a good illustration of an important basic premise: Even with all the benefits provided by C, some operations are best handled by Paradox.

The Checkered Flag

If you plan to use the Paradox Engine, you should learn Paradox first. Although the manual has a chapter for C programmers who are not familiar with Paradox, I don't think that there is enough detail included to use the Engine as a standalone development library—especially if the library will be used for network development.

If you work extensively with Paradox, and especially if you have a basic knowledge of C, the Paradox Engine would be an excellent addition to your library. Although the Engine does not provide much raw power alone, if you can write the processing routines, the Engine gives you the vital link to Paradox tables. ■

Bradley Dyck Kliewer is the author of Guide to Paradox 386 *(McGraw-Hill, 1989) and principal of DK Micro Consultants, a microcomputer consulting business in Bloomington, Indiana. You can reach him on BIX as "bkliewer."*

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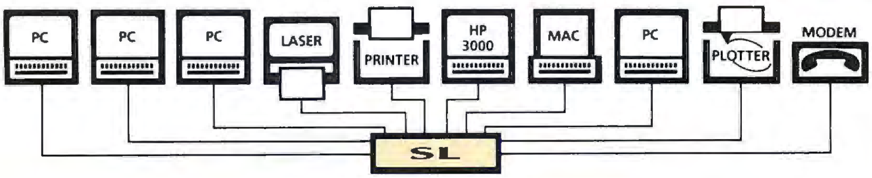

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Circle 181 on Reader Service Card

Tom Yager

REVIEW

DOS on a Pedestal

Theo+DOS supports multiple DOS and Theos sessions on the PC console and inexpensive serial terminals.

If you want a multiuser system, you should start with a multiuser operating system. Some multitasking enhancements to DOS might let you run several DOS programs at once, but they won't give you what a real multiuser operating system can—E-mail, fast file systems, advanced command interpreters, and scripting languages. For these and many other services, you need to invest in more than just a DOS multitasker.

An interesting case in point is a product from Theos Software called Theo+DOS. On its own, it is what you'd expect a DOS multitasker to be these days: It runs multiple DOS sessions, either on the PC console or on serial terminals. Theo+DOS's real strength is its base—the Theos 386 operating system.

Theos 386 is a protected-mode, multiuser operating system that has operated in various forms on everything from 64K-byte Z80-based systems to fully loaded 386 and 486 PCs. The base operating system occupies only two high-density floppy disks, and Theos 386 supports multiple native users on a 386 PC with only 1 megabyte of memory.

Installing Theo+DOS is handled with a Theos installation utility. During the installation process, it prompts you to insert a DOS boot floppy disk. You can choose your favorite flavor of DOS, as long as it is version 3.1 or higher. I tested Theo+DOS on a Dell 325 with Dell's version of MS-DOS 3.3.

Theos grants DOS access to a user by copying selected DOS files (e.g., COMMAND.COM, AUTOEXEC.BAT, and CONFIG.SYS) to a DOS subdirectory under the user's home directory. By default, this Theos directory appears as DOS drive C when you start Theo+DOS. This, along with a number of other Theo+DOS attributes, is entirely configurable.

Go Configure

Under native DOS, a user typically has access to everything connected to his or her PC, because these devices do not have to be shared with anybody. Under Theo+DOS, a device must be attached to a user's Theos session. In addition, each device that a user wishes to access from Theo+DOS must be listed in a Theos file called *user_name*.DOSCFG. Assignments in this file map DOS lettered drives to Theos subdirectories, attach printers, determine memory allocation, and make room for special devices accessible only to DOS.

Most DOS drives under Theo+DOS are simulated. Legal DOS file operations are transparently converted to equivalent Theos operations, reading and writing directly to the Theos file system. DOS drive letters, all the way up to drive Z, can be assigned through the DOSCFG file to any Theos subdirectory to which the user has access. Since DOS file operations go through the Theos file system, Theos retains native access permissions.

You can also make a genuine DOS partition, if one exists in addition to the Theos partition, available to Theo+DOS users through the DOSCFG file. While all users can have read access to a DOS partition, only the first user that attaches it can write to it. This is a limitation of the DOS file system structure, and similar restrictions are imposed under other DOS multitaskers, such as Locus Merge 386 under Unix.

Building a Memory Map

Another function of the DOSCFG file is to determine how access to memory will be granted. Rather than access memory directly, the virtual 8086s work inside regions mapped to them by the 386. Theo+DOS places much of this process in the hands of the user.

If Theo+DOS is running on an EGA or VGA console, the ROM on the display adapter must be mapped into the virtual 8086's region. DOS programs will run on the console without this, but they will be unable to change video modes through BIOS calls. Other memory-mapped devices, such as network adapters, can be mapped into Theo+DOS's address space with other DOSCFG directives.

Theo+DOS's greatest achievement may be MEMPLUS, a scheme that allows certain DOS programs to be loaded into memory above the 640K-byte boundary. With it, a DOS session can be started (i.e., COMMAND.COM and other TSR programs loaded into the MEMPLUS area), and a full 640K bytes can still be available to applications. This MEMPLUS area can be as large as 312K bytes. MEMPLUS isn't without its limitations, however. The first 64K bytes is taken from the area normally assigned to EGA graphics RAM.

When the MEMPLUS area is enabled, Theo+DOS restricts that session to running text-mode applications. This isn't a problem at all for terminal users, and if a console user wants graphics, he or she can start an extra Theo+DOS session that forgoes MEMPLUS in favor of graphics. A simple hot-key sequence switches between sessions at the console.

When MEMPLUS is not enough, Theo+DOS also provides an EMS emulator, to which up to 8 MB can be assigned. Because EMS is emulated, each user can allocate only as much as he or she needs.

The memory region, I/O port range, interrupt vector, and DMA channel of special DOS devices, such as tape drives and network controllers, can all be added to the DOSCFG file. This won't always work; some device drivers expect to be able to directly manipulate other PC devices, such as timers, and Theo+DOS restricts this. To do otherwise would play havoc with the underlying Theos. Still, the Theo+DOS manual claims compatibility with tape drives, Bernoulli Box

continued

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Putting Theo+DOS to Work

Testing Theo+DOS was easy. Virtually every well-behaved PC application that I ran through the program worked as expected. The list of software that I tested includes Microsoft Works, WordPerfect 5.1, Lotus 1-2-3 release 2.2, Spinnaker's Eight-In-One, Borland's Turbo C 2.0, and the MKS Toolkit. With MEMPLUS disabled and with the VGA BIOS mapped into Theo+DOS's region, the graphics programs shared the console with text-only applications. Microsoft Works, which must be told the type of display adapter being used, came up in unpleasant colors without the VGA BIOS. It also wouldn't display properly on the Kimtron KT-70/PC serial terminal I used. Lotus 1-2-3 release 2.2 exhibited the same symptoms, but both were repaired by configuring special monochrome-only versions. Auto-sense programs, such as Turbo C, came up in color on the console and switched to monochrome for the Kimtron.

For comparison, I ran identical test programs under both Theo+DOS and Locus Merge 386. In most cases, Theo+DOS's limitations matched those of Merge. For instance, I was not able to access a Western Digital WD8003E card from either Theo+DOS or Merge. The device driver (from FTP Software's PC/TCP package) reported that it recognized the device, but the first attempt to access it locked up the DOS session. Since each virtual 8086 is protected from the others, you can usually get away with crashing a DOS session. Theo+DOS resets the current session when it sees Ctrl-Alt-Del, just like regular DOS.

Serial terminal performance was a bit of a surprise. Running at 19,200 bps (the limit of the KT-70/PC used), PC applications were quite usable, with word processing programs apparently running at full speed. Oddly, Merge often had trouble losing characters and had to be stepped down to 9600 bps. The difference was immediately noticeable. But Theo+DOS lost its performance edge under Lotus 1-2-3. Every time a horizontal scroll is activated, 1-2-3 repaints the row numbers on the left side of the screen. This is usually unnecessary, and Merge filtered out the redundant output. Theo+DOS displayed every character, resulting in a bothersome flicker during scrolls.

Merge also held sway over Theo+DOS when running Microsoft Windows 286 release 2.11. By disabling both MEMPLUS and the EMS emulator, I was able to get Windows to run, but starting up Microsoft's Excel for Windows brought Theo+DOS down with an illegal op code error. Theos Software, however, could not duplicate the error. Merge ran both Windows and Excel without difficulty.

Adding It All Up

Because Theos 386 runs atop a capable multiuser operating system, every user immediately benefits from the services it provides and the applications that run under it. On a PC with 4 MB of memory, there's room for six Theos users and two Theo+DOS sessions. That's a lot of power to squeeze out of 4 MB.

If you already use Theos 386 to run any of the hundreds of applications available for it, Theo+DOS is a valuable plus, letting you replace dedicated DOS PCs with serial terminals. However, users unfamiliar with Theos should take a closer look. If you are currently considering costly networks, you could save a great deal of money and aggravation by adopting the simpler Theos approach.

It seems unlikely that you would buy Theos 386 just to run Theo+DOS. If you just need multiple DOS users on your 386, there are other, cheaper ways to accomplish it. If, instead, you want to build a true multiuser system with a full complement of facilities to support it, the combination of Theos 386 and Theo+DOS should serve you well. ■

Tom Yager is a technical editor for the BYTE Lab. He can be reached on BIX as "tyager."

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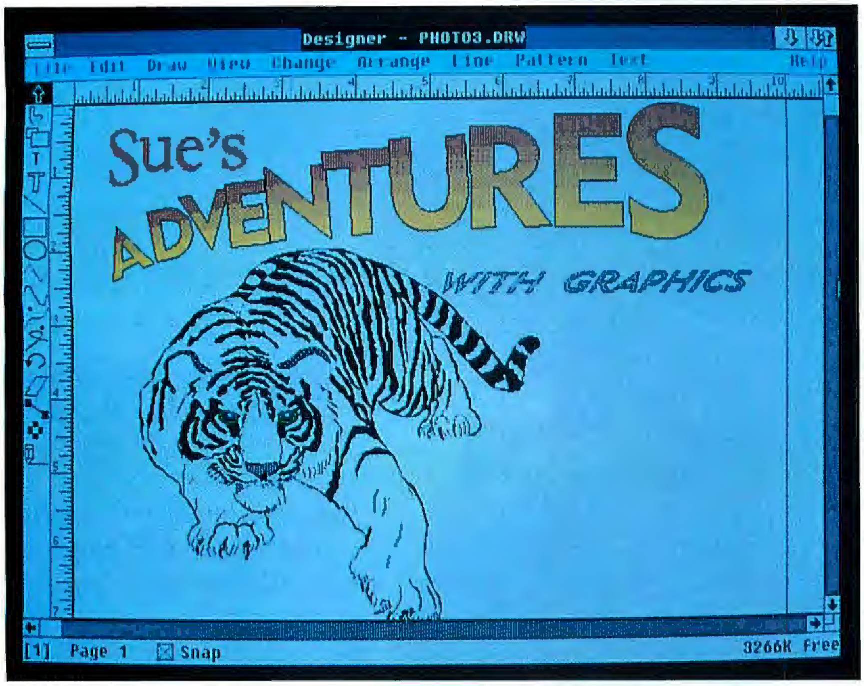
Circle 81 on Reader Service Card (RESELLERS: 82)

Sue Rosenberg

REVIEW

New Adventures in Graphic Design



Micrografx Designer 3.0 lets you create interesting effects with text, like the Indiana Jones–like title in the photo here.

Micrografx Designer, the first and perhaps the best-known graphic design software for Windows, has just taken on some new features that a lot of folks have been eagerly awaiting.

Of course, it already had a lot of tools, commands, and features to create and edit drawings for graphic design, desktop publishing, and technical illustration. With a half-dozen ways to draw lines, three ways to display text, the ability to rotate objects and control line widths, and colorful on-screen images, you doubt that there could be more.

Yet Designer 3.0 brings another way to draw lines and even more ways to reshape them. Not just more fonts, but outline fonts. Control over line height and angle (in addition to width) to draw calligraphic lines. Not just the ability to rotate an object, but the ability to set the point of rotation. Not only colorful images, but the option to see what makes up those images.

For $695, including all the program enhancements, Designer 3.0 comes with an extensive clip-art library, a desktop slide show program, and a utility program to transmit drawings via modem to selected image-processing companies.

I tested the program on a 12.5-MHz AT clone with a Paradise VGA board and Logitech mouse. I ran Designer initially under Windows 2.1 and discovered a number of problems. Even though I used Micrografx's special driver to overcome a well-known Windows weakness, I could not fill a rotated object with a gradient or rotate an object that had been filled with a gradient. Both operations caused my computer to lock up. Occasionally, selecting Exit to leave the program would cause both Designer and Windows to hang. However, when I installed Windows 2.11, these problems went away.

The Designer package does not let you know in advance how much space you will need on your hard disk for the installation, but you will need quite a bit with all Designer's appurtenances. The software is supplied in a compressed format, so I guessed that 10 megabytes would be enough to hold the installed program and data files. It wasn't. The clip art alone takes 4.5 MB, the fonts more than 2 MB, and the translators (including GEM and Macintosh PICT) more than 600K bytes. Altogether, you will need at least 15 MB of free hard disk space to hold everything and to have some room for your drawings.

Graphical Improvements

The most significant improvement in Designer is its new ability to manipulate outline fonts. Previously, Designer could handle only device, vector, and screen fonts. Screen and vector fonts do not produce the high-quality output of outline or device fonts. Device fonts print at the highest resolution of the output device, but because they are specific to the device, they may remap to other fonts when you change printers or switch to another display.

Outline fonts are device-independent and are true WYSIWYG. Outline fonts never remap when you change the printer or display. Because they consist of Bézier curves, outline fonts print at the highest resolution, even if the font is not resident in the output device. In addition, you can convert the text to Bézier curves and edit it as a reshapable symbol.

No matter what font you choose, you can mix fonts, sizes, styles, and colors within one string of text, and you can do it while you enter the text. In addition, you can specify the margins and indentation and change them as you enter the text.

You can draw irregular objects initially as Bézier curves, in addition to drawing them as curves, polylines, and freehand, and you can reshape any object as a Bézier curve. To draw Bézier curves, you move the mouse to draw and then click on the object to set each Bézier control point. I prefer to use the Freehand tool to scribble an approximation of an object, which Designer then translates into Bézier curves, and use the Reshape Bézier or Reshape Points tool to chip away anything that doesn't look like the object.

Designer lets you view a drawing as a wire frame to speed up screen refresh. The wire view also lets you see what otherwise hidden object you've selected and makes it possible to find those invisible objects whose color is the same as the background. I can't imagine how anyone can get along without this feature. It's a great improvement over previous versions.

You can display wide lines in color and adjust the height, width, angle, and shape of the pen to create calligraphic lines. The pen size that you can set is dependent on the resolution you specify. The higher the resolution, the finer the gradations.

There are now more ways to fill an object. In addition to solid colors and hatches, you can fill an object with another object and with an array of objects. You can also specify whether cutout areas are to be filled or left open.

There's a lot more flexibility in printing. You can now specify both page ranges and selected pages in one request. Printing options include simultaneous spot and process color separations, page labels, crop marks, registration marks, and bleeds.

Sue's Adventures

Several of the enhancements incorporated in Designer 3.0 sound a lot like the features in Corel Draw, another graphic art program—and perhaps Designer's chief competitor. Corel Draw has far fewer tools and commands than Designer but a great deal of flexibility. In particular, Corel Draw gives you extensive control of text size and position and the ability to rotate and slant any object, and it lets you locate the center of rotation of an object anywhere on or off the drawing. It also offers powerful commands to manipulate Bézier curves, calligraphic lines, and side-by-side wire-frame and preview displays.

Because of the apparent similarity between Designer's new features and those of Corel Draw, I decided to check out Designer by testing how closely I could replicate a Corel Draw graphic with lots of squeezed, stretched, slanted, rotated, and gradient-filled text, a Bézier curve image with calligraphic lines, and some clip art from Corel's library. I called the drawing "Sue's Adventures with Graphics." It features a gradient-filled word swooping across the screen, à la Indiana Jones, with the fonts getting larger from left to right; lowercase text aligned to the top of the letters, rather than the base; and text strings illustrating various features: mixed fonts and colors, nonproportional resized text, outline font, wire-frame view, rotated text, and slanted text. In the midst of this is SuperSue (a character of modest origin) that is composed of Bézier curves, rectangles, ellipses, and calligraphic lines.

It was easy in Corel Draw to align the text string "Sue's" to the top of the letters, because users can set the vertical alignment. It wasn't easy to do in Designer, because the Designer text editor considers text entered near other text to be part of the same text string and forces the alignment to the baseline. I got around the restriction by typing the letters on separate lines and then moving them into position. Alternatively, I could have converted the text to curves.

To get the variable font size for the word "ADVENTURES," I had to grab a resizing handle to enlarge the text, because the largest font size settable via the text dialog box is smaller than the size I needed for the last two letters. It was easy enough to resize the other letters to smaller text. Then I converted the text to curves to resize the last letter and position all the letters on a curve. Designer doesn't have anything like Corel Draw's Fit Text to Path command to align text to a freehand curve, so I cheated a bit. I noted the angle assigned to each letter in the Corel drawing and used that to rotate the corresponding letter in Designer.

To squeeze the Italic text "WITH GRAPHICS," all I had to do in Corel Draw and Designer was to push on a resizing handle. Creating the slanted shadow, however, was different in the two programs. Corel can slant text; Designer can't. The text in Designer had to be converted to curves, combined, and then slanted.

The drawing illustrates outline fonts with text surrounded by a heavy outline and wire-frame view with a line enclosing white space. Corel Draw lets you select the text outline color and width independently of the text fill. Designer does not. Text in an outline font has a hairline outline in the same color as the text fill. The only way to get rid of the line or to change its color is to convert the text to curves. Only then does the outline become selectable as a line. What this means is that text printed in an outline font looks bloated. To get crisp-looking text, the text in an outline font must be converted to curves and the line made invisible. This means that the text is no longer editable as text.

Designer does something with text that Corel Draw can't: It mixes colors in a text string. Corel Draw can't do that without converting the text to curves. Both Corel Draw and Designer can, however, reproportion text by pushing on the resizing handles. And the programs do equally well at handling calligraphic lines. I found that it was marginally easier in Corel Draw to reshape Bézier curves, but that might be due to my greater familiarity with the Corel Draw tools.

As for the clip art, there is enough overlap in the libraries supplied with Corel Draw and Designer that I was able to take similar images from each. The advantage goes to Designer here, however. Its clip-art preview mode lets you scan the library to select an image before you import it.

Drawing Conclusions

I was able to replicate the Corel Draw drawing image completely in Designer. The flexibility of the Rotation command makes up in part for the lack of a Fit Text to Path command. The clip-art preview mode makes it easier to organize and locate the right image. It is possible to do fancy things with text—as long as you are willing to use it as a symbol and not as editable text.

I was disappointed to discover that the outline of the outline font was not removable from the text. The company that I work for has thousands of text-intensive graphics that are output to different devices. The new outline font capability of Designer 3.0 seemed, at first, to be the answer to maintaining a single set of graphics files for all the applications. But the quality of the printed outline font is blurry, particularly at small point sizes. This means that to maintain the contents of the files, you will need to keep two sets: one to edit and one to print. This is an inconvenience, not a fatal flaw, and something I hope will be corrected in the next release.

In general, I was pleased with Designer 3.0. The enhancements make the program easier to use. And I like the way "Sue's Adventures" turned out. ■

Designer 3.0

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Sue Rosenberg is a consultant at James Martin Associates in Reston, Virginia. She can be reached on BIX as "suer."

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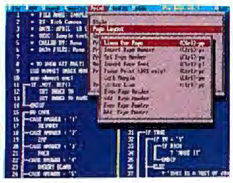

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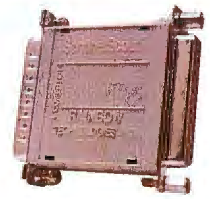

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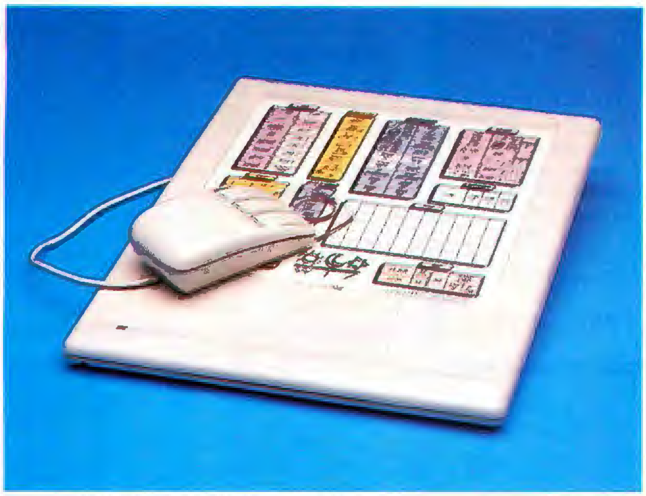
REVIEW

Eccentric Mouse Tames Complicated GUIs



A mouse/digitizer hybrid, Wiz works best in applications with multiple menu layers.

Love 'em or hate 'em, pointing devices for PCs and Macs are proliferating. In fact, they're necessary for many of today's graphical-user-interface-driven applications. You used to have the choice of either a mouse or a mouse. But lately we have seen a confusing array of alternatives: trackballs large and small, touchscreens, touchpads, and light pens, to name a few.

CalComp, a company best known for its high-end plotters and digitizers for CAD applications, offers the latest variation: an idiosyncratic mouse-and-digitizer hybrid with an equally idiosyncratic moniker—Wiz.

Available in both PC and Macintosh versions, Wiz consists of a half-inch-thick, 9½- by 11¾-inch pad with a lift-up clear plastic panel under which you slip application templates. Wiz works minor magic in applications with extensive command-driven interfaces (e.g., Novell NetWare) or those with multiple menu layers (e.g., Lotus Symphony).

The mouse component looks pretty standard at first glance, but its three switches rock either forward or backward, giving you six button options. Then there's the clear plastic window with cross hairs—not the kind of thing you find on most mice.

Installing Wiz is a minor chore, and I didn't appreciate the messy rat's nest of wire that I ended up with after installing my test unit (the PC version). Wiz gets power from the keyboard (an AC adapter is optional), so an adapter plugs in between the keyboard and the system. Then a power connector goes into the serial adapter, with a cable going to the pad. Finally, the mouse plugs into the pad. Fortunately, Wiz's software is straightforward.

After installation, Wiz works much like a standard mouse, with the added plus of 1000-dot-per-inch resolution for super-accurate positioning. Because it depends on the electromagnetic pad for positioning, there are no moving parts on the mouse. That's both good and bad: There's nothing to wear out or get dirty, but there's also a slight resistance to moving the mouse. You get used to this in time, but I prefer my mice to roll more easily. (A light-pen option is available for $75.)

Wiz's application templates are quite a unique feature. A plastic sheet lists all the various menu options. Instead of remembering a command or pulling down an on-screen menu, you point at your choice on the template and click the mouse button. CalComp offers 42 application templates for most popular PC and Mac applications, including dBASE IV, WordPerfect, PageMaker, Excel, VersaCAD, and MacDraw.

To use a template, you slide it under the plastic panel of the pad, pop up Wiz's utility program, and choose the template you've loaded. Then you just position the mouse's cross hair to choose and click on commands and menu choices for your application.

It sounds great in theory, but I found that the usefulness of the templates varied greatly from application to application. For applications that I've used extensively or those with pull-down menus, using the templates actually slowed me down. I had to look away from the screen, find the command on the template, move the mouse, click on it, and look back at the screen.

Plus, there's a "gotcha": Wiz comes with a DOS, Windows, or HyperCard template and a coupon for one additional application template. Beyond that, templates cost $49 each. If you're like most people and use more than a couple of applications regularly, you will break the bank quickly.

Wiz's digitizing abilities really shine through in a full-fledged CAD operation. I used it with AutoCAD to input a simple architectural drawing. The cross hairs are easy to align, and Wiz's 1000-dpi resolution matches—and sometimes exceeds—the resolution of a full-size graphics tablet. However, Wiz doesn't pretend to be a full-size graphics tablet; its 7½- by 7½-inch digitizing area can be a real limitation if you are a CAD aficionado.

Wiz does have its annoyances. The springs on the mouse buttons were so tight that my fingers got tired after working with it for a couple of hours. And the plastic panel on the pad could be more durable: I inadvertently gouged it with my fingernail. But at $199, Wiz is the lowest-priced digitizer (with added features) that you'll find anywhere. CalComp has truly brought a new dimension to pointing devices. ■

Wiz

BYTE LAB

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CalComp
2411 West La Palma Ave.
Anaheim, CA 92801
(800) 225-2667

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Price
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Inquiry 853.

Stan Miastkowski is a BYTE consulting editor, managing director of K+S Concepts (a documentation and consulting firm), and editor of the OS/2 Report *newsletter. He can be reached on BIX as "stanm."*

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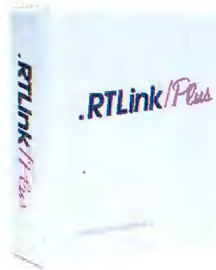

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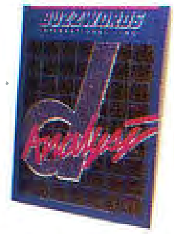

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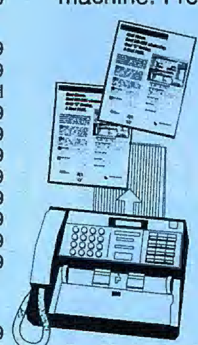

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End-User Programming

Productivity is the name of the game. There's constant pressure on all of us to become more productive year after year. So we do our best to streamline our work flow, to get rid of time-wasting procedures, and to make the most efficient use of our time.

Now there are tools to help. End-user programming tools are easy, powerful, and higher than high-level languages. They are not traditional programming languages—many are written in plain English, while some are written in a simple computerese. These "languages" coordinate and connect various applications and help you to create a more efficient, customized environment.

In the past, we have sometimes called such tools "macros" and "scripts," but now they qualify as end-user programming languages. As applications have become more complex, the need to choose between different options at run time or to automatically combine them in more efficient ways has increased. In "Full Circle," Rick Cook examines some of the innovations that have made end-user programming a practical reality.

One type of end-user programming tool is the query language. Some of these languages are more complex than others. For example, Structured Query Language is relatively complex in comparison with plain-English requests. In "Natural Selection," Klaus K. Obermeier discusses natural-language query systems. Their ease of use enhances the accessibility of the information in your database and thus increases your productivity.

Another kind of end-user language is the authoring system. It provides the structure that enables you to link audio, video, graphics, and other multimedia capabilities together into a single presentation. Authoring system commands tend to be simple and English-like in character, and you don't need to be a programmer to use them. In "Managing Multimedia," Mark D. Veljkov discusses how different authoring systems coordinate the various elements of a multimedia presentation and which capabilities are most important.

Scripting languages aren't new, but there is a new generation of them. The latest iteration lets you interconnect various applications the way that you want to—or need to—and do it in graphical user interface-based, multitasking environments. In "Scripts Unbounded," Bob Ryan discusses the newest generation of scripting languages and their capabilities. And in the accompanying text box "Scripts, Unix Style," Ben Smith discusses several Unix scripting languages.

Another way to improve productivity is to do more than one thing at a time. Multitasking provides this ability, but coordinating and controlling the various tasks in a multitasking system to improve the efficiency and productivity of the end result can be a real bear. In "Rexx in Charge," Charles Daney explores the capabilities of Rexx, an application coordination language that succeeds in this effort where others fail. In the text box "ARexx at Work," Steve Gillmor explains how to implement Rexx for the Amiga.

As long as there is competition in the marketplace, productivity will continue to be an issue. End-user programming languages are powerful, easy-to-use tools that can help to improve our efficiency and make us more productive.

—Jane Morrill Tazelaar
Senior Editor, State of the Art

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Full Circle

In the beginning, everyone was a programmer. Now, with powerful user languages, everyone is a programmer again.

Rick Cook

There was a time when "computer user" and "programmer" were synonymous. Ten years ago, if you owned a computer, you almost certainly wrote programs. Buying application programs was originally a way to get around the drudgery of writing your own software. In time, more powerful and flexible applications made it unnecessary—even downright silly—to write your own.

The irony is that the more powerful and flexible an application becomes, the more options you have, and the more useful it becomes to be able to perform diverse functions based on system state. If you have commands that can alter system state, conditionals that choose alternate execution pathways, and a method of storing these things, you have a programming language.

Originally, people didn't think of these facilities as languages at all. They were a "macro capability" or a "scripting feature," not a language. In the last few years, however, programmers and users alike have come to recognize that they are, in fact, languages. So there we are—all programmers again. Everything comes full circle in the end. But this time, software developers are consciously trying to make the languages more powerful and easier to use.

What Do You Mean, "User"?

One of the first questions an applications language designer faces is, Who will be using the language? Speaking broadly, there are two answers to this question and, hence, two schools of user-language design.

One school equates "user" with anyone who sits down at the computer. This group tries to make user languages as friendly as possible. The computer's resources ease you into the language and guide you through it. HyperTalk, for instance, was written so that just about anyone could use it.

The other school sees the user as a "power user"—someone who needs to get the most power and flexibility out of an application. The reasoning is that most users are never going to want to get under the hood of the application, and the ones who do are going to want performance above all else.

Consequently, languages for power users tend toward the complex and difficult. AutoLisp, the programming language for AutoCAD, is an excellent example of this approach. Lisp is a notoriously difficult language to learn, mostly because it is so different both from other languages and from the way most people think. But it also offers certain advantages for programming a CAD package.

People can and do make careers out of

continued

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programming in power-user languages. Programming in dBASE and other database languages is a recognized specialty. In addition to developing custom software, power-user languages lend themselves well to applications that augment the host application. For instance, there are about 700 applications written for AutoCAD, most of them in AutoLisp.

Need to Know

The split between user and power-user languages is not along application lines. In almost every category, from communications programs to word processors, some software companies have opted for easy-to-use languages while others have chosen languages that wring the most power they can out of the machine.

This is especially obvious in database languages. Because databases put such heavy demands on the system, they tend to use power-user languages. In an attempt to make their DBMSes as easy to use as possible, some companies are even willing to sacrifice some power.

One of the more interesting trends in applications is to provide more than one language. In addition to a power-user language, some packages now offer a simpler scripting or macro language for casual use. AutoCAD, for instance, not only has AutoLisp and facilities for writing C routines, but it also has a menu-oriented facility that is much easier to use.

You can make too much of the entire question of user versus power-user languages. Most people have a strong ability to learn the information they need to do their jobs, and if they have to, they can master nearly anything.

Roots

As computer languages, applications languages are a real grab bag. Some of them are based on well-known programming languages, occasionally so closely that programs are virtually indistinguishable. Others go off in new directions and do things unlike any conventional language. In some cases, the basis for the language is well thought out. In others, it seems to be whatever appealed to the programmer. More to the point, some applications languages are easy to use, with appropriate interfaces and powerful control structures, while others barely qualify as languages. Of course, the easiest languages to use are the natural-language interfaces found on some database systems (see "Natural Selection" on page 217).

There isn't a lot of consistency in any of this. You find some of the worst excuses for languages in some of the most expensive professional packages, and some of the best in inexpensive programs. There is a tendency for more recent packages to have better applications languages, but that's hardly a universal rule. One of the reasons for so much variation is that, as a rule, the language isn't a major selling point for the application. There isn't the pressure to improve it that there is for other features.

The idea of a pictographic programming language sounds like a GUI that has run wild.

Again, this isn't universal. Some companies, such as Clarion Software, have built their advertising around their applications languages. In general, DBMS users are more concerned than others about the languages.

Popular models for applications languages include C and Pascal. C-like languages tend to be power-user languages. They generally have the advantages of C: They're terse, capable, and small.

Pascal is a popular model in a variety of applications. Probably the best known is HyperTalk, the language behind HyperCard. Using Pascal as a model tends to produce a language that is readable and has well-defined control structures, at the expense of being verbose and taking up more memory. There is also more of a tendency to include type declarations in Pascal-like languages.

BASIC is also a popular model. Its popularity has slipped, however, as its use in serious programming has waned.

The Little Guys

Besides the major languages, some of the lesser-known ones have also served as models for applications languages. AutoLisp is the best example. Lisp was chosen as the basis for AutoCAD's programming language because the designers thought it was a good fit with what they needed to do, not because the application was written in Lisp—it wasn't.

Lisp is designed to interpretively process variable-length lists of heterogeneous items. The coordinates of a point on a CAD drawing and the properties associated with that point can be treated as a list. Because Lisp is interpreted, it is interactive. Given enough computing power, lists are evaluated almost instantly. That makes it easy to make a change to a drawing, examine the results, and change it again if it wasn't what you wanted.

Some applications have used Forth or a Forth-like language. For instance, PostScript is similar to Forth. Forth's strengths include small size, extensibility, and the ability to work very closely with hardware—all of which are important for a language that controls laser printers.

Basing an applications language on an existing computer language is a boon to the software developers, because they can draw on experience when they write other implementations of the language. For users, the picture is mixed. If you're familiar with the model language, it's a good approach. You can learn the language more quickly if it works like something you already know. However, the point of applications languages is that, these days, most users don't know any conventional computer language.

Picture-Perfect Programming

Although most user languages are based on conventional ones, there is nothing that says they have to be. Many companies have used languages that are not like any of the major programming languages.

One increasingly popular approach is iconic. Examples include the Double Helix DBMS from Odesta for the Macintosh, and Bars and Pipes, a MIDI program from Blue Ribbon Bakery for the Amiga. In an iconic language, commands and conditionals are represented by icons. You build programs by stringing together icons and adding more information as needed.

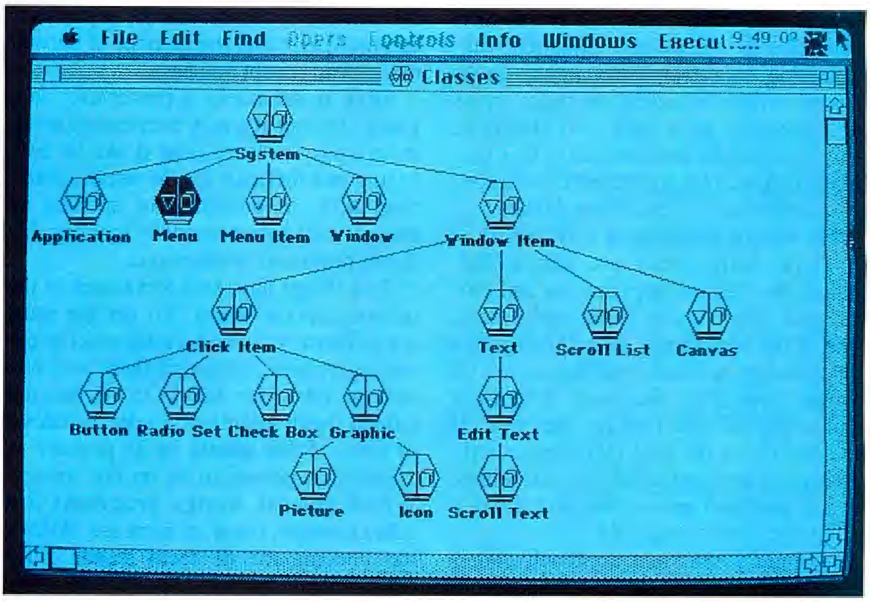
Iconic languages are especially popular for multimedia authoring (see "Managing Multimedia" on page 227). Making multimedia work requires blending images, sounds, and other resources in tight synchronization. If things get out of sync, the words don't match the pictures, and the video effects may not match either. That can be annoying or amusing, but it definitely isn't what you want.

To ensure that everything stays synchronized, directors who do multimedia projects without computers use various forms of graphics notation. An iconic multimedia authoring language refines and continues the trend.

At first glance, the idea of a pictographic programming language sounds like a GUI that has run wild. However, it has some significant strengths. For one thing, an iconic language automatically focuses you on the big picture. Because the icons typically stand for operations, such as sort, an iconic language naturally focuses attention at a high level.

An interpreted iconic language facilitates playing what-if games with the design of the operation. Assuming the hardware is fast enough, you can make changes by rearranging icons on the screen, and you can see the results almost immediately.

Because each icon usually represents a high-level operation, built-in error checking becomes easier. Iconic commands can have type, range, and other attributes as part of the icon definition. Icons also decouple the symbol from the word or group of words represented. This makes it easier to focus on how the iconically represented operation actually works rather than how it should work.



Prograph is an object-oriented iconic programming language for the Macintosh. It supports a class hierarchy and inheritance.

Every Picture Tells a Story

By their nature, iconic languages tend to be object-oriented. Pictures represent bundles of concepts, and that makes it easier to think of an icon as representing a programming object. The photo shows a screen from Prograph, an object-oriented programming language for the Macintosh.

Iconic language commands must be parsed and translated into something the program understands. This is true of any language, of course, but it's especially obvious with an iconic language because what appears on the screen is so completely human-oriented.

This presents both a difficulty and an opportunity. The difficulty is that the translation requires computing resources. The opportunity is that it provides a natural breakpoint for applications that run over networks. The user interface and translation is handled on your machine, and the information moves over the network in a more efficient form. Double Helix uses this strategy in its network version.

Of course, nothing says that the front end and back end have to come from the same company. It would be quite possible to have an iconic front end with a SQL translator that connects to conventional SQL databases.

If iconic languages have strengths, they also have drawbacks. The biggest problem with a general-purpose iconic language is the number of icons needed to express all the commands and conditionals in a language. Another problem is the difficulty of adding new functions with meaningful icons. An application's language with a more limited command set makes for a more manageable language, but even so, things can become unwieldy. This is especially true if the language is extensible, and you have to come up with new icons.

Another characteristic of iconic languages is that they need a lot of resources. An iconic language needs a lot of RAM, processing power, graphics resolution, and hard disk space to be really effective. Double Helix was actually conceived before the Macintosh was developed, and the first crude prototypes ran on the Apple III using a joystick instead of a mouse. However, it was held in abeyance until someone developed hardware that could work with the software.

Babel Revisited

A basic problem with applications languages is that there are so many of them. They aren't standardized, and they usually don't work in the same way, even on products of the same class. The notable exception to this seems to be spreadsheets. Everyone has copied Lotus 1-2-3's macro language closely.

In some ways, this is worse than the bad old days. When everyone did their own programming, you only needed to know one language. Today's power users might have to know half a dozen to wring the most out of their application programs. Ideally, there would be one applications language that would fit all applications. That isn't practical because it ignores one of the most important characteristics of applications languages: the close fit with the application.

However, as software developers recognize the importance of applications languages, there is some tendency to standardize. One example, again, is HyperTalk. Many companies have brought out HyperCard-like systems for computers other than the Macintosh, including MS-DOS machines and the Amiga. Their programming languages tend to operate much like HyperTalk.

There is also another problem with this Babel of applications languages. The programs can't talk to each other.

Holes in the Wall

Programmers, users, and software companies all realized some time ago that programs that could exchange data were much more useful than programs that worked in splendid isolation. So today many programs can input and output files in popular formats, such as .WKS, .GIF, or Microsoft Word.

When most small computers only did one thing at a time, that was sufficient. But we are rapidly moving into the era of multitasking operating systems. Between OS/2 on IBM-compatible machines, MultiFinder on the Macintosh, and the growing popularity of Unix on the desktop, multitasking is becoming the norm rather than the exception.

Multitasking gives you the opportunity to automatically take data from one program and feed it into another one.

continued

Ideally, you could treat your entire software base as one giant application, manipulating data seamlessly in the background while attending to those tasks that absolutely must have your attention. The first step in that direction is a language that will let applications pass control rather than just exchange data.

The classic example of this facility is in Unix. Unix shells are simple languages that can run applications and process the output using pipes and filters. One of the best things about Unix is the rich and diverse toolkit that has grown up to use these shell facilities. The Unix philosophy is "one tool for one job." If you don't find the tool that does exactly what you want, you build your own either as a C program or as a macro calling a collection of existing tools.

A slightly different approach comes with Rexx, a language developed especially to control applications (see "Rexx in Charge" on page 245). Rexx was originally written to run on IBM mainframes. It is an especially interesting example because it isn't tied to any one application.

At its lowest level, Rexx functions like a very sophisticated version of the MS-DOS batch-file facility with scripting and macro features. However, Rexx can also reach inside programs to give commands, extract data, and do just about anything you can do at a keyboard. Of course, Rexx can only reach into a program if the program has the necessary hooks and commands to make it "Rexx-aware." There are varying degrees of Rexx-awareness possible, depending on the number of commands the application can recognize and the number of parameters it can accept and pass.

Rexx is definitely a power-user language. Except at a very elementary level, it isn't easy to learn, and it can be confusing and difficult for the nonprogrammer. Still, its potential for opening up the software environment by melding different programs is enormous.

Two things have held Rexx back in the microcomputer world. To get the most out of Rexx, you need a multitasking operating system. Although there is a version of Rexx for MS-DOS, it has not gained much attention. Under Windows or OS/2, Rexx should be as popular as ARexx has proven to be on the Amiga. While not all Amiga programs are ARexx-aware, many of them are. ARexx has become the de facto standard for communicating among applications. The latest version of AmigaDOS (2.0) includes ARexx. Presumably, ARexx compatibility will become a standard feature of Amiga software.

Future Directions

Perhaps the most important development in applications languages is the recognition that they are languages. If they are designed and implemented as languages rather than as automated key presses, you can expect them to become much better.

What constitutes "better" depends on what you want to do with the language. The split between user and power-user languages is going to become more pronounced. This split is less a matter of the power-user languages becoming more powerful (although they do with each new release of the applications) than it is one of the user languages becoming better fitted to their role. Innovations like iconic languages, object-oriented languages, and a general concern for the needs of the average user are showing up more strongly all the time. Iconic languages in particular seem to be drawing an increasing amount of attention.

Applications languages are a subset of the user interface, and as such, they tend to soak up the available computer resources. This situation is probably going to continue as computers become more powerful. For users, this means more windows, menus, icons, and other goodies to make life easier. For power users, it means more debugging tools, integrated editors, and other things to make programming easier.

As multitasking becomes more popular, so will languages and facilities like Rexx for tying programs together (see "Scripts Unbounded" on page 235). As users of all levels of ability strive to mesh their applications more closely, you will probably also see iconic Rexx-like languages or iconic shells to fit around Rexx. However these trends develop, one thing seems certain. Getting the most out of your software is still going to take programming, but it will be a very different sort of programming than it was 10 years ago. ■

Rick Cook is a freelance writer in Phoenix, Arizona, specializing in computers and high-technology subjects. You can reach him on BIX as "rcook."

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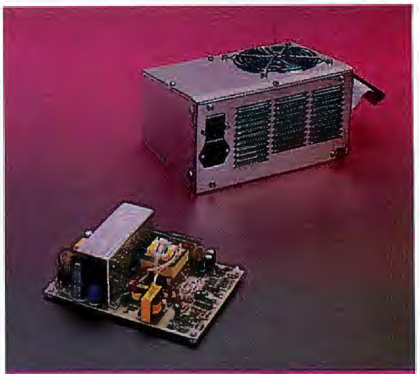

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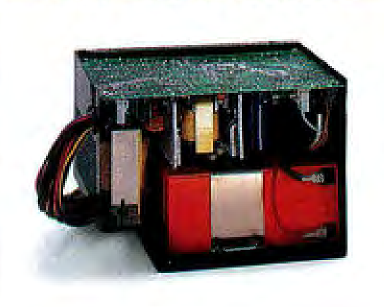

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Natural Selection

You don't have to be a programmer to query your database

Klaus K. Obermeier

Today, a natural-language query system (NLQS) can provide easy access to your DBMS by accepting queries in the form in which you normally ask questions—in English. In the past, you had to learn a query language, such as SQL, to access that information.

Interrogating a relational database using a query language is not a trivial task. It involves not only learning the syntax of the language, but also understanding the structure of the DBMS, translating intentions from English into computer language, and, in today's increasingly heterogeneous computing environment, distinguishing which language or dialect goes with which DBMS.

But today, an NLQS can provide the kind of easy-to-use, ad hoc query capability that's required to give more and more people access to increasingly complex database systems.

The Challenge

If installed properly, integrated effectively, and explained appropriately, an NLQS solves the problem of how to easily retrieve information from a database. It lets you ask questions of your database in as familiar a form as possible—plain English (see figure 1).

In general, the central task of natural-language-processing programs is to transform potentially ambiguous input into an unambiguous form that a computer program can use internally. An NLQS used as a front end to a database translates the English you input either into an intermediate form or directly into the query language of the back-end DBMS. The natural-language system must be able to handle problems where more than one potential interpretation of the input is possible (e.g., "List all the employees broken down by sex"), or where the input is incomplete ("f u cn rd ths u r smrt").

Natural-language systems for databases must also deal with a twofold problem (see figure 2). On the one hand, the NLQS has to provide a many-to-one mapping of English words for one particular database field (e.g., there are many English words that could be used to refer to the database field "employee"). On the other hand, the NLQS has to provide a one-to-many mapping from the same English word to many database fields (e.g., the English word "name" can refer to numerous data fields containing "name" as an element).

No Magic Wand

Natural-language technology for databases has been the subject of debate for years, from the standpoints of both technological feasibility and commercial

continued

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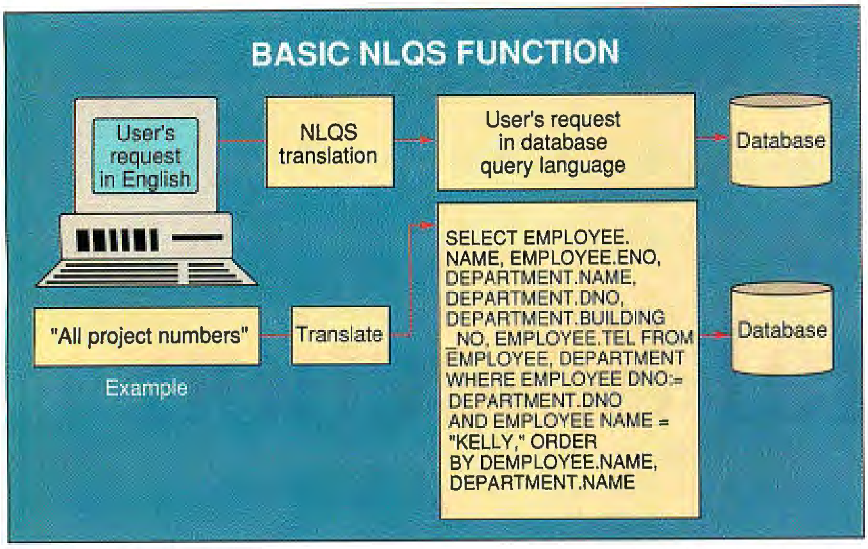

Figure 1: *An NLQS sits between you and your database. It takes English sentences and translates them into an equivalent SQL query.*

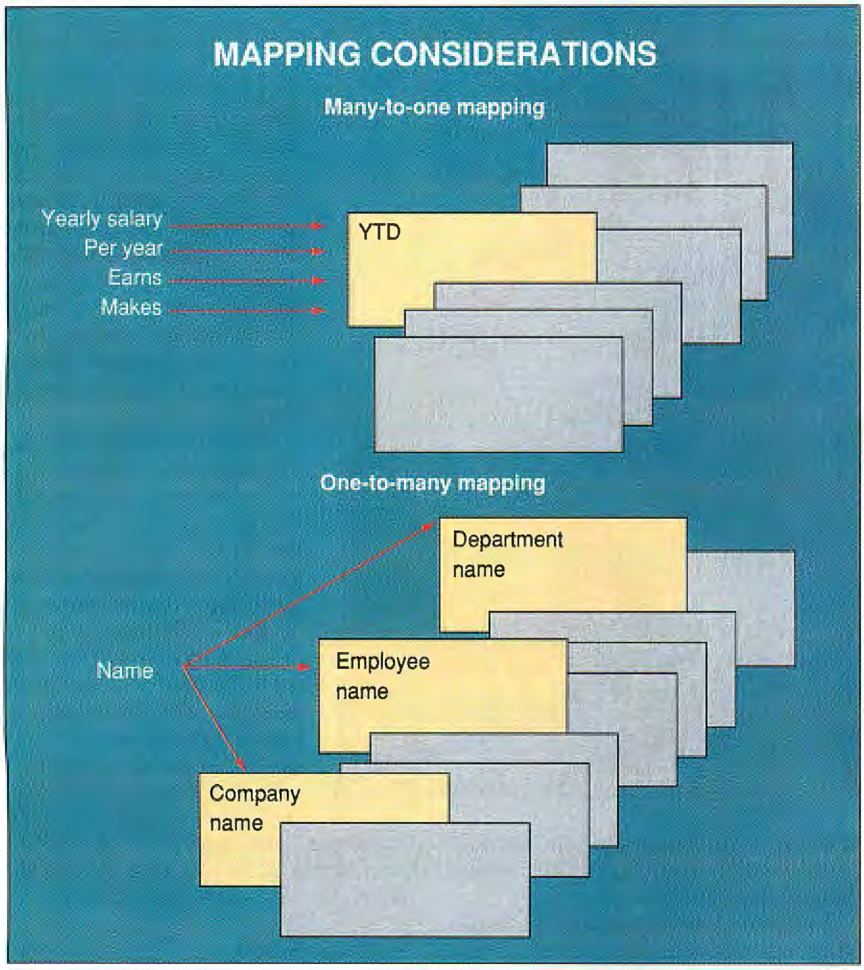

Figure 2: *One of the major concerns with accessing relational databases is handling many-to-one and one-to-many situations. The NLQS must be able to match many different English words to one specific relation and handle the many instances where one English word refers to different elements in the database.*

viability. In the past, a typical NLQS required megabytes of memory, was slow and cumbersome to use, and, more important, required a major customization effort. Moreover, the natural-language concept was, to some extent, oversold: People were expecting a HAL 9000 on their desks.

Today, the goal of an NLQS is to make it easier for you to retrieve data without having to learn another computer language. Ideally, it should also integrate various software programs, such as spreadsheets and graphics software, into the data-retrieval process.

Ultimately, an NLQS may be the lingua franca for any computer application program. However, it is not a panacea for all the retrieval problems, nor a magic wand that will eliminate computer illiteracy, nor the pinnacle of AI research. (For a description of a new merger of natural language with other technologies, see the text box "Natural Images" on page 220.)

Implementation Issues

The keys to effectively using an NLQS for a specific application are managing expectations and assessing computer knowledge. High expectations almost always turn into disappointment and frustration. This can be avoided with proper education.

At times, you may need elaborations on why and how the retrieved piece of data relates to the overall scheme of things (e.g., "List the customers who paid their credit card debts after Christmas. Did they respond to our grace period offer? If so, how?"). Without explicit preparation for exploring causal relations, even a state-of-the-art NLQS would be at a loss to come up with the answers.

NLQSes are meant to be used by "intelligent agents"—people who are familiar with the context of the database and know what tasks they have to perform. If you query a shipping and receiving database for a list of all single men over the age of 40, you're defeating the purpose of the NLQS. However, the same question would be appropriate for an NLQS used by a dating service. Idiot-proofing an NLQS is not only impossible and uneconomical—it also takes away resources better spent elsewhere on improving the system.

Other issues that are connected with implementing an NLQS are operational in nature. Although you can probably save money by giving more people access to corporate information resources, you

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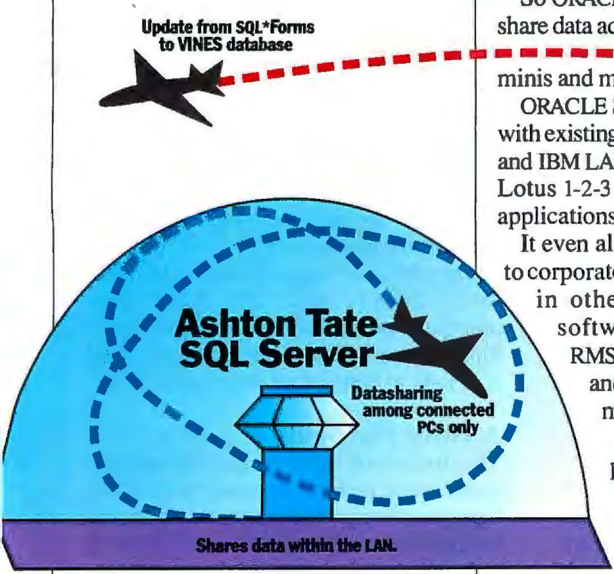

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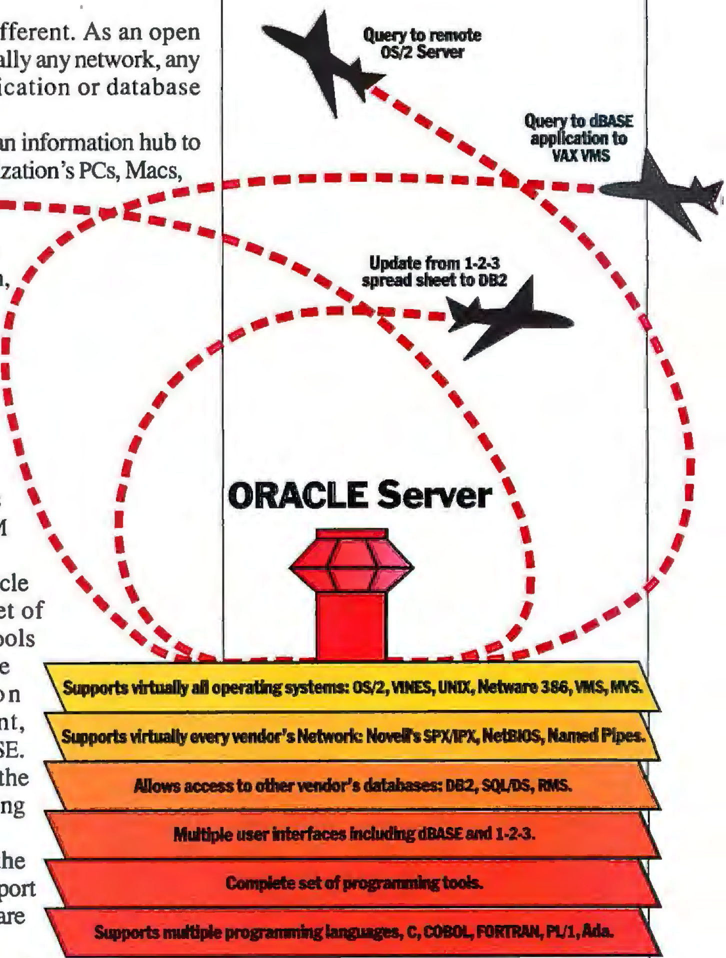

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Natural Images

So far, natural-language access to your DBMS remains at the cutting edge of interface technology. One major integrator of imaging and LAN systems, iLAN, together with Battelle Columbus, are about to change that perception. They will integrate NLQ, Battelle's PC-based natural-language query system, into iLAN's LAN-based image-processing system, ImageBase.

Despite the best efforts of the computer industry, over 80 percent of business information is still on paper. In fact, computers and laser printers only automate the generation of paper; they do not eliminate it. The real payback from computerization is eliminating the tons of paper associated with business activities.

Image processing and natural-language access are the key technologies that let you scan, store, and retrieve documents, making gigabytes of data available without extensive training or programming experience. These two technologies have now matured to the point where they can be implemented enterprise-wide on top of existing LANs, wide-area networks (WANs), and other personal computer networks.

Natural-language processing technology has also matured to the point where it can be integrated into real-life applications. The challenge is to implement both technologies in a way that is most cost-effective and easiest to use while making it a general-purpose tool in your organization. As with other significant changes in technology, the more people and applications that have access to the tool, the higher the payback per user.

ImageBase uses nondedicated inexpensive personal computer workstations. The only requirements on a PC are a Windows-supported graphics display and a Token Ring or Ethernet card. ImageBase uses Oracle for managing the storage and retrieval of the documents. Because Oracle runs on over 80 different computer systems and connects to IBM's DB2 and DEC's RDB, you can easily add this image system to your existing computer system. Furthermore, ImageBase takes advantage of the Oracle search engine by adding a version of NLQ that is customized for imaging. This allows anyone who understands English to be able to find image records rapidly.

Documents can be made available through English queries to anyone on your LAN or WAN, and the system can be completely transparent. For example, documents that were scanned in France (via satellite) can be referenced as Oracle records stored on your mainframe in Florida. All these records can be viewed in California using NLQ without the viewer knowing where the data is coming from. Given the current storage capacity of 300 gigabytes per document server, you could search the equivalent of 600 four-drawer file cabinets of documents simply by typing in a request in English.

can run into problems with people who issue complicated searches and tie up the database with expensive retrieval operations.

You can probably determine the success of an NLQS for your application before you invest in the technology. An NLQS should fit easily into your working environment. It should work on your platform and perhaps provide hooks into your favorite spreadsheet. It normally takes about a month to get used to a new interface option.

Another success factor is setup (and its corollary, maintenance). A successful NLQS will be inexpensive to get up and running, and it won't overload your machine or human resources. An NLQS is very cost-effective when the initial task analysis is done right.

Adding Intelligence

NLQSes range from systems that do simple keyword (pattern) matching operations to ones that perform intricate inferencing operations. While early NLQSes were closely tied to specific applications, the first widely used systems were domain- and application-independent. A large group of current products can perform inferences unsupported by the structure and contents of the database.

In order to appear to make intelligent inferences about the contents of a relational database—which aren't very amenable to an English-language description—most NLQSes create an outer layer of intelligence around the DBMS and its specific applications. In effect, the NLQS recreates and retools the database. This restructuring accounts for the high costs of NLQSes that strive to be more informative than the database itself. While powerful, these systems still don't have the full capability of information retrieval experts. They cannot deliver a system that can actively manipulate data and turn it into real information.

One way around the interface problem is to change the database paradigm. In Orion, a Microelectronics and Computer Technology Corp.-sponsored project, NCR and Control Data are exploring object-oriented databases. Neuron Data is doing the same with its Nexpert product. Object-oriented databases are much more amenable to making inferences on the data objects themselves without going through intermediate data structures.

Currently, object-oriented databases use intricate processing algorithms. As the technology becomes better established, these will be superseded by a more appropriate knowledge structure and control mechanism that will directly tie into the knowledge representation that the database provides. Such knowledge-manipulation mechanisms will no longer look at linguistic structures; rather, they will look at conceptual structures.

A Three-Way Split

The distinction between special-purpose systems and general-purpose systems has been conveniently used to separate NLQSes on the grounds of performance and cost. In the past, NLQSes, such as the Lunar system that was used to access the finds from the moon explorations, were built for one application only. Sometimes such handcrafted systems were later redesigned and adapted to another domain, but no longer. However, current products do require setup procedures that range from intricate to cumbersome.

Underlying all the current systems is the notion that the NLQS administrator must follow whatever technique is inherent in the NLQS shell. You can classify an NLQS by three factors: the hardware it runs on, its structure (whether it's pattern-based, syntactic, or knowledge-based), and the way in which it performs its function. This last factor distinguishes between inference capabilities that are limited to what is explicit in the database and those that are embedded in the outside interface layer created through the shell.

The Hard Facts

NLQSes run on three types of hardware: personal computers tied into a local database, such as dBASE or R:base; systems

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based on mainframes or workstations; and micro-to-mainframe and LAN linkages that let you access a host database while having the NLQS portion of the program resident on your personal computer or workstation. Three major characteristics that distinguish the different types are memory requirements, linguistic and conceptual coverage, and cost of setup.

A PC-based NLQS that resides on the same machine as the database itself is limited in memory. The productivity gain you see with such a system will be commensurate with the customization effort you put into it. While you probably don't need NLQS capability for a database you set up and use yourself, it can be very helpful if the database serves a large group of users.

Mainframe- and workstation-based systems are normally designed to download most information from the database into the natural-language processor. First-generation systems labeled certain values in the database to be in the lexicon of the NLQS, which performed mostly syntactic parsing on nouns, verbs, and so on. Second-generation systems construct a representation of the domain more powerful than the data in the database to increase utility of the NLQS. Both types of systems are based on the assumption that setting up the NLQS on mainframe- and workstation-based systems will demand a major customization effort and investment.

PC-to-mainframe and network-based systems bring a number of advantages to NLQSes. These include an increase in speed that results from separating the processing tasks; an increase in utility that comes from letting you use your favorite spreadsheets and report writers with mainframe databases; an increased integration of mainframe/LAN/wide-area-network software and PC-based software; and a lessening of computer anxiety among people who are non-computer-literate.

Form and Function

Structurally, you can classify an NLQS into three groups according to its approach and architecture: pattern-based systems, syntactic systems, and knowledge-based systems. A simple pattern-matching program reduces the natural language to a number of stock phrases. A syntactic-oriented NLQS system requires an elaborate grammatical analysis of the input. And a knowledge-based program accrues a large overhead for modeling the domain. The higher investment required for knowledge-based NLQSes may pay off because they offer more sophisticated inferencing capabilities than the other two.

The functional dimension divides NLQSes into two groups: those that are concerned with the information that the database and data dictionary provide, and those that create their own outer layer of data representation, thereby letting the interface reason by itself without accessing the database. The differences between these types of systems are exemplified by the question "What color is Fred's white horse?" Such a question would trip up the first type of system, but not the second.

As DBMSes become more complex, the intelligence of the interface must keep in step providing fast, friendly, and effective access.

It's debatable whether the gain in coverage and robustness of the interface is worth the effort to handle such redundant questions. The critical factors with most of the sophisticated systems are setup time and maintainability. In most cases, creating the "outer layer" that the interface needs isn't worth it.

Avoiding the Pitfalls

Today's NLQSes cannot string together more than one or two utterances. This lack of sophisticated discourse capability, coupled with overblown expectations, has contributed to the frustration of many users. With the proper instruction and education, such situations can be avoided.

An interface that lets a program converse with you in English needs to have knowledge of such things as proper turn-taking, appropriate topic shifts, and conversational rules, to name just a few. It is much easier to capture syntactic rules than conversational rules. Thus, most existing NLQSes rely primarily on syntactic and semantic knowledge to process natural-language input.

Sometimes, the unsatisfactory responses of such systems can be labeled uncooperative. For instance, consider the question "Which female makes more than $50,000 in department 302?" Responses such as "None" or "Does not compute" don't tell you enough. A response such as "There are no females in that department" is cooperative because it tells you the whole story. In a cooperative response, the system returns the specific point of failure to let you rephrase the question, if necessary.

Metacommunication, as expressed in clues such as the phrase "but first" in the question "Which employees in department 601 were promoted in 1988, but first, tell me who was over quota?" exceeds the capability of current NLQS systems. The two examples illustrate that NLQSes have to do more than just process isolated utterances; they have to know the rules of conversation that underlie the discourse.

The problem is compounded by the fact that different domains use specialized lingo, characterized by syntactic, semantic, and lexical idiosyncrasies. Dialogue-based NLQSes are still in the laboratories. They are often built around specific research topics that include modeling beliefs, goals, and plans.

Forget the Snake Oil

Even as they grow larger and the number of people who use them increases, relational databases are still built for retrieval efficiency, not for user effectiveness. Meanwhile, it is the interface, and not efficiency considerations, that has become increasingly important for catering to casual computer users. Natural language significantly enhances user productivity by providing a universal language capable of making database access less cumbersome. It also provides a gateway to multiple software packages to manipulate data more effectively.

Not so long ago, NLQSes seemed to consist of no more than parlor tricks and snake-oil slogans. Today, they are starting to have an impact on the market. As the complexities of DBMSes increase, the intelligence of the interface must keep in step. NLQSes are leading the way with fast, friendly, and effective access. ■

Klaus K. Obermeier is director of marketing for NLQ at Battelle (Columbus, OH) and author of Natural Language Processing Technologies in Artificial Intelligence: The Science and Industry Perspective. *He can be reached on BIX c/o "editors."*

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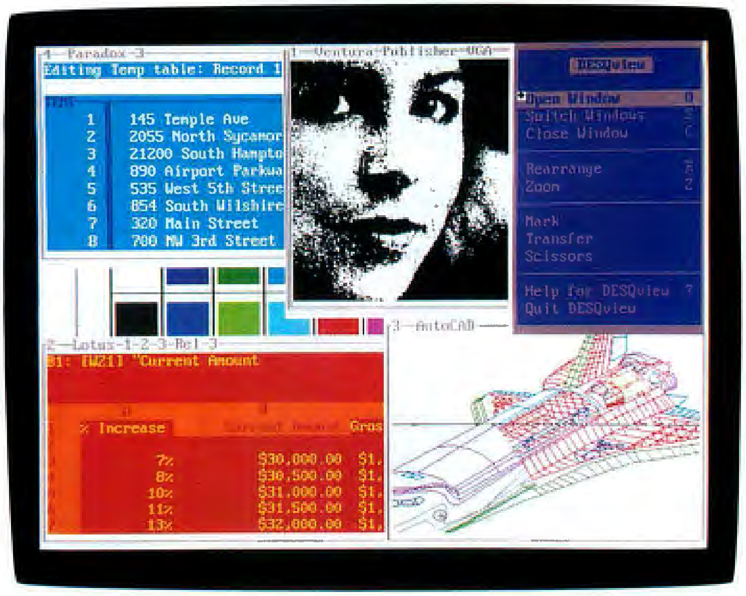

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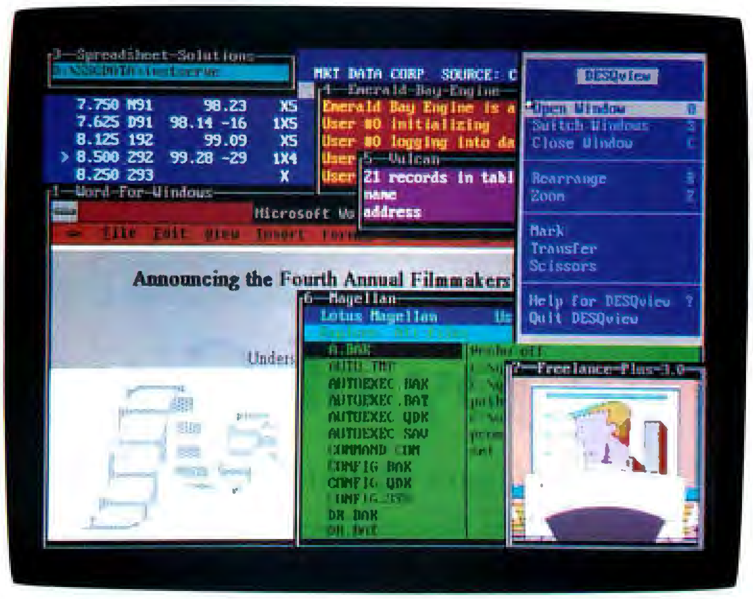

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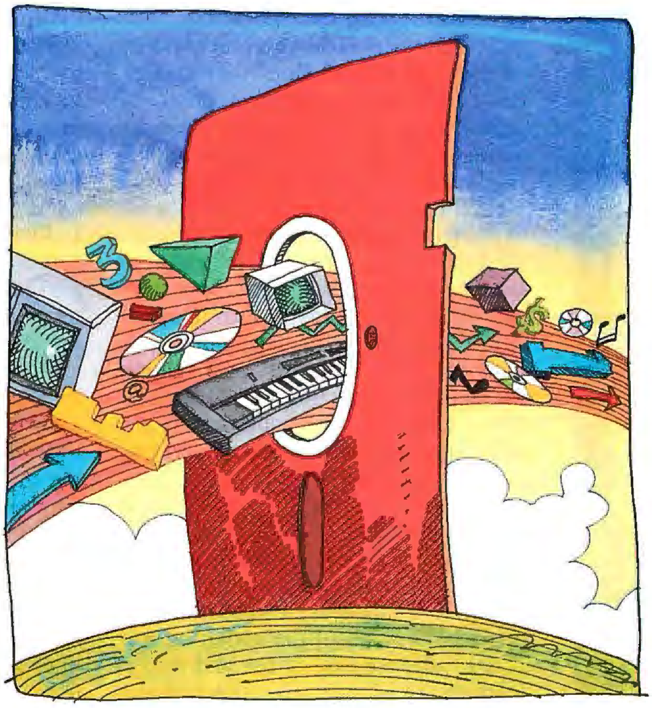
Managing Multimedia

Authoring systems are the glue that holds multimedia applications together

Mark D. Veljkov



Whatever you call it—multimedia, interactive multimedia, hypermedia—the idea is the same. By linking computer-based information with stereo audio, full-motion video, animation, and graphics, you get a teaching and presentation system of unparalleled impact.

The software tools that are needed to integrate computers and peripherals such as CD-ROMs and laser videodisks are called *authoring systems*. Educators, managers, sales personnel, and training directors are among those who can use authoring systems to create their own customized interactive multimedia programs. Authoring systems used to be called *computer-aided instruction* programs. However, advancements in hardware and software technology have moved multimedia far beyond CAI applications.

In the Beginning

In the past, you had to use a procedural language such as Pascal, C, or COBOL to develop CAI courseware. This requirement took the design of the courseware away from educators and put it into the hands of programmers. In addition, early CAI applications had difficulty controlling a basic computer, much less a laser disk. These limitations kept CAI courseware in the research labs and out of the hands of the average user.

Multimedia authoring systems let you create applications using plain English rather than relying on a programming language. They provide specific tools to create customized programs and provide for complex branching to various elements associated with each application.

First-generation CAI systems were stand-alone development tools: They didn't have the ability to control external media devices such as laser disk players. The trend, however, is toward authoring systems that can control and synchronize numerous external devices, such as laser disk players, CD-ROMs, and CD-I (compact disk interactive). While some researchers and educators still use a procedural language, such as Pascal or C, for creating courseware, authoring systems are becoming more powerful and more widely accepted in the interactive multimedia field.

Multimedia Platforms

Authoring systems are available for many platforms. On personal computers, MS-DOS and Macintosh platforms are best represented, although newly announced products for the Amiga and Windows 3.0 are attracting the attention of many potential courseware developers. Some personal computer–based systems can only create simple CAI applications (meaning

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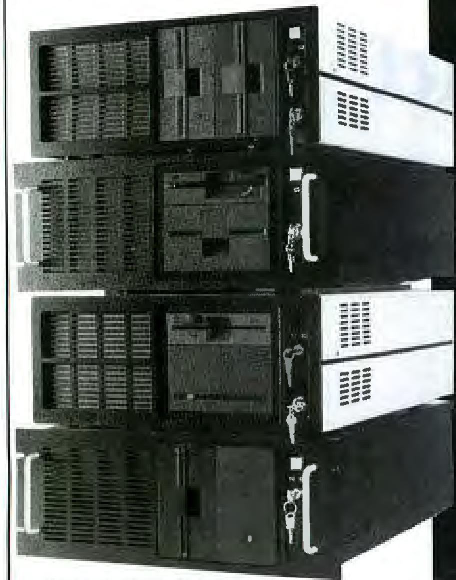

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no control for external media devices), while others are full-featured authoring systems that are designed for sophisticated multimedia development. Currently, there are far more authoring systems available for MS-DOS-based computers than for other platforms. However, the Mac is having a great impact in this area through its combination of processing power and ease of use.

Examples of Macintosh authoring systems are Mentor/MacVideo from Edudisc, Course of Action from Authorware, and Video Builder from TeleRobotics International. MS-DOS programs include Propi from ASYS, LinkWay from IBM, and Quest from Allen Communications. These all let you create sophisticated interactive multimedia projects. No matter what platform you use, you can probably find an authoring system that fits your needs. However, selecting an authoring system can be as complex and time-consuming as selecting a relational database or a sophisticated graphics application.

Since multimedia applications bring together so many different elements, you must first determine your own needs before investigating specific systems. Do you need to control external devices, such as CD-ROMs? Does your application need to track student responses and scores? Does it need to display computer animations? You can't choose an authoring system until you know exactly what capabilities you require.

Many features are available in multimedia authoring systems. By deciding on the features that best fit your application, you should be able to make an informed choice between the many authoring systems available. In reality, no single authoring system contains all the listed features. However, any authoring system with most of these features constitutes a powerful system.

Navigation Aids

An authoring system should make it easy to move around inside a multimedia application. It should use a standard design interface throughout the authoring process to advance ease of use and ease of learning. In addition, the authoring system should provide access to the standard tools available to your specific computer system. You should not have to use a different interface every time you create a new element for an interactive multimedia program.

Another "must" feature of an authoring system is full integration of graphics, text, animation, sound, and video. Access to these elements should be built into the standard interface. You should not have to "jump through hoops" just to use digitized sound in an interactive multimedia course or presentation. Moreover, graphics and text files should be easy to import from other applications.

Animation capabilities may or may not be built into the authoring system. If not, the system should provide easy access to other animation software.

Here and Back Again

Controlling the flow of a presentation is central to an authoring system. Some of the functions a complete system should include are excursion branching and launch and return functions.

Excursion branching lets you take a side trip to a related topic. You can then decide to return where you left off or continue down another path. Launch and return features let you launch other applications from inside the multimedia program and then return. For example, an interactive multimedia course on creative writing might launch WordPerfect. After students have performed whatever writing task is required and quit WordPerfect, they would be returned to the multimedia course.

Transporting from one part of a course to another is a major feature in any authoring system. Transporting lets you move users to any preselected part of a course and then return them to where they left off.

Information in Context

Hypertext functions are an important part of a multimedia presentation. They let you dynamically link on-screen elements—video, animation, text, or graphics—to additional information. With the increasing amounts of information and knowledge being used in interactive multimedia, hypertext features are becoming indispensable in authoring systems. Guide from Owl International is a good example of a hypertext application for both IBM and Macintosh computers.

Interactive graphics form another way to move about in a multimedia application. Such a system uses "buttons" or "hot spots" that you select with a mouse to initiate an action. HyperCard is probably the most famous program to offer interactive graphics. However, interactive graphics go beyond simple buttons.

For example, a multimedia anatomy course might draw a picture of the human body with specific areas designated as hot spots. The system might then ask you to click on the thorax. You would then click on an area you thought to be the thorax. If you were correct, the course might then branch to a video, another graphic, an animated sequence, or some other display that provides more information and detail about the thorax. The key to interactive graphics is the ability to link elements of any graphical image to additional information associated with it.

Authoring systems should also offer context-sensitive help systems. They should offer help to both the developers of a multimedia application and its users. Providing a help system is a mandatory feature for an authoring system. It not only helps you over the rough spots but also serves as a means to reinforce specific navigational schemes.

Behind the Scenes

Most of the features discussed so far deal with the output of an authoring system—the actual multimedia application. It's important to remember, however, that an authoring system is an application itself. More so than other development environments, an authoring system should be easy to learn and use. You shouldn't even consider one that requires the support of a full-time programmer or a hardware engineer. The point of an authoring system is to give users the power to design and create their own applications.

In line with this, a true authoring system should not require that you learn and use a procedural language in order to create interactive multimedia projects. Authoring systems shouldn't get in the way of content specialists who want to create interactive multimedia projects.

Even though you shouldn't have to use a procedural language, having one available as an option can be very helpful. Thus, an authoring system should either contain its own procedural language or offer you direct access to such a language. Quest and Propi are examples of authoring systems that provide you with access to a procedural language. Quest has a language built in, while Propi lets you connect to the Pilot language.

An authoring system should also make it easy for you to integrate the output of external applications into presentations. For instance, all systems should let you use preexisting text files.

The same is true for graphics. An authoring system, whether or not it has its own graphics editor, should let you import graphics that are created in an external graphics application. (This capability should apply to animations as well.) Authoring systems should recognize and take advantage of multiple graphics formats. The Mac has an advantage in this area due to its Clipboard functions. MS-DOS-based systems, on the other hand, must support many graphics formats, such as PCX, PIQ, TIFF, RIFF, and Encapsulated PostScript. The more formats an authoring system supports, the better.

Authoring systems should also take advantage of your particular graphics hardware. They should be able to handle all the colors and resolutions of your system, whether you're using VGA on a PS/2 machine or a 24-bit color board on a Mac II.

Toolbox

In addition to using external files, an authoring system must give you the ability to create input files. Believe it or not, some authoring systems do not have a built-in text editor. For example, Propi uses an external text editor to edit on-screen text. Other authoring systems treat text as a single graphical element. Thus, size and style changes are global

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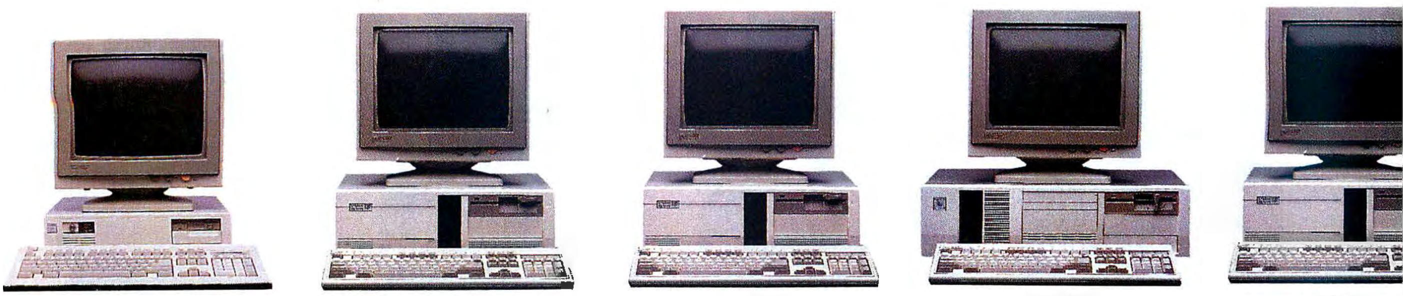
Here's the world's



(e.g., boldface one word, and the entire text is boldfaced). An authoring system should come with a good text editor that offers most of the features of a basic word processor.

A built-in graphics editor is not as important as a text editor. In fact, most graphics editors that come with an authoring system are not very powerful. You will probably want to stick with a stand-alone graphics application to create complex graphics.

In many cases, good animation is just as valuable as good video.

Bells and Whistles

One of the newest interactive multimedia tools is digitized sound. Here the Mac has a distinct advantage over MS-DOS machines. The Mac II, for example, can reproduce 8-bit stereo sound. (By comparison, the average home compact disk player plays back sound in 16-bit stereo.) All Macs include a built-in sound chip that can play back digitized sound. MacRecorder from Farallon Computing and Impulse Stereo Sound System from Impulse are external sound digitizers for the Mac.

MS-DOS computers are a different matter. You need to add some type of internal card for digital sound recording and processing in addition to an external playback unit. The IBM PS/2 Audio Capture/Playback Adapter/A board is an example of a digitized audio system for MS-DOS computers. A good multimedia system will let you play back sound samples under application control.

Given the capabilities of full-motion video, you may think that an animation capability is superfluous to an authoring system. In many cases, however, good animation is just as valuable as good video. For example, it would be difficult to videotape a chemical reaction from inside a sealed tank. However, an animation sequence of the reaction would be far more descriptive and much safer to produce. Therefore, an animation capability should be available to multimedia applications, either directly or through an easily accessible external program.

Simple animation may be adequate for some projects. However, for more advanced and sophisticated animation, you may want to use a professional animation application. If you go this route, be sure the authoring system can access the animated sequence in some way.

Showing motion video and computer information on the same screen is called *single-screen interactive video*. IBM's InfoWindows is the most popular example of a single-screen system. Single-screen boards from Edudisc, Mass Micro Systems, Orange Micro, and Data Translation have also made single-screen interactive video a reality on the Mac.

There are many pros and cons regarding one screen versus two screens for interactive multimedia. Whichever direction you choose, the authoring system should support both single-screen and

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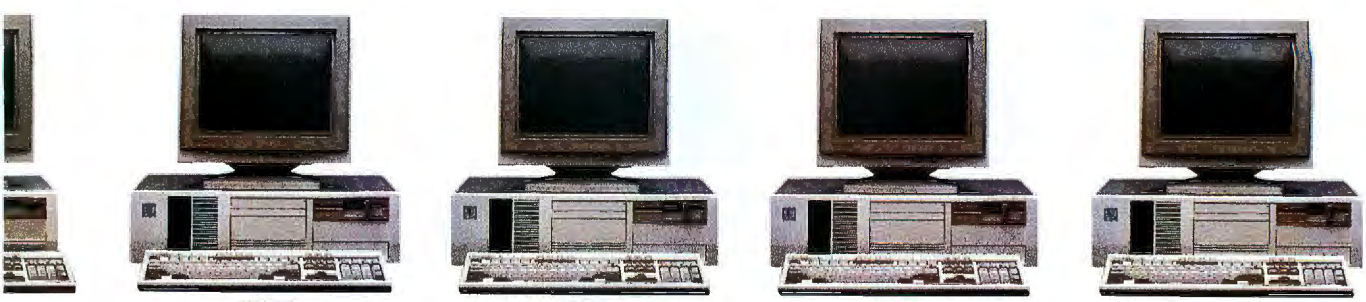

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two-screen applications. Support for single-screen interactive video should be a simple and standard procedure for an authoring system. There should be no need for special control characters or strange commands.

Although not a mandatory feature of authoring systems, special effects can add pizzazz to any interactive multimedia presentation. Special effects include dissolves, iris in/out, barn door close/open, and fade in/out. These should be available for any format you wish to apply them to, such as text screens, graphics screens, wipes to video, and animation screens. Video Builder and MacroMind Director make good use of special effects.

Media Control

Controlling external media is a prime requirement of any authoring system. Such a system should supply drivers for several laser disk players and other remote-media peripherals as standard features. Mentor/MacVideo, for example, comes with drivers for 20 different laser disk players (and player/recorders). Quest also offers numerous drivers as a standard feature. Some authoring systems provide one standard driver and then charge as much as $200 for any additional drivers you may need.

An authoring system should also have a mechanism that lets you select the specific video clips needed for an interactive multimedia course or presentation. This is normally provided by a laser disk clips editor that interfaces with your laser disk player. The key here is that the editor must provide transparent control of your laser disk player. You should not have to write any special program or initiate a string of commands just to select clips from a laser disk.

Another valuable feature of a laser disk clips editor is the ability to select clips and give them meaningful names. Once it has named the clips, the editor lets you use those clips at any time within a course or presentation. In addition, the system should let you make the clips editor available, in a limited form, to the people using the application.

Finally, an authoring system should let you access special features of your laser disk player. For example, the Pioneer LD-V 4200 provides eight lines of 20 characters per line. The Pioneer LD-V 6000A also offers some simple graphics, such as thought bubbles. You should never have to write any special code to use these character sets; the authoring software should provide the access.

Just for Students

If you plan to create educational and training courses instead of more generalized interactive presentations, you will need some special features that let you evaluate people using the courseware.

An authoring system used primarily for training should maintain records of people who participate in an interactive multimedia course and permit you to extract such information from the course. The records might include such things as the number of correct answers a person made, or how long it took a particular person to finish a specific section. In addition, you should be able to export evaluation data to programs such as Microsoft's Excel or Lotus 1-2-3, where it can be analyzed and graphed.

Another useful feature for training applications is weighted branching. This

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lets an application track the percentage of correct answers or the percentage of correctly answered questions. Using weighted branching, you can specify that students can't progress to a higher level of instruction until they correctly answer 90 percent of the questions in a single topic area.

Finally, an educational application should have the ability to handle fill-in-the-blank, true-false, and multiple-choice questions. When used correctly, fill-in-the-blank questions can simulate an AI interface. The authoring system should have parsing capabilities to deal with multiple-word answers, foreign spellings, and credit for randomly ordered answers and common misspellings.

Spreading the Word

An authoring system should provide a run-time option that lets you distribute an application to people who don't own a copy of the authoring system. People using the applications should be able to run them as they would any other piece of software.

Additionally, you should be free to distribute run-time applications without worrying about licenses. Some companies charge a royalty fee for every course or presentation you sell that was created with their authoring system. You should not have to pay any royalty fees for the courseware or presentations you create with an authoring system and sell commercially.

The Big Picture

Authoring systems are only a part of the interactive multimedia puzzle, albeit a large part. In putting together a multimedia system, however, you shouldn't downplay the importance of the many adjunct tools that add style and professionalism to your interactive multimedia projects: graphics software, scanners and video digitizers, audio digitizers and sample editors, video-editing software, titling software, and specialized script-writing and storyboarding software. Not to be forgotten are the general-purpose applications, such as project managers, spreadsheets, word processors, and desktop publishing programs.

In the future, look for a ton of new software aimed at the multimedia market. Presently, multimedia hardware development has definitely outpaced multimedia software. But the hardware needs software to make it go. Authoring systems will have to be continually updated to take advantage of the hardware advances and match the evolving demands of multimedia users.

Imagineering

Authoring systems provide most of the tools needed to create sophisticated and powerful interactive multimedia courseware. However, any authoring system is only as good as the creativity and imagination of the author.

Walt Disney coined a term, *imagineering*, to describe the creative use of technology. You may not have the budgets and the talents of a major film studio, but multimedia can let you take advantage of the technology you have in unique and creative ways. ■

Mark D. Veljkov is an interactive multimedia design specialist at Western Washington University and coauthor of Creating Interactive Multimedia: A Practical Guide. *You can contact him on BIX c/o "editors."*

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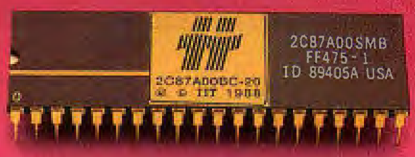

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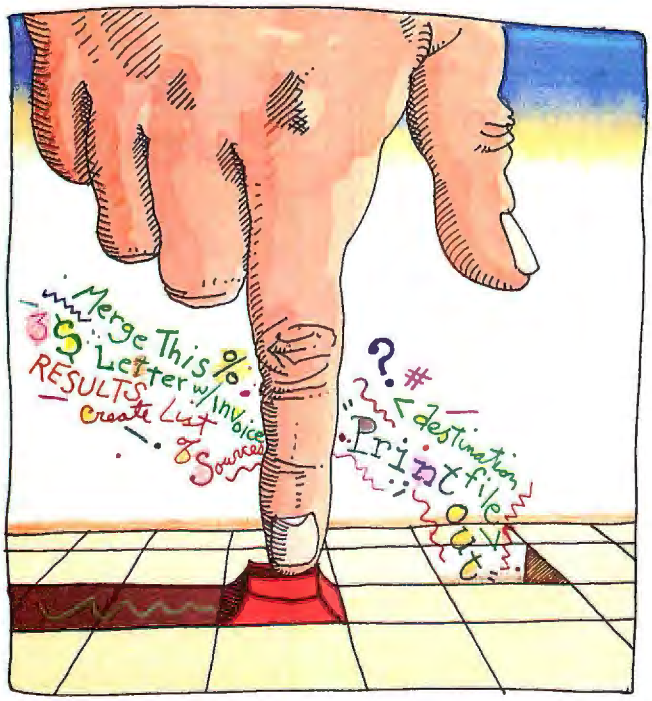
Scripts Unbounded

A new generation of scripting languages lets you control any aspect of your computing environment

Bob Ryan

Standardization—where would we be without it? Without machines and software applications that look and perform the same for different users in different places at different times, computing would be chaos. Standard hardware encourages the development of standard software, which allows everyone in a huge, multinational corporation to perform the same tasks with the same tools.

The problem with this rosy picture is that standards, and the tools based on them, must be general enough to appeal to many different users. This can be frustrating when your needs don't exactly match the specifications of any commercially available tool. In the best of both worlds, you'd be able to customize standard tools to best fit your needs. Enter scripts.



Talking Heads

What is a script? It depends on whom you talk to. Most telecommunications packages let you write scripts (or produce scripts by recording your actions) that automate part or all of a telecommunications session. For example, you can create a script that accesses your E-mail service and downloads your messages. You can even have a program launch a script when the internal clock of your computer reaches a predetermined hour. For telecommunications, then, a script provides the means to access the features of a program automatically.

Apple Computer refers to the sequence of HyperTalk statements that define a HyperCard stack as a *script* (see photo 1). In this case, the script is composed of the statements of a programming language—albeit one that you can access and manipulate without needing to know its underlying syntax. The HyperTalk language allows you to access and control certain aspects of the Macintosh environment without having to delve into the complexities of the Mac Toolbox.

The most familiar scripts in the personal computing universe are the millions of variations of AUTOEXEC.BAT, the script file that the MS-DOS command processor executes whenever you boot an MS-DOS computer. In fact, you can say that every DOS command is simply a single-command script. The power of scripts only becomes evident, however, when you string a number of commands together.

Common Ground

Despite differences in purpose and syntax, all scripting languages must exhibit some common features. First and foremost, scripts must be accessible. You have to be able to easily create, modify, and execute scripts. Most applications

continued

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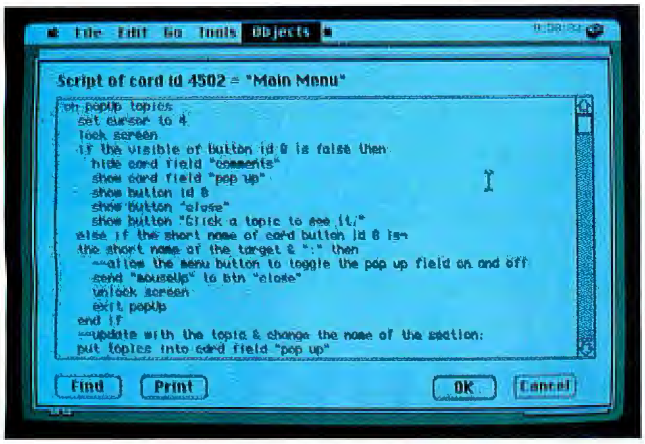

Photo 1: *This fragment from a HyperTalk script shows the English-like nature of the language. It is designed to be easy to learn and use.*

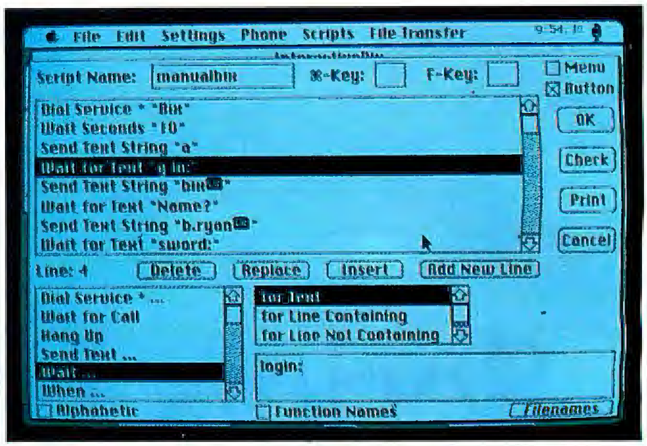

Photo 2: *Microphone II from Software Ventures is a Macintosh communications program that records scripts and lets you edit them. Its point-and-click editor makes syntax errors virtually impossible.*

that support scripts make creation a snap by supplying a facility that turns your actions into a sequence of scripting commands (see photo 2). On the other hand, scripting languages that work on the operating-system level usually require that you create your scripts with a text editor. In any event, scripts must be available as text files that you can edit.

In addition, a scripting language should provide you with control structures that let you determine the actions to be taken based on specific conditions. For example, the MS-DOS batch facilities contain limited facilities for testing conditions and branching. Others, such as PERL (a Unix scripting language), contain many of the control structures and variable-handling capabilities that you normally associate with traditional

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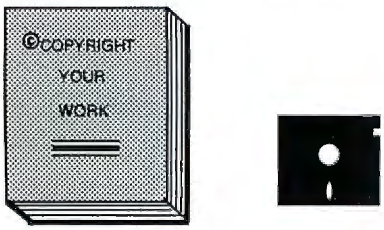

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Scripts, Unix Style

Ben Smith

Unix, like other minicomputer and mainframe operating systems, is very dependent on scripting languages. Many, if not most, Unix utility programs are designed for use in shell scripts—command files that are written with the language for interacting with the operating system. Some Unix utilities are actually just scripts themselves.

Listing A: *This PERL script applies the command you supply at each directory in a directory tree starting at the current directory. It is interactive in that it prompts for a command if you do not supply one on the command line.*

```
#!/usr/bin/perl
$| = 1;
if ($#ARGV >= 0) {
    $cmd = join(' ',@ARGV);
}
else {
    print "Command: ";
    $cmd = <stdin>;
    chop($cmd);
    while ($cmd = s/\$//) {
        print "+ ";
        $cmd .= <stdin>;
        chop($cmd);
    }
}
$cwd = 'pwd'; chop($cwd);
open(FIND,'find . -type d -print|') || die "Can't run find";
while (<FIND>) {
    chop;
    unless (chdir $_) {
        print stderr "Can't cd to $_0;
        next;
    }
    print "--> ",$_,"0;
    system $cmd;
    chdir $cwd;
}
```

Bourne, Korn, Berkeley

The three Unix shells are the Bourne shell, the C shell, and the Korn shell. The Bourne shell is the original Bell Labs Unix command interpreter. The C shell, which was developed at Berkeley, is now widely distributed. The Korn shell is a Bourne shell–compatible language that provides the advanced facilities of Berkeley's shell.

All three shells can be used to create sophisticated applications since they all can take parameters; have internal, named variables; control flow, including looping and case statements; and have commands for interactive control. An excellent example of a complex Bourne-shell script is the Run file that controls the BYTE Unix benchmarks (see "The BYTE Unix Benchmarks" in the March BYTE for a description of how it works).

Aho, Weinberger, Kernighan

Other than the shell scripts, the most popular Unix scripting language is awk, a text parser and formatter. Bell Labs Unix developers Alfred Aho, Peter Weinberger, and Brian Kernighan developed the awk utility for the common data construction of records and fields.

Although its variables are typeless, the awk utility can perform important mathematical operations, such as exponential and logarithmic functions, random-number generation, and trigonometric functions. Its greatest strength is in its broad range of string-manipulation functions.

The awk utility makes extensive use of *regular expressions*, a standardized notation for specifying and searching for strings. All awk instructions consist of a condition and a block of instructions (enclosed in curly braces) for that condition. The usual condition is a regular expression, but you can use any condition. Two special conditions, BEGIN and END, are predefined to be true only before and after (respectively) any data is parsed.

By default, the record separator is the new line, and the field delimiter is any other white space (tabs and spaces). The syntax for a field is a dollar sign followed by the field number. For example, $2 represents the second field in the current record. The awk utility has pre-

programming languages like C or Pascal. In general, however, even more advanced scripting languages are a far cry from general-purpose programming languages. If a scripting language isn't easy to use, it isn't very practical.

Environmental Matters

In general, a script is a sequence of commands that lets you automatically control a particular computing environment. The commands available in any environment define its scripting language.

Take, for example, the telecommunications program mentioned earlier. Scripts let you control the environment—in this case, the program itself—by using the commands in a scripting language. The language is defined by the environment and only works within that environment. Trying to execute the script elsewhere—for example, trying to execute a Procomm script with HyperCard—will get you nowhere.

A script out of its environment is like a fish out of water. HyperText without its interpreter is as useless as AUTOEXEC .BAT without its command processor, COMMAND.COM. Each scripting language has its own scope; some work within individual applications, others work at the operating-system level. With some operating systems, a single scripting language predominates (e.g., the DOS scripting facilities). Other environments use many different scripting tools. Unix is a prime example of this diversity of scripting facilities (see the text box "Scripts, Unix Style" above).

In some cases, you can mix scripting environments to achieve an even greater degree of automation and control than you can get from a single scripting language. For example, you can call a telecommunications package such as Pro-defined variables that keep track of the various possible states it may be in.

Pathologically Eclectic Rubbish Lister

The PERL scripting language is relatively new and not part of the Unix distribution. It is a free program donated to Unix users by Larry Wall of the Jet Propulsion Laboratory (Pasadena, CA). This scripting language combines all the capabilities of shell scripts, awk, sort, and sed (for stream editor), along with fast functions for doing system and network management. Because so much is available from within the PERL interpreter, it is seldom necessary to spawn child processes to run supporting tasks such as sorting and formatting. The effect is that PERL scripts are much faster than shell scripts that use Unix utilities.

The PERL script in listing A doesn't use subroutines, but it includes an example of an internal implementation of the standard Unix command chdir and the ability to use child processes with system.

PERL has many predefined variables, most of which are designated with a dollar sign and a special character; for example, the $_ variable is used to hold the current record. Unlike awk variable names, all PERL scalar variables are designated with a leading dollar sign. Arrays are designated with a leading @ sign, and associate arrays are designated with a leading % sign.

Ben Smith is a BYTE technical editor. He can be contacted on BIX as "bensmith."

Listing 1: *This script demonstrates how Bridge can control different programs to create a "superapplication." You launch programs with the* exec *keyword and send input to a program using* put. *Note the use of parameter substitution for the variable* shot *in the* for *loop.*

```
rem Bridge program for a slide show of saved screens. Screens
rem were saved to clipboard with Windows 3.0 PRINT-SCREEN
rem function, then to file from clipboard. SCRSHOT.EXE pastes
rem a bit map to the full screen.

rem run clipboard, alias clip, and minimize
exec /n:clip clipboard; minimize

rem run 2 instances of pbrush to load palette
rem send commands "file open FILENAME", then use tabs and
rem arrows to check the pcx option in the file-open dialog

exec /n:pb1 pbrush; put
"%%foc:\tgl\sunset.pcx{TAB}{TAB}{TAB}{DOWN}{DOWN}~"; minimize
exec/n:pb2 pbrush; put
"%%fos:jon_u\vignette.pcx{TAB}{TAB}{TAB}{DOWN}{DOWN}~"; minimize

rem loop through list of saved clipboard files
rem select clipboard, send command "edit delete"
rem send command "file open LOOP-VARIABLE"
rem run scrshot.exe, a program to display a bit-map full screen
rem send key HOME to scrshot.exe, to activate display
rem wait for any key
rem send key END to scrshot.exe, to end program

for shot in (sqlwin pm designer bridge actor dynacomm)
  select clip; put "%%ed~";
  select clip; put "%%fo\jon\junk\%shot%.clp~"; minimize
  exec /n:screen \windev\samples\scrshot\scrshot.exe;
  select screen; put "{HOME}"
  wait /k; select screen; put "{END}"
next shot

select pb1; close
select pb2; close
```

comm from within a DOS batch file and have it execute a predetermined script file (by including the /f option on the Procomm command line). This intermixing of scripts is called *nesting*: The DOS script calls Procomm, which in turn executes the script you specify. Once the Procomm script finishes, it exits the program and returns control to the DOS script. This ability to nest scripts greatly expands your scripting options.

The practical problems of nesting scripts, however, are difficult to overcome. For instance, in the above example, you have to know two different scripting languages—one for DOS and one for Procomm. If you wanted to control another application from within the same batch file, you'd have to learn a third scripting language. An obvious solution to this dilemma is for DOS and all its applications to support a common scripting language. Retrofitting such a language into DOS would be practically impossible at this point, but including such a facility with newer, graphical user interface (GUI) based systems could fundamentally change how you view computer applications. Instead of treating programs as stand-alone units, new and coming scripting facilities let these programs cooperate as never before.

New Horizons

Although most GUIs provide a command-line interface, providing access to GUI features using scripts has been sorely lacking. Many utilities on many different platforms let you record mouse movements and menu selections, but few let you edit such macros and use them in scripts. Also, despite the uniformity that most GUIs demand from applications, few provide an easy, automatic way for programs to work cooperatively. Lately, however, a few companies have pointed the way by providing the type of scripting facilities required by a multitasking GUI environment.

Leading the way has been Rexx, a scripting language developed at IBM and now available on many systems. Rexx for OS/2 and ARexx for the Amiga provide you with the ability to integrate stand-alone programs into one application (see "Rexx in Charge" on page 245), because they work at both the level of the operating system and the applications level. Other systems and products are following suit.

Bridge from Softbridge (Cambridge, MA) is such a product. This new Windows 3.0 scripting language allows you to launch Windows and DOS applications; control windows, menus, and dialog boxes; provide keyboard input; and supervise dynamic data exchange between different applications (see listing 1). It can even pass messages between applications that are "Bridge-aware." It does all this using scripts that you can modify.

When used with Bridge-aware applications, Bridge permits you to control many internal aspects of a program, not simply feed it input and retrieve output.

continued

Individual programs are no longer standalone but can cooperate to create multiprogram applications. Unlike Rexx for OS/2 and ARexx, which are endorsed by IBM and Commodore, respectively, Bridge comes from a third party. Consequently, finding Bridge-aware applications is a more difficult proposition.

Not-So-Secret Agents

NewWave, Hewlett-Packard's object-oriented extension to Windows, also provides powerful facilities that let applications work cooperatively. It provides transparent data exchange between any two NewWave applications. More important, it lets you create *agents*—scripts that can control the operation of NewWave programs.

Agents allow you to automate tasks that span multiple applications. You use them to combine the functions of databases, spreadsheets, and graphics programs into a seamless "superapplication." The cost of such integration must be borne primarily by the individual software developers, who must ensure that agents can access their applications.

The Last Holdout

The Mac is one of the few platforms that don't offer a command-line interface. Consequently, it doesn't have a built-in scripting capability, and Mac users have been unable to automate many of their tasks. Given the capabilities provided to other platforms by languages such as Rexx and Bridge, it isn't surprising that Apple is readying its own scripting language, called AppleScript.

AppleScript, which is expected sometime after the initial release of Mac System 7.0, will provide a powerful, interapplication communications and control capability to System 7.0 programs. It uses System 7.0 interapplication communications to tie applications together. It passes AppleEvents between these applications. AppleEvents are messages understood by cooperating applications.

Best of all, AppleScript is a powerful language that will let you control multiple applications using a single script. You'll be able to pass data and events between applications. For example, you could have your communications program download stock information into a spreadsheet, which would massage the data and pass it along to a graphics program, which would produce and print a graph—all with one click of a button. AppleScript extends the concept of a common user interface to the inner workings of applications, not just their external appearance.

Future Scripts

Obviously, scripting languages aren't just for batch programming anymore. They are evolving into the glue that connects multiple applications in graphical, multitasking environments.

In the future, you will see more applications that support the kind of communication and cooperation provided by products like Rexx, Bridge, and NewWave. As they become indispensable tools in a GUI environment, the scripting languages themselves will change. They will become easier to work with, perhaps by providing a visual-programming interface. The most important change, however, will be in how you work with your application programs. The standalone program is dead; long live scripting languages. ■

Bob Ryan is a BYTE technical editor. You can contact him on BIX as "b.ryan."

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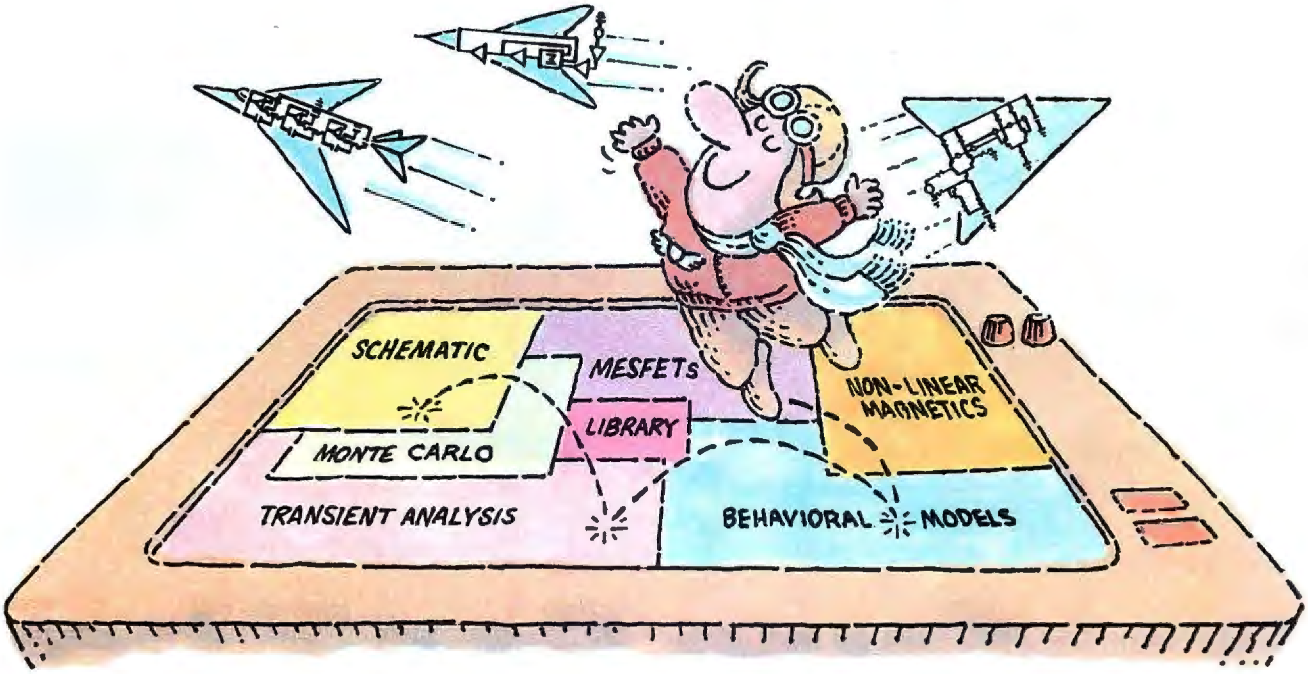

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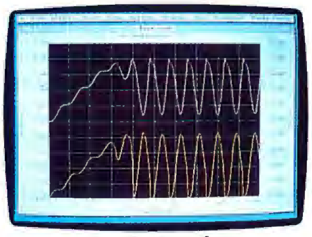

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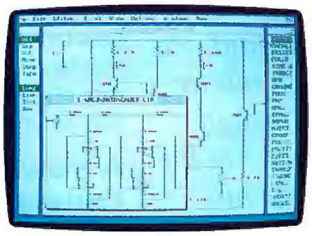

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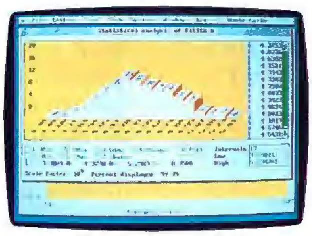

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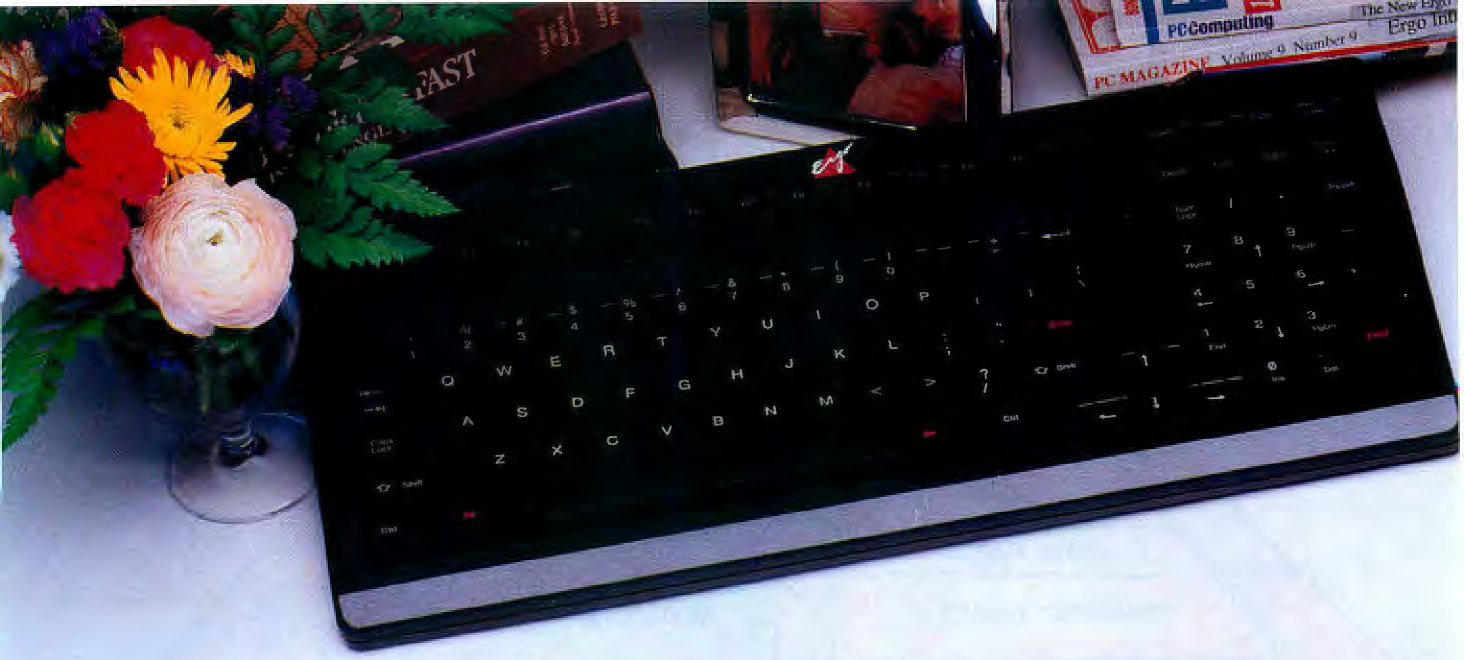

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Rexx in Charge

You're not really multitasking in OS/2 unless you're using Rexx

Charles Daney

OS/2's most highly touted feature is its multitasking environment. Until recently, however, OS/2 multitasking simply let you run multiple applications at once—any communication between and coordination among your various applications were rudimentary or nonexistent.

Rexx can change all that. It lets you control and coordinate the actions of any two or more applications that support its interface. In effect, it lets you create super applications out of your current stand-alone programs. If its experience on other platforms is any indication, Rexx could soon become a vital factor in the success of OS/2.

The Background Story

Rexx is a structured high-level programming language that was consciously designed to be easy to read and write. It was conceived and first implemented between 1979 and 1982 by Mike Cowlishaw of IBM. During this time, Rexx was widely disseminated within the company. Consequently, it was improved by the feedback of hundreds of users. Rexx was first made commercially available as the system-procedure language for IBM's VM/CMS operating system in 1983.

When IBM announced its Systems Application Architecture in 1987, it included Rexx as the standard system-procedure language. By doing that, IBM indicated that Rexx would eventually be implemented in a standard way on all the company's strategic computing systems. IBM brought out an implementation for the MVS system in 1988. Finally, this year, the company released an implementation of Rexx for OS/2 in IBM's Extended Edition 1.2.

Various third parties have also implemented Rexx on a number of computers and operating systems. Mansfield Software Group created the first such implementation, known as Personal Rexx, for MS-DOS in 1985 (see "Personal REXX," January 1988 BYTE). Mansfield followed with a version of Rexx for OS/2 in 1988. ARexx for the Commodore Amiga made its debut in 1987 (see the text box "ARexx at Work" on page 246).

Design Goals

Mike Cowlishaw's description of Rexx emphasizes that the language was designed with end-user personal programming in mind: "Rexx is a procedural language that allows programs and algorithms to be written in a clear and structured way. The primary design goal has been that it should be genuinely easy to use both by computer professionals and by casual general users. A language that is designed to be easy to use must be effective at manipulating the kinds of

continued

ILLUSTRATION: JOSEPH CIARDIELLO © 1990

symbolic objects that people normally deal with: words, numbers, names, and so on. Most of the features in Rexx are included to make this kind of symbolic manipulation easy" (see reference 1).

There are several key characteristics of Rexx that contribute to its ease of use. These are as follows:

- character-string orientation
- dynamic data typing (no declarations)
- automatic storage management
- content-addressable data structures
- straightforward access to system commands and facilities
- few artificial limitations

Its ease of use does not limit Rexx's appeal to nonprogrammers only. Because Rexx programs can be developed

continued

ARexx at Work

Steve Gillmor

By including it as an integral part of version 2.0 of the Amiga operating system, Commodore acknowledged the central role ARexx has played in bringing the power of mainframe interprocess communications to the multitasking Amiga. When first introduced in 1987 by Bill Hawes, ARexx was perceived primarily as a macro tool for creating utilities that automated various housekeeping activities and for reconfiguring text editors to look and feel like editors found in Unix and other environments. Soon, however, the potential of applications that sported ARexx communications ports became evident.

Much of this potential comes from extended-function libraries that provide the ability to bring up windows and menus under ARexx control. Now, many products sport extensive ARexx hooks that let you control them from other applications or, conversely, let them control other programs. For example, ARexx lets you select fields from your database and load them into a text editor, such as CygnusEd from ASDG, or send them to a spreadsheet for processing and display.

This kind of multiple-program integration—in which stand-alone programs work like one super application—bears a surface resemblance to HyperCard. However, it doesn't have the limitations imposed by trying to patch together a subset of various properties under a single-tasking umbrella.

Beyond HyperCard

You can find ARexx in many Amiga hypermedia products, from hypertext ones like Poor Person Software's Thinker to the HyperTalk-like UltraCard Plus from Intuitive Technologies. UltraCard uses ARexx to exploit multitasking. For example, UltraCard can interact with an ARexx-compatible paint program, such as NewTek's Digi-Paint 3, rather than having to provide its own bit-mapped paint system.

Inovatronics' CanDo shares some hypermedia concepts with UltraCard, but it's primarily an applications generator that can create stand-alone programs that send and receive ARexx commands. This lets you customize program front ends to control ARexx-speaking tools. For example, Express Copy from Express-Way, an archive utility, lets you select files for backup from one directory while it archives another directory—all under the control of a CanDo deck.

Other interactive presentation programs, such as Electronic Arts' Deluxe Video III, The Right Answers Group's The Director, Very Vivid's InterActor, and Commodore's AmigaVision authoring system, support ARexx to some extent. These tools can take advantage of the Amiga's IFF image and sound compatibility standard, and animations that support the ANIM OP5 format.

ARexx is useful not only in tying things together, but in automating and customizing the production of the various elements of multimedia presentations. For example, you can prepare a shooting script using a word processor, and control styling and font selection via ARexx macros.

You can then generate titles simply by exporting that text in an ARexx string to a three-dimensional package, such as Mindware's Page Render, where the individual letters can be extruded, rotated, and animated. Objects in Page Render, as well as in other animation packages, can be moved and rotated under ARexx script control. Thus, you can render complex and lengthy animations in overnight unattended sessions.

MacroPaint from Lake Forest Logic lets you create ARexx macros that draw, for example, a diamond shape. You can then add this macro to a list of available user tools. These appear in the program's toolbox as icons, alongside the basic line, flood fill, and other hard-coded effects.

ARexx support is also available for preparing animation productions you want to transfer to videotape. Using MicroIllusions' Edit Decision List Processor, you can have ARexx automate list conversion, calculation, sorting, and transfer for multiple lists. At the hardware level, you can control genlocks via ARexx, letting you automatically fade Amiga visuals in and out over live or taped video.

Once you've assembled all the elements of a multimedia presentation, the focus turns to providing the most effective display strategy for your mix of pictures, animations, sound effects, MIDI sequences, and videotape and laser disk scenes. Gold Disk's new ShowMaker is one program that coordinates all these elements, using multitasking and memory management techniques to maximize the display of Amiga animations, titles, and audio in real time. Through ARexx, it can interactively load sequences, depending on the choices you make in your authoring system.

The Snowball Effect

By bundling ARexx and AmigaVision with AmigaDOS 2.0, Commodore has, in effect, expanded the developer community to include almost all of the nearly 1.5 million Amiga owners worldwide. Releasing an Amiga product without ARexx support no longer makes sense, and the next few months should see ARexx ports added to leading desktop publishing, image-processing, and music applications. Much of the success of the Amiga as the multimedia platform of choice will hinge on the continued acceptance and use of ARexx.

Steve Gillmor is a freelance writer in Charleston, South Carolina, who specializes in the Amiga. You can reach him on BIX as "tchase."

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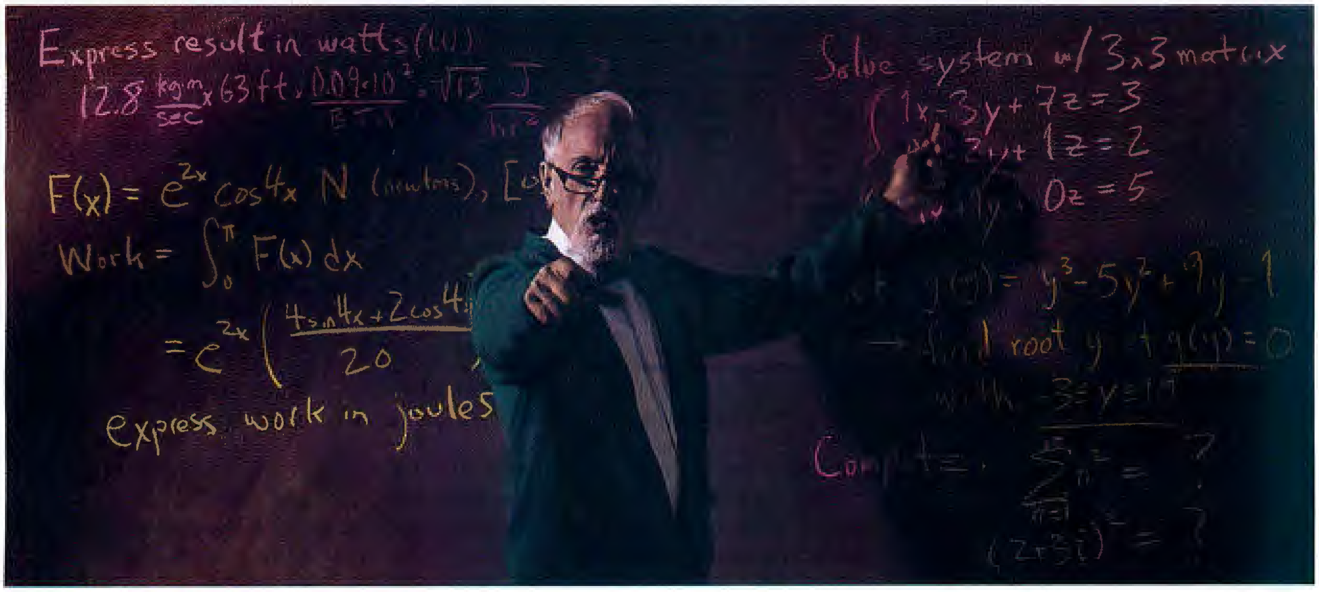

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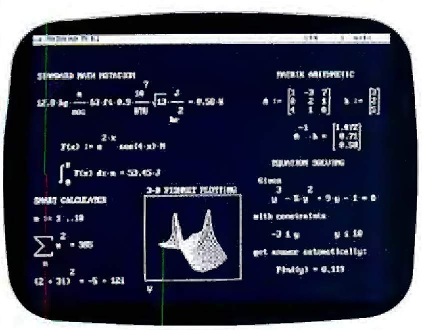

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and debugged much faster than programs in most conventional languages, it is also useful to professional programmers who need a utility programming language for quick-and-dirty jobs.

The Rexx Look

Rexx looks like a fairly conventional language, not too different from Pascal, C, or other languages that trace their ancestries to Algol. Consequently, Rexx has much in common with Algol-like procedural languages—variables, expressions, control structures, subroutines, and I/O facilities.

Listing 1 shows a Rexx program that prompts for a filename, asks you to make a selection from a menu, and executes a command corresponding to the selection. The fact that the program should require no further explanation to be understood illustrates the naturalness and readability of the language.

Rexx is first and foremost a system-procedure language. Specifically, the capability to execute system or application commands is an integral part of the language, rather than a function that is available (if at all) only through library routines. In other words, like a Unix shell language or the MS-DOS and OS/2 batch language, the Rexx language automatically passes commands to the surrounding environment for execution. This characteristic is the reason Rexx is often referred to as a universal macro language.

One Type Fits All

Perhaps the most noteworthy departure of Rexx from other Algol-like languages is its "natural" data typing. All data is treated as character strings. Numbers, including both integers and reals, are just special cases of strings. Numbers need to be recognized as such only for computational purposes, but Rexx requires no explicit conversion—no formatting—for communications with users. This alone is a major aid to usability, as anyone who has ever been baffled by a format statement can testify.

Another consequence of this approach is that Rexx never requires data declarations. (In fact, data declarations are not even possible.) Other languages provide data declarations for the convenience of the compiler, not the programmer. Declarations are an accommodation, because computers use a variety of internal data representations for different purposes and must be told which representation to use for a given data item. Rexx isolates you from concern with these internal representations.

Listing 1: *A complete Rexx program. It requires no further explanation to be understood. This illustrates the naturalness and readability of the language.*

```
/* execute file utilities */
say 'Enter file name:'
pull file_name
say 'Choose a file operation by number:'
say '  1 - Edit'
say '  2 - Print'
say '  3 - Delete'
pull response
select
when response = 1 then 'edit' file_name
when response = 2 then 'print' file_name
when response = 3 then 'erase' file_name
otherwise
say response 'is an incorrect choice.'
end
exit
```

A further side effect of treating data as character strings is that there are no inconvenient limits on the magnitudes of numeric data items. Although seldom required, hundreds of digits can be handled in Rexx as easily (from the outside) as five or six. Subtle errors resulting from the inability to represent a number in a particular word size are not possible. This also makes Rexx programs much more portable.

In conventional languages, data declarations not only specify internal representations but also define storage allocation. Since there are no declarations in Rexx, it is not necessary to worry about allocation issues (at least as long as there is enough storage available). This is another great simplification. All data items, even elements of arrays, are allocated storage automatically when, and only when, they are required.

One other pleasant benefit of Rexx's dynamic memory management is that, even on a CPU without memory protection, Rexx is almost crash-proof. One of the most unpleasant experiences in programming is the tendency for undebugged programs to crash themselves, other programs, or even the operating system, because they have overwritten their own code or code belonging to other applications or to the system. With the exception of functions explicitly providing access to external memory, this is impossible in Rexx.

A Simple Compound Array

Another unusual feature is the way Rexx handles arrays. In Rexx, data variables have names that are either simple or compound. A *simple* name is just a sequence of alphanumeric characters that contains no periods. A *compound* name is composed of two or more simple names connected by periods (e.g., `age.fred`). The portion of a compound name before the first period is called the *stem*; it is taken literally. The remaining portion of the name is itself a variable—in effect, the subscript.

To work with arrays of any number of dimensions, you use a stem followed by the appropriate number of subscripts. For instance, `temperature.x.y.z` is an element of a three-dimensional array called `temperature`. If the variables `x`, `y`, and `z` have values 1, 2, and 3, respectively, this element is `temperature.1.2.3`.

There are many important points here. The first is that Rexx doesn't allocate storage except for array elements that have actually been assigned values. The subscripts may be as large as necessary, but if only three elements have values, then only these are allocated storage. Thus, the array can be very sparse.

But more important than that, array subscripts need not be numeric—they can have any data value at all. This permits *associative indexing* in which the subscripts are general nonnumeric data. For instance, you can have an `age` array whose elements include, in particular, `age.fred`, `age.sally`, and so on. Subsequently, a computation can deal with a data reference like `age.person`, where `person` is a variable that ranges over values `fred` and `sally`.

Playing the Strings

As you can see, the uniform representation of data as character strings is very important in Rexx. This is connected with another design objective of the language, which is to place a great emphasis on symbolic manipulation. Because most system commands and application programs use arbitrary strings of symbols rather than numbers to interact with users, or with Rexx, this is a necessity for a system-command language.

The most basic operation involving character strings is concatenation, so Rexx makes it as easy as possible to express. There are several flavors of concatenation. The following example illustrates two of them:

```
'The date is:'
  month'/'day'/'year'.'
```

Here, strings in quotes are literals, while `month`, `day`, and `year` are variable names. In this expression, all these parts are simply concatenated. The extra blank before `month` is even retained, because it is actually the operator for "concatenate

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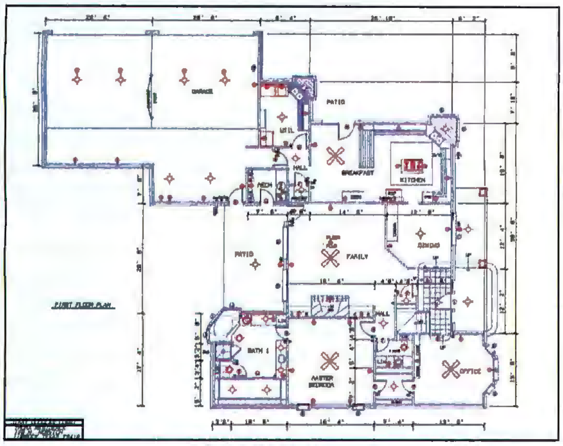

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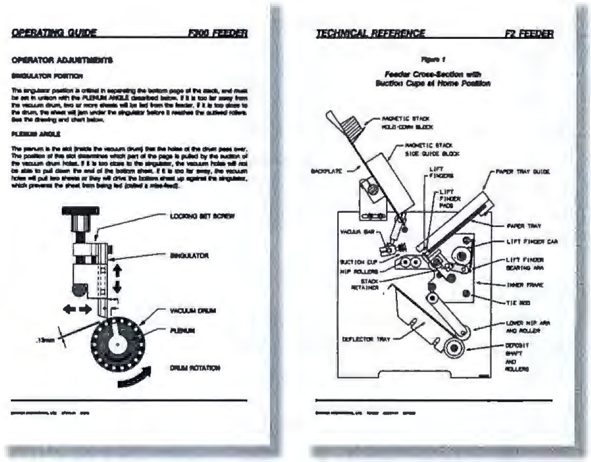

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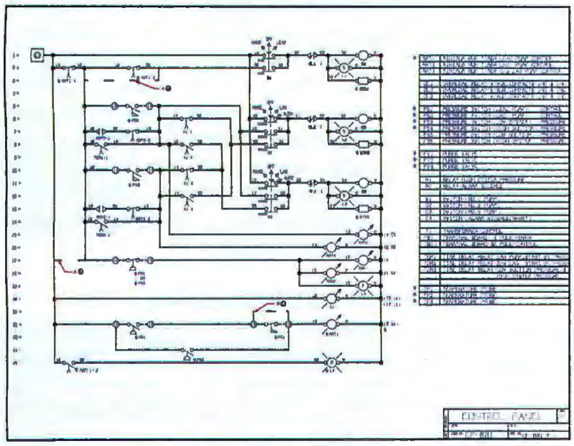

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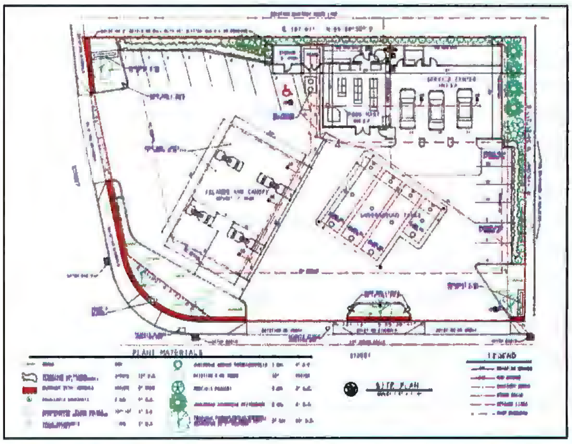

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with a blank in-between." No explicit operator is required to express direct concatenation. (An explicit operator, ||, is provided for cases where juxtaposition alone would be ambiguous.)

Rexx provides many other character-string manipulation primitives by means of built-in functions. Included are such operations as substring, replacement, insertion, translation, verification, searching, and the like. There are even operations to reverse the characters of a string or to center a string in a given field. Because it is frequently useful to treat a string as a sequence of words delimited by blanks, Rexx includes functions to count and extract such words.

Universally Used

While traditional computer languages are designed primarily for professional programmers, there are many sorts of languages designed for end users, as well as for professionals. These are variously called macro, script, batch, and shell languages. Their function is not so much to write general-purpose programs as it is to control an application, a group of applications, or the operating system. Macro languages for spreadsheets and word processors, and script languages for communications programs are the best-known examples of these languages. Such languages are the most widely used computer languages.

Although there are some fortunate exceptions, many of these languages are just as hard to use as traditional programming languages. They also present other problems besides ease of use. As Bill Gates put it, although macro languages are powerful and effective in creating programs, they are limited in three basic ways. Too many of them exist, they are normally bound to a specific application, and they don't have the power and flexibility of traditional programming languages (see reference 2).

If you look beyond the personal computer industry, however, you find that Rexx addressed and solved these problems long ago. Rexx combines a sufficiently rich and powerful language and a set of interfaces for communicating between the language and other applications. In fact, the interfaces are more important in this regard than the details of the language.

The Rexx Advantage

What separates Rexx from other macro languages is that it can communicate with any application that implements the required interfaces. Thus, it can act as the single macro language used by all such applications. You need only learn a single language to write procedures that control any number of different applications.

Rexx can communicate with any application that uses the required interfaces.

This is precisely what happened with Rexx in VM/CMS and even more dramatically with ARexx on the Amiga. For this approach to work, software vendors must support the same interfaces in their own applications. For example, in VM/CMS and on the Amiga, you find many applications and development tools—editors, word processors, database systems, spreadsheets, and communications packages—that use Rexx as their macro language.

Even better than a single language able to control multiple applications sequentially is a language that can control them simultaneously. Such is the case with Rexx. In a multitasking environment, it acts as the "glue" that lets you combine powerful, general tools (that support its interface) in useful and interesting ways. It supplies the integration that makes it easy to build larger systems out of simpler building blocks. It provides a flexible interprocess communication facility that the user, rather than applications designers, controls.

Breaking the 640K-byte Barrier

Several of MS-DOS's well-known limitations, especially the 640K-byte memory limit, have prevented Rexx from realizing its full potential. Today's most sophisticated DOS applications tend to use all the available memory for themselves. They rarely leave even enough room for a Rexx interpreter, to say nothing of other applications of similar power. Storage limitations alone preclude the use of the building-block approach that Rexx excels at supporting.

The lack of multitasking is MS-DOS's other big problem that deprives Rexx of much of its potential. Significantly, both VM/CMS (with its multiple virtual machines) and AmigaDOS, where Rexx has had great success, support multitasking. The importance of multitasking lies in the fact that independent, autonomous applications can coexist and operate simultaneously to provide whatever services they were designed for. And now, such applications can communicate and be coordinated through a common command language—Rexx.

These considerations imply that OS/2, which supports both multitasking and large address spaces, is an ideal environment for Rexx. All that OS/2 needs to support Rexx as a universal macro language are well-defined and documented interfaces for communication between Rexx and individual applications. IBM has provided these interfacing standards with OS/2 Extended Edition 1.2. You will find support for the standard interface both in IBM's Rexx, which is provided with OS/2 Extended Edition, and in Mansfield Software's Personal Rexx, which supports all releases of OS/2. (Personal Rexx in DOS and ARexx in AmigaDOS use equivalent but different interfaces in their respective environments.)

Because the interfaces are published industry standards, anyone can use them freely to take advantage of Rexx as a command language. Several OS/2 applications that do this have already appeared, including IBM's Dialog Manager, Mansfield Software's KEdit text editor, and Quercus Systems' RexxTerm asynchronous communications package. If the experience with ARexx on the Amiga is any indication, a Rexx interface should become a common feature on OS/2 applications.

The OS/2 Connection

There are several parts of the Rexx interface definition under OS/2. The first and most important is a system call named `rexxsaa` that lets any application instruct the Rexx language processor to execute a particular Rexx program. This program may be in a disk file or loaded into memory (for efficiency, if it is called repeatedly). You can pass several kinds of information in the `rexxsaa` call, but the most important information is the name of the initial Rexx environment.

In Rexx, an environment is systems or applications code that can execute a command that is issued in a Rexx procedure. The default environment receives commands if you do not explicitly use the Rexx `address` instruction.

In OS/2, for example, the system command handler, CMD.EXE, has a Rexx interface. It executes a file that has a CMD extension as a Rexx procedure, if the file begins with a Rexx comment (i.e., something enclosed between /*

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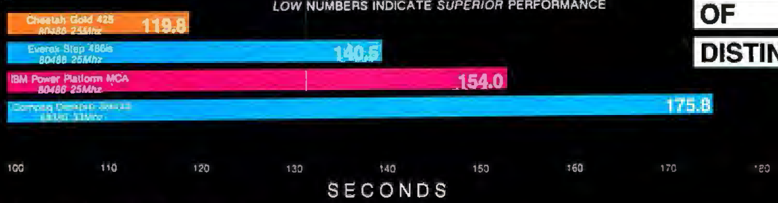

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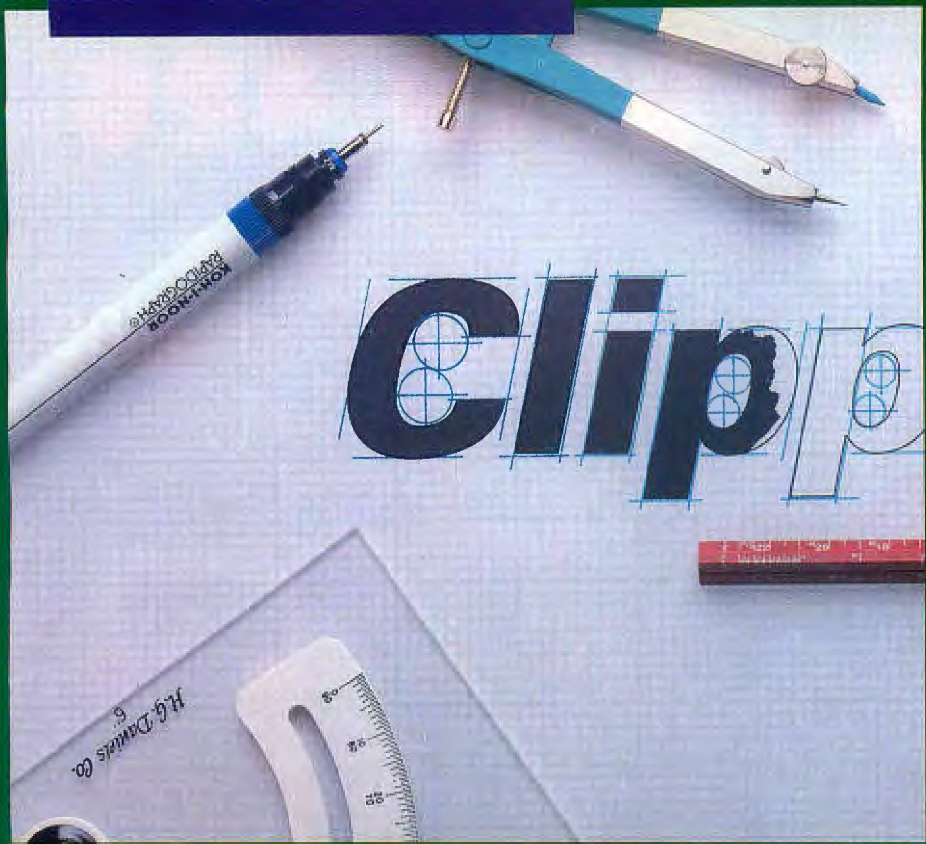

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and */). This means you can write system batch procedures in Rexx as well as in the primitive batch language that OS/2 inherited from DOS. When you execute system commands in such a procedure, they are passed back to CMD.EXE in an environment named `command`.

You use the `address` instruction either to send a command to a specifically named environment or to change the name of the default environment.

Assuming Command

Perhaps the most important feature of Rexx for OS/2 is that any Rexx-compliant application can act as a command environment. Such applications register with Rexx, making it known that they provide a Rexx subcommand interface (usually called a subcom interface). This interface lets an application receive and execute commands from a Rexx procedure. Such an application need not have started a Rexx procedure with `rexxsaa`. Any data-link library (DLL) in the system can register an environment name with Rexx and process commands from any Rexx procedure. That is, environment names can be global to the system. It is this feature that allows Rexx in OS/2 to act as the glue for integrating multiple applications.

If the subcom handler is contained in a DLL, the registration process records the DLL name and the procedure name of the handler. If the handler is part of an .EXE file, where the environment name is local to the process in which the .EXE is executing, only the address of the handler needs to be recorded.

Language Library

The third component of the Rexx interface is similar to the subcom interface, but it allows code written in other languages to be invoked as Rexx function calls instead of commands. Rexx has a large number of built-in functions analogous to the library routines of other languages. Rexx programs can define subroutines within themselves. They can also call other Rexx programs as subroutines. Finally, they can call code written in other languages through the external function interface.

As with the subcom interface, external functions must be registered by name with Rexx before you can use them. If the code resides in a DLL, the name will be global to the OS/2 system, and any Rexx procedure can use it. It will be located automatically in a standard search order. For code that is part of an .EXE module, the function name is local to the process executing the module. This mechanism allows you to call vendor-supplied libraries of routines from Rexx for special applications, just as libraries are provided for other languages. In Rexx, however, linkage is dynamic and essentially transparent. It doesn't require a static linking process.

Sharing and Service

A fourth part of the Rexx interface for OS/2 allows for data sharing between an application and a Rexx program. Using the so-called shared-variable interface, applications can both read and write Rexx variables. This is particularly useful when you have to pass a large amount of data to or from a command or external procedure, because the application code can use Rexx's compound-variable facility to access or change an arbitrary number of elements of an array.

The last notable aspect of the Rexx interface is the service exit routines. The Rexx language processor calls these routines to perform generic services, including keyboard and screen I/O, function calls, and command processing. For example, the service exit routines make it possible to have an application format output from Rexx in a manner that is consistent with the output of other applications.

Support Your Local Candidate

Given its powerful interprocess communications and control facilities and ease of use, you can expect Rexx to play an important part in both end-user and professional computing under OS/2. For these reasons, it is an excellent candidate for use as a universal macro language. The controlled development of the language has also improved its universality in another respect; it is well standardized and operates similarly on all supported platforms.

To be successful, Rexx must receive the same type of support from OS/2 developers that it has on other platforms. With sufficient support, Rexx will make it possible for you to exercise unprecedented control over your OS/2 environment and applications. ■

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Charles Daney is president of Quercus Systems (Saratoga, CA). You can reach him on BIX as "charlesdaney."

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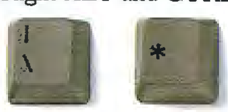

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OPENING DOORS FOR THE DISABLED

Adaptive technology lets blind, deaf, and motor-disabled personal computer users lead more productive lives

Joseph J. Lazzaro

Imagine what life would be like if you couldn't see, hear, or move around freely. Now suppose you'd like to pursue a job or get an education. What would you do? Explore the world of adaptive microcomputer technology.

Over the past five years, microcomputers have invaded nearly every aspect of business and education. While the able-bodied take for granted the power and flexibility that personal computers offer, microcomputer technology represents an electronic bill of rights to the physically challenged, granting them broad independence. Although I am legally blind, I have used the microcomputer to build a career as a technical author, freelance consultant, and director of an adaptive-technology project. But none of this would be possible without the aid of adaptive electronic equipment. These devices allow disabled people access to mainstream personal computers and the educational, employment, and social opportunities they offer.

The field of adaptive computer technology extends the best hope for people facing either sensory or physical disabilities. This technology includes synthesized speech for the blind (see figure 1), telecommunications devices for the deaf, and voice recognition and other control devices for the motor-impaired. Most of this adaptive hardware and software is compatible with off-the-shelf personal computers like the IBM PC, the Apple IIGS, and the Macintosh.

Adaptations for the Blind

Traditionally, the visually impaired have not had access to the latest printed information because of the time it takes to transcribe printed material into either braille or audio formats. Several microcomputer-based technologies are changing that.

Prior to the advent of optical character recognition technology, blind people employed human readers, braille, or talking books. Nowadays, however, they can read printed information by using sophisticated OCR systems that interface with most personal computers (or operate as stand-alone devices) and output the material in speech-synthesized form.

Synthesized speech is one of the most powerful and least expensive access devices for the blind. Numerous speech products designed with the blind community in mind are on the market. Some are internal circuit cards, while others come in the form of external serial- or parallel-compatible devices. Many internal varieties can emulate a serial or parallel port, and most cards come equipped with jumper blocks and/or DIP switches to change interrupts if necessary.

Also available are numerous screen readers—software packages designed to direct all keyboard input and screen text directly to the voice synthesizer. Current speech-synthesis products retail for between $250 and $4000, although most high-quality products retail for under $1000.

The Apple II was one of the first computers to become popular among the blind because of the inexpensive Textalker screen reader and Echo II synthesizer (see "The Search For Speech," December 1984 BYTE, page A48). But the Apple II couldn't make off-the-shelf software talk, because it couldn't run two programs at the same time; it could use only software that had speech ability written in. Microtalk and GW Micro offer specially written, talking Apple application programs, as does the American Printing House for the Blind.

Most screen-reader software development is currently based on DOS because of its popularity and the PC's ability to stack more than one program in memory at a time. The current DOS-based screen readers work with almost all PC-based software, except those based on pure graphics. These screen readers are also highly programmable and can be taught to track highlight bars, inverse video, selected screen colors, pull-down menus and windows, blinking text, dialog boxes, and so forth.

By necessity, all screen readers are TSR programs. The normal DOS prompt reappears after the voice is loaded, so the user can run another program on top of the speech-access system. It is a relatively uncomplicated matter to make popular off-the-shelf software talk with an unlimited vocabulary. Included in this domain are most databases, programming languages, word

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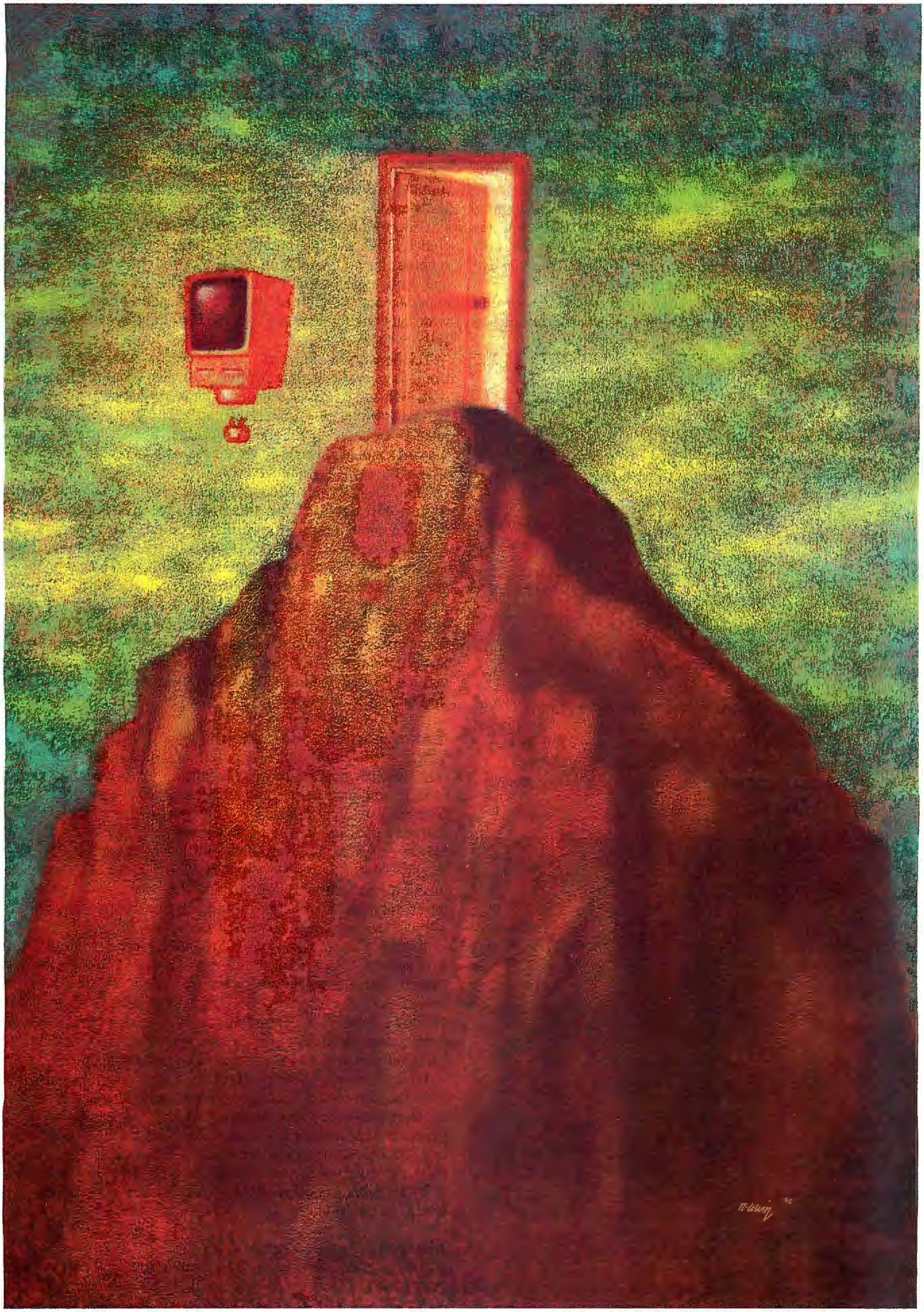

processors, spreadsheets, terminal emulators, CD-ROM systems, and utilities.

Henter-Joyce's Job Acquisition with Speech program is a DOS-based screen reader that retails for $495. JAWS can drive a multitude of synthesizers from various vendors and has sophisticated programmable features, allowing the user to track and vocalize many different video attributes. JAWS can be programmed to read any color on the screen and can define regions of the screen as verbally inactive. JAWS was hailed as the most powerful screen reader by the *Journal of Visual Impairment and Blindness*, a disability-oriented newsletter.

The Macintosh has a screen reader all its own in the form of Berkeley Systems' OutSpoken, which can be programmed to verbalize icons, pull-down menus, and dialog boxes. OutSpoken does not require the addition of any speech hardware, and thus it drives the built-in Macintosh speech chip directly. The current version supports many Macintosh programs but does not support HyperCard. Plans are in the works, however, to support this important software package in the next version of OutSpoken.

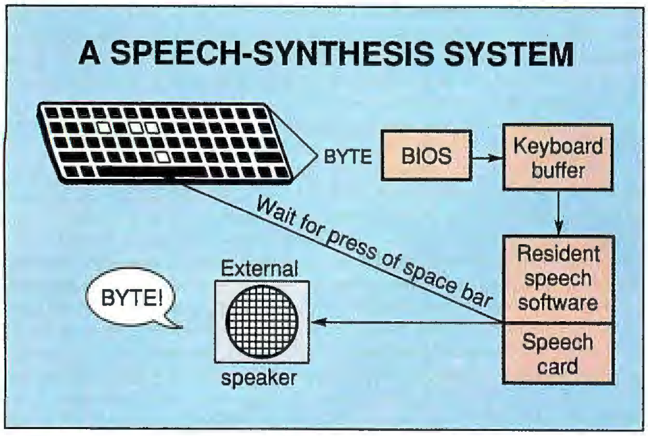

Figure 1: *Generally, a speech system consists of resident software that converts text into speech, a speech-synthesis board with audio amplification and an interface to the PC bus, and a speaker that sits outside the computer. When users press a series of keys on the keyboard, the system turns the letters into phonemes (the smallest units of sound), runs through a series of rules that tell it how to say the word, and outputs the word through the external speaker.*

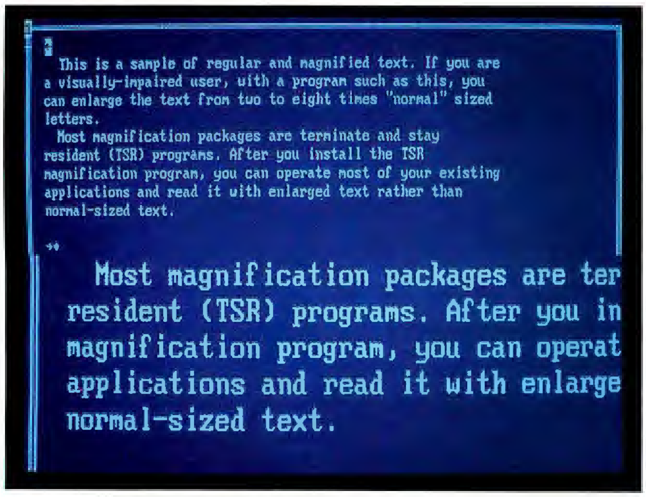

Photo 1: *This ZoomText software by AI Squared magnifies the display of existing software to up to eight times its original size. Users can also change to a number of fonts and read text at different speeds. The software is compatible with most character-based software, including word processors, spreadsheets, databases, and communications programs.*

The present state of the art of speech in the PC world excludes OS/2 and Presentation Manager, but there are speech schemes based on OCR in the works for these graphics-based operating systems and applications. IBM has demonstrated an experimental version of its Screen Reader program to work with selected portions of OS/2 and PM, but there is no commercial product yet.

TeleSensory's Personal VERT (verbal emulation in real time) is one of the new synthesizers. Personal VERT comes with text-to-speech screen-reading software and a half-size PC-compatible plug-in circuit card. The system works with most DOS-based application programs. The unit comes with a printed manual, braille cheat sheets, and an audiocassette version of the owner's manual.

The CD-ROM has opened many doors because of its ability to store entire reference works on a single disk rather than taking up a whole room with braille volumes. Many of these CD-ROM systems are compatible with adaptive technology. Talking Computer Systems (Watertown, MA) markets an adaptive version of Microsoft Bookshelf that comes with a CD-ROM disk, a printed manual, and an audiocassette manual as well as configuration files for speech-access systems. With the invention of personal computers, and adaptive devices to work with those computers, the blind now enjoy up-to-date information and job access via either speech synthesis, large-print processing, or braille output systems.

Adding Large-Print Capability

While speech remains a popular method for screen access, other modes of operation are also in constant use. The two basic ways to add large print to an existing personal computer are to connect a hardware-based large-print processor or to load a software package that increases the size of the video display. Hardware-based large-print systems use a special video card, a larger monitor to increase font size, and a special joystick or mouse to move the cursor around the screen. The software-based large-print systems provide larger letters and graphics without any additional hardware.

Vista is a TeleSensory hardware-based large-print processor. The system comes with a full-size IBM-style circuit card, a mouse, and cursor-tracking software. The software allows the user to vary the magnification, and it can display a navigation window, showing the enlarged screen in relation to the normal video image. Vista can also enlarge graphics. There is a version for machines based on the Micro Channel architecture.

HFK Software produces Qwerty Large Print, a software-based screen-enlargement program compatible with the popular Hercules-style video boards. It offers an inexpensive large-print environment for low-vision computer users. The software is a TSR program, so you can load off-the-shelf software on top of it. AI Squared's ZoomText is another popular large-print software package, compatible with EGA and VGA display systems (see photo 1).

Electronic Braille Capabilities

Although braille is not as widely used as either speech or large print, many blind users rely on it to access their computer

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Photo 2: *Blind people who use conventional computer keyboards can output what they have written on a braille printer, in speech, or on a braille display. Shown here is a user at a 40-column TeleSensory Navigator braille display unit consisting of a row of 40 8-dot cells. The top 6 dots display a standard braille symbol; the bottom 2 display character attributes and tell whether or not the cursor is on that symbol. Here the user reads the braille display with his right hand and manipulates the cursor with his left hand.*

systems. Braille systems fall into two basic groups: printers and access terminals. Braille printers are identical in concept to standard impact printers, and they interface to most computers via either a serial or parallel port. They are well suited for providing hard copy, but they are not designed as an access device for operating a computer independently.

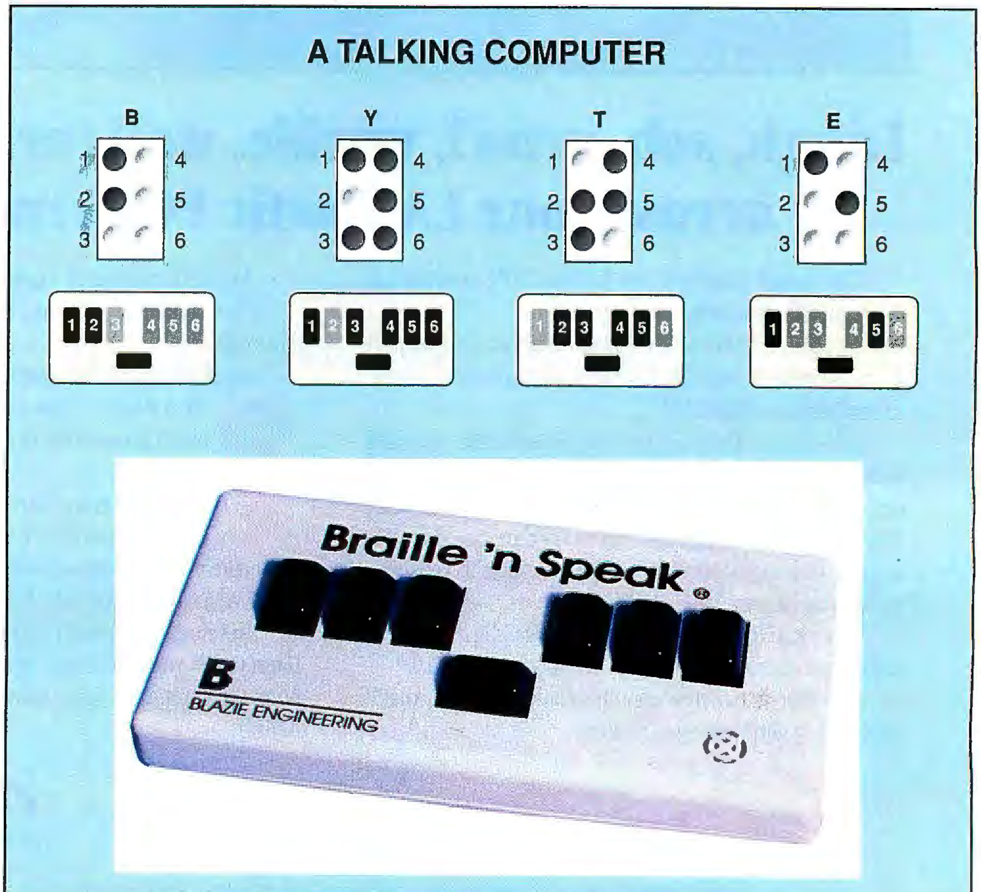
Imagine what it would be like running your computer using only your printer and printscreen switch as an output device. This is the reason braille access terminals were created, to provide the blind user with a movable braille window on the world.

The braille alphabet comprises characters having a 6-dot code. The display of a braille display terminal consists of a strip of 20 to 40 braille cells, with six solenoids per cell. When you press a key or update the screen, you activate one or more of the six solenoids. The system can be programmed to track highlight bars, as well as selected video attributes.

TeleSensory's Navigator is one of the new paperless braille terminals (see photo 2). This hardware and software system can interface to any DOS-based computer via the RS-232C serial port. The Navigator comes with a DOS-based braille screen-access program called Gateway, which allows for interaction with off-the-shelf software.

With this system, users can input text by typing on a regulation keyboard and at the same time review it on the 1-line braille display that sits in front of the keyboard. They can also receive a signal when there is any change (such as an error message) in any part of the screen that they are not working on at the time. Then the program outputs the message on the braille display. The Navigator can attach to many desktop and several portable computer environments.

Figure 2: *Although many blind people use a standard computer keyboard, those who prefer to use a braille keyboard can. Shown here is Blazie Engineering's Braille 'n Speak, a stand-alone talking pocket computer that also acts as an input device for DOS machines. The user presses a combination of keys that produces a standard 6-dot braille symbol. For example, to create the letter* B, *the user would simultaneously press the 1 and 2 keys.*



HumanWare also markets a paperless braille terminal, KeyBraille 360, compatible with laptop and desktop DOS machines. You can connect KeyBraille to the PC with a simple parallel interface cable.

Blazie Engineering's Braille 'n Speak is a pocket talking computer with speech hardware and software built into the unit, and a braille keyboard (see figure 2). You can upload and download text to a PC via a standard serial port. The unit has a word processor, stopwatch, calculator, and terminal communications in a paperback-size unit.

Computers for the Deaf

For more than 20 years, the deaf have relied on telecommunications devices for the deaf for daily communications needs. The typical TDD linkup is very similar to two personal computers that connect via a telephone line and a modem. Of course, devices on both ends of the conversation must be equipped with a TDD. If a deaf person wants to talk to a hearing person who doesn't own a TDD, they must both use a Relay Bureau, a service responsible for conveying incoming TDD messages by voice.

The SM85 is a product of Krown Research (Culver City, CA) and is a dual Baudot/ASCII modem designed to work from any standard RS-232C serial port. (Baudot code is a non-ASCII-compatible five-unit synchronous code developed around 1880.) The SM85 can operate at line speeds of 45, 110, and 300 bps, making it compatible with both ASCII and Baudot systems. In other words, a single unit can function as a TDD communications system and can also interface with more widespread BBSes and information utilities, giving the deaf or hard-of-hearing person the best of both worlds.

The deaf do not have major problems with personal computer access, because the use of keyboard and screen presents no great barriers. But training can be a problem, because many computer instructors do not know American Sign Language, and the frequent beeps and blips that emanate from the PC speaker are obviously meaningless to the deaf. To compensate for this problem, the deaf user can employ special software to convert the audio output into a video format.

The Macintosh can be adjusted to assist the deaf and hard-of-hearing through the use of the volume control in the control panel. If you set the speaker volume to 0, the Mac will flash the menu bar instead of beeping, making it user-friendly for those who are deaf.

MicroSystems Software's SeeBeep is a DOS-based memory-resident utility that produces a visual signal whenever the computer's speaker beeps. The software uses only 1K byte of memory and can be adjusted to either allow the whole screen to flash or have the word *beep* flash at the cursor location. Consequently, the PC can also be user-friendly for a deaf or hard-of-hearing user.

Computers for the Motor-Disabled

The list of adaptive technology designed to assist the motor-disabled is long. It includes voice-recognition devices, adaptive keyboard technology, software macro generators, and word prediction software, as well as point-and-shoot devices and special switches. If a person has at least one functional, voluntary movement—be it a finger, foot, eye blink, or whatever—an

continued

How to Choose an Adapted PC

If you're in the market for a personal computer with which you will use adaptive equipment, you need to consider several factors. Popular computers that can readily handle adaptive devices are the Apple IIGS, the Macintosh, and the PC. The machine you purchase should have enough expansion slots, memory, speed, and power to run your adaptive equipment as well as your off-the-shelf hardware and software.

When you make your decision, remember that a computer that has adaptive equipment installed typically dedicates one or two slots to it. If you're a blind user, you'll take up at least one slot for your speech-synthesis card or for the serial board that will drive an external speech device. The three-slot, small-footprint-style computers are too limited in slot space for a disabled computer user. And since you will undoubtedly be running many more expansion cards than in a standard system, you should choose a machine with a hefty power supply.

If you are purchasing an IBM PC compatible, you should choose a machine that has 640K bytes of conventional memory, because your adaptive software will consume some of this lower RAM for itself. Machines with expanded or extended memory also make a lot of sense, since these features give you more loading options for adaptive and off-the-shelf software. A computer with a megabyte of memory is a good middle-of-the-road system. This gives you the maximum 640K bytes allowed by DOS, while leaving you expanded or extended memory to use for other applications.

Consider what your minimum microprocessor requirements are—you should start with at least a 286. If you want to add an optical-character-recognition system to your PC (to use as a reading machine, for instance), you'll find that your scanner either won't run on an 8088-based machine or will run very slowly.

Top-of-the-line Mac IIs, such as the IIcx, are fine as adapted computers but currently will not run many large-print programs. The Mac ships with Close-view, a large-print software package that is somewhat helpful. A Mac with slots offers future expansion (it can be opened up without violation of the warranty).

If you are considering an Apple II, the Apple IIGS offers the most in terms of adaptations. It is faster than the IIe and offers more to the disabled user because of its greater memory capacity and increased speed. The Apple IIe is an older version of the IIGS and is an inexpensive machine suitable for performing home-based word processing, database management, and telecommunications with adaptive equipment. The IIe is very user-friendly, but its capabilities don't compare in scope with what can be done on a PC.

As a platform for adaptive computing, the PC has some advantages: It can stack more than one program in memory at a time, and you can expand its capacity with a multitude of available expansion cards. Also, most of the current adaptive hardware and software products are aimed at the PC, offering disabled computer purchasers greater choices and greater independence.

One of the most useful technologies for the motor-disabled is voice recognition, although it is expensive and out of reach for many disabled users.

adaptive system can be configured to suit that individual.

One of the most useful technologies for the motor-disabled is voice recognition, although this continues to be an expensive answer, out of the reach of many disabled computer users short on cash. The concepts behind voice recognition are fairly simple, but lots of sophisticated software and hardware have been designed to accomplish the task that nondisabled people take for granted.

The typical voice-recognition system listens to the audio spectrum, using a standard microphone. These signals are fed into the computer as analog input and are run through an A/D converter. This digital stream is then fed into a sophisticated software algorithm, which compares the incoming sound energy against each word in a RAM-resident dictionary.

Once a match is detected, the system can be programmed to perform several different tasks. It can send text to the console as if it were typed at the standard keyboard buffer, or it can activate other devices plugged into the system. In this way, a voice-recognition unit can perform many different functions, such as DOS operations, entering text into a word processor or database, or controlling remote household or office equipment.

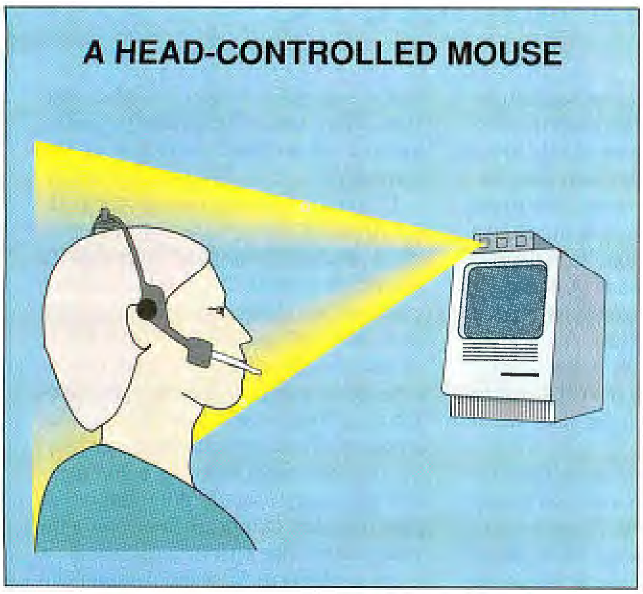


Figure 3: *With software that puts a virtual keyboard on-screen and a HeadMaster "point-and-shoot" device by Prentke Romich, motor-disabled people who can move their heads can communicate. The headset emulates a mouse—the control unit on top of the Macintosh measures the change in the headset's angular position and translates the change into cursor commands. Then, by lightly puffing into a mouth tube attached to the headset, the user can enter the selected character into a word processing program.*

The Kurzweil Voice Report voice-recognition system is a product with a lot of potential in the adaptive computing field. However, it carries a hefty $26,100 price tag (including a personal computer). It can be purchased as a turnkey system, or it can be plugged into most PC compatibles. Dragon Systems (Newton, MA) also provides voice-recognition products.

If a person has some manual dexterity, a specially adapted keyboard can sometimes make the playing field more level. Adaptive keyboards come in many forms, from miniature keyboards suited for one-handed operation to larger-than-normal sizes with built-in programmability. The objective behind an adaptive keyboard is elementary: Create a keyboard so that a user with limited typing ability can enter data into a personal computer.

Technical Aids and Systems for the Handicapped (TASH) produces a line of adaptive keyboards. The PC Mini Keyboard is a miniature keyboard, useful for a person to use one-handed or with a typing stick. The keyboard measures 7½ by 4½ inches. The device is most useful for people with a small range of movement but with some typing ability. It has closely spaced membrane keys, with the space bar in the center of the keyboard. TASH's King Keyboard is a large adaptive keyboard, measuring 23½ by 12 inches. It plugs into the standard PC keyboard socket.

For a person who has some typing ability but is unable to press more than one key at a time, a sticky-key program might be the answer. You can adjust these programs to make the Shift, Control, or Alt key a toggle. When the Shift key is pressed, it locks into position, making the next keystroke a shifted key. The second time the shift is pressed, it is locked down into position, until a third strike releases it altogether.

MicroSystems Software's HandiShift is a DOS-based sticky-key program that works this way. The software can also disable the repeat function of the PC keyboard, making typing easier for typists with spastic hand movements. The program displays the current shift status and lets you vary the length of time the key must be held down before the character is accepted. The use of macros to generate long strings of information is also an inexpensive way to allow a disabled person with limited typing ability to enter large blocks of text.

Word-prediction software is another useful tool for those with limited typing abilities. Once the predictor is loaded, it constantly watches the keyboard. Based on incoming keyboard input, the predictor makes guesses as to what word you are trying to type. These guesses are based on the first and upcoming letters and do not involve context. For example, if you type the letter *T*, the predictor would offer *the*, *that*, *there*, *they*, and so forth. You could then pick one of these words from a menu choice, or you could type more letters to further narrow the choice of words. Predictors are also usually smart enough to know which words you use most frequently and will move these preferred words closer to the top of the list. Two popular word predictors are Brown Bag Software's MindReader and Microsystems Software's HandiWord.

Point-and-shoot devices are another important way to give motor-disabled people access to computers. These special hardware and software combinations display representations of the keyboard or preprogrammed menu choices. The disabled user can employ a head-mounted pointer or mouse to select the desired choice and then use an adapted switch to fire the mouse

continued

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The Sounding Board..................$395
Vocal-Eyes Screen Reader..................$450
WordTalk Apple Word Processor..................$195
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Fort Wayne, IN 46825
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CCTV Viewpoint..................$2695
KeyBraille..................$8495
Software only..................$6995
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Loomis, CA 95650
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Echo PC..................$250
Echo II..................$130
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Carpinteria, CA 93013
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Grolier Electronic Encyclopedia..................$395
Microsoft Bookshelf..................$295
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Watertown, MA 02172
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HandiShift..................$50
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HeadMaster..................$900
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Inlarge..................$95
OutSpoken..................$395
Berkeley Systems, Inc.
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King Keyboard..................$700
PC Mini Keyboard..................$700
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Kurzweil Personal Reader..................$8000 to $12,000
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Cambridge, MA 02139
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Kurzweil Voice Report..................$26,100
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Kurzweil Applied Intelligence
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MindReader..................$90
Brown Bag Software
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(408) 559-4545
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Voice Scribe Systems..$1200 to $9000
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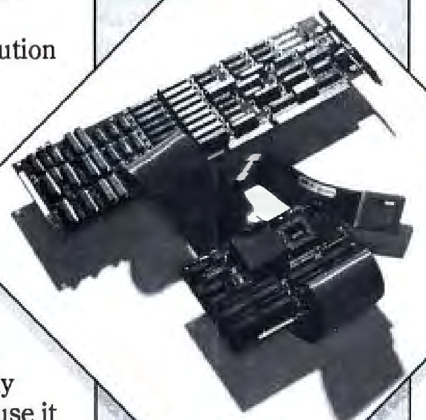

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button. At the user's instruction, the system can then verbalize stored voice messages or send commands to an application program.

The switches can consist of joysticks with a fire button for someone with spastic motor control. "Sip and puff" switches are available that can be inserted into the user's mouth and fired by breath control.

Prentke Romich's HeadMaster is a popular point-and-shoot device that is widely used in education and business settings (see figure 3). HeadMaster, which emulates a mouse, lets the wearer direct the cursor to keys on a virtual keyboard displayed on the monitor. A simple puff into a straw (part of the headset) will select that particular key and type it on the screen. The system can be used to enter data into a word processor or other application and can expedite its performance with the optional addition of word-prediction software.

Easy Access, which is shipped with every Macintosh, facilitates one-finger typing and also lets the user employ the numerical keypad as a mouse. For someone who doesn't have the motor coordination to use a mouse or to accomplish compound keystrokes, this program can be very useful.

More Coming...

The past five years have seen an unparalleled growth in adaptive technology for the disabled. This trend can only increase over time.

The United States Congress has recently amended the standing Vocational Rehabilitation Act of 1973 in a way that requires the computer industry to make its equipment accessible to the disabled if it wants to sell its wares to the federal government. The new Section 508 amendment prohibits the federal government from purchasing any microcomputer technology unless it has the hooks to become adaptable to the physically challenged. Current federal regulations mandating hiring of the handicapped, as well as purchasing adaptive computer equipment, should improve this atmosphere even more.

Presently, graphics and graphical interfaces are problems for blind users. IBM has opened the source code for OS/2 and PM, hoping its graphics-based operating system can be made available to the blind market through the technology of synthesized speech. IBM has gone so far as to establish a Special Needs Center in Atlanta, Georgia, to handle issues relating to the physically handicapped. Apple has encouraged many third-party vendors to create adaptive hardware and software for its line of personal and business computers. Microsoft and other companies have encouraged distribution of documentation in electronic-disk formats to aid in the production of braille and large print.

You might get the impression that there are no serious obstacles for the disabled now that the so-called major players are getting into the act. Unfortunately, that isn't so. There are still real challenges facing the disabled computer user. These challenges include graphical interfaces that don't talk for the blind, non-ASCII telecommunications systems that isolate the deaf, and hyperexpensive solutions for the motor-disabled that don't meet the needs of most of them.

Adaptive technology has brought the use of personal computers to disabled people, for whom the combination of personal computers and adaptive technology means a more productive life. ■

Joseph J. Lazzaro is the director of the Adaptive Technology Program for the Massachusetts Commission for the Blind and is a freelance technical writer and founder of Talking Computer Systems. He can be reached on BIX as "lazzaro."

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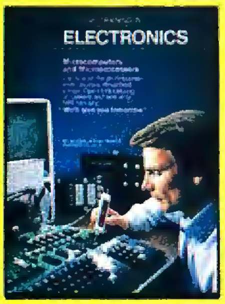

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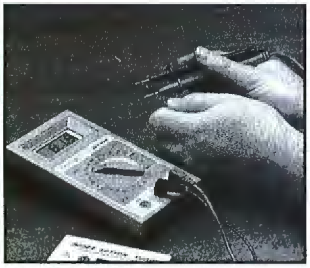

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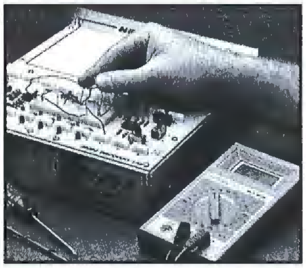

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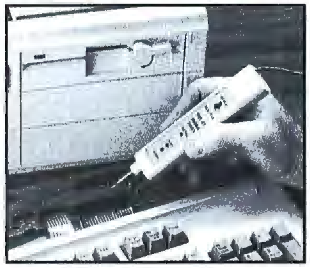

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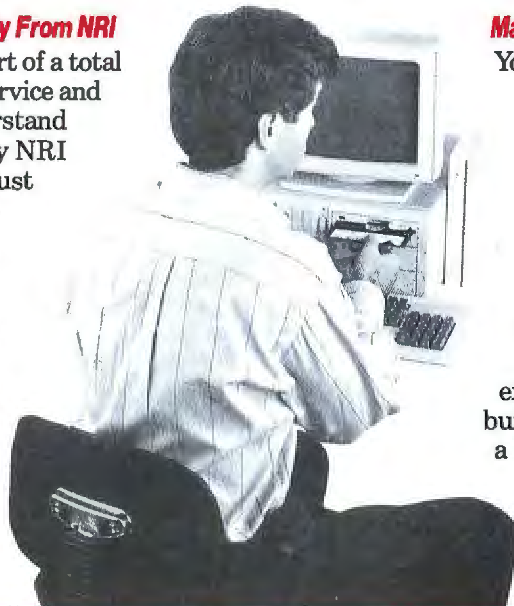

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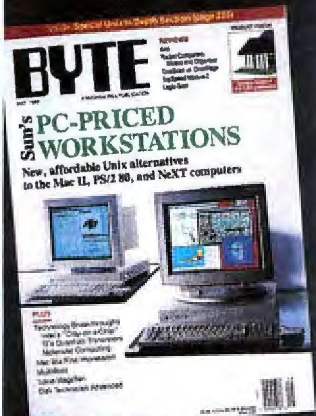

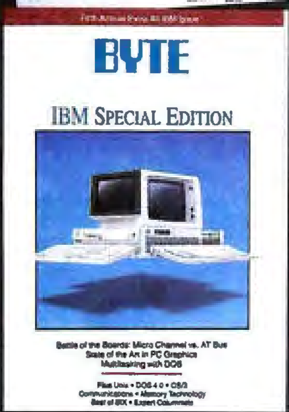

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A SOFTWARE DEVELOPER LOOKS AT OS/2

Presentation Manager provides a rich platform for graphical user applications

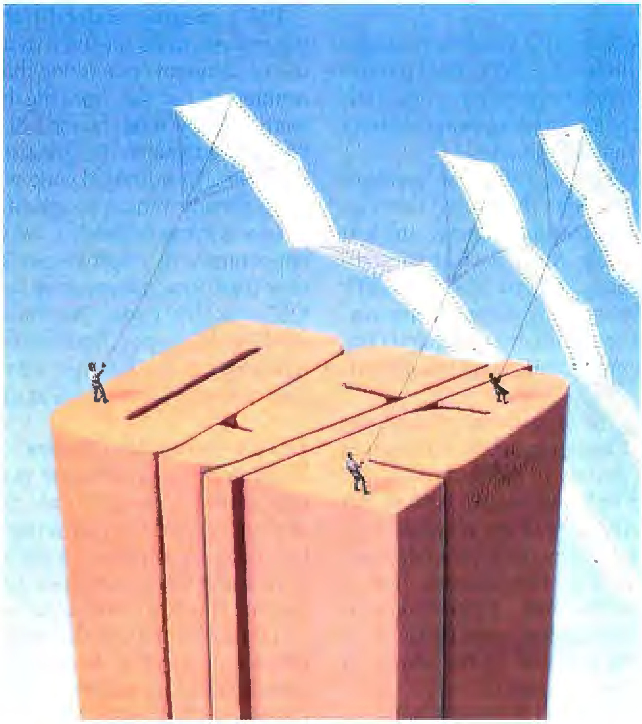
Peter Kron

Aldus PageMaker for OS/2 Presentation Manager (PM) began shipping in September 1989 after more than two years of development. After the first developer conferences, Aldus engineers worked closely with Microsoft and experimented with a number of prerelease software development kits.

During this period, Aldus created and released new versions of PageMaker for the Macintosh and for Windows. This gave Aldus a unique vantage point for assessing OS/2 as a development environment. OS/2 represents a rich arena for developers, but it is not without pitfalls. Some are endemic to the operating system itself; others result from developers who are accustomed to developing applications for Windows or the Macintosh.

As software engineers, our experiences in developing the Windows and Macintosh versions of PageMaker made it easier for us to design PageMaker for OS/2. PageMaker *had* already straddled the host application programming interface (API) fence for almost three years and was developed under the *core code* concept. Between 50 percent and 75 percent of PageMaker, which is written almost entirely in C, is shared between the Macintosh and Windows platforms. The remaining code, which we call *edge code*, is specific to the individual platforms.

With OS/2's and Windows' common hardware and software ancestry, there was no need for an entirely new third edge. Instead, OS/2 became more of a subdivision of the Windows-specific code. Our goal was to use as much core and Windows code as possible, preserving the look and feel of PageMaker and ensuring file compatibility. But we also wanted to take advantage of inherent features of OS/2 to improve productivity wherever possible.



Commitment to Portability

From its beginning, Aldus has dedicated itself to developing software from a common code base with a high degree of portability. Portability is, of course, essential to code reusability for any product that is available on more than one platform. For the developer, that reusability is key to efficiency in product testing and enhancement. This concept bears fruit for the user as well, on several levels.

At the most abstract level, common code ensures common design. If designs diverge, enhancements on one platform become increasingly difficult to support on other platforms. While some features are not feasible on all platforms, users benefit from common features where they

continued

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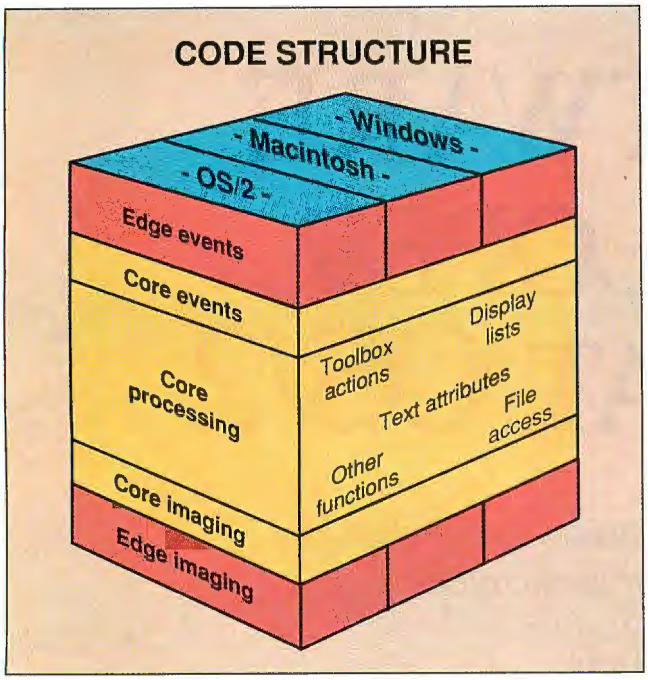

Figure 1: *Edge code handles APIs specific to a platform. Core code performs portable functions specific to PageMaker.*

exist. Users are free to choose the platform best suited to their tasks—on the basis of the availability of applications, peripherals, or connectivity—and, at the same time, enjoy a familiar user interface and feature set.

Furthermore, a portable code base ensures that the file format is also portable. As a result, the user can work on any platform, yet still exchange data with other users on other platforms.

OS/2 PM

PM is really a mixture of two levels of API: window management and graphics imaging. This division reflects dual parentage by Microsoft and IBM. Window management is very similar to the Windows API, while graphics imaging bears a strong resemblance to IBM mainframe graphics models.

Similarly, PageMaker's code base has a window management edge (front end) and an imaging edge (back end) (see figure 1). The various core functions, such as data storage and text composition, generally fit in the middle. Since we had an established Windows edge for the front end, we were able to modify it to handle the OS/2 API, often by creating compiler macros. Other API differences are limited to argument types and constants and could be resolved by conditional data type definitions.

Implementing features that required significant change was not quite that straightforward. We found that subtle differences can trip you up. One of the most pervasive distinctions is the switch from a top-left screen origin in Windows to a bottom-left origin in PM. This orientation affects relative placement of child windows (such as rulers), common drawing code, and generation of bit-mapped images. The computation that is needed to convert from one form to the other depends on current window height. While this computation is not difficult, it affects a surprising amount of code and can be the source of many bugs if its use is not thought out thoroughly.

For example, Aldus had isolated many differences between Windows and the Macintosh in their respective edges. If core code contained assumptions specific to one or the other, the problem soon became apparent during testing. But, because both platforms follow a top-left-based imaging model, portions of the core code that assumed this orientation subsequently caused problems in porting to OS/2.

A second subtlety is that some of the PM event messages differ only slightly from the equivalent Windows messages either in interpretation, parameters, or order of generation. These slight differences are more bothersome than outright new messages, which the application can handle conditionally.

For example, the slightly new interpretation of OS/2 keystroke messages changed the basic assumptions of the event handlers. This forced us to make changes to a large amount of code spread throughout the program. In many respects, the PM scheme is an improvement, but we found the difference to be bothersome. A particular problem arises when engineers port stable, familiar code to a new environment. Sometimes they think in terms of the previous environment, and subtle differences can become real blind spots.

Imaging Models

Due to the exacting nature of typography itself, desktop publishing is based on the WYSIWYG concept. While a VGA screen cannot show all the detail of a document that a 1200-dot-per-inch imagesetter will produce, the final result must be predictably precise.

For example, if the final imageset copy of an annual report shows unexpected problems in alignment, even though the material looked fine on-screen, it will have to be redone. If the user encounters expensive surprises (and extra trips to the printer), the value of desktop publishing diminishes considerably.

To ensure precise output, PageMaker follows strict rules in generating and interpreting the screen image. Usually these rules do not exactly match the underlying imaging model, so the edge code must be carefully written to achieve the required result.

PM's imaging model differs radically from Windows, causing macros to be ineffective as a porting tool. We were able to use conditional code (code that is included only in certain environments) for the imaging because the necessary functions were already modularized at the back end of the application. Certain edge-specific modules required complete rewriting, however. (Conditional code was used primarily in modules that were already Windows-specific.)

In a few key instances, we were able to take advantage of the opportunity to improve our core-edge boundary by defining new platform-independent service routines to encapsulate the OS/2-specific code. Our main guideline was readability. If we could write a specific section as conditional code without too much loss of readability, we thought it was unnecessary to define new service routines at that time.

Device-Dependent Issues

Resolving the problem of pixel-specific idiosyncrasies of the two graphics models was much more difficult. While both models are based on stroking path lines of a defined width, the two imaging engines do not always affect the same pixels. It took some work to recode the algorithms so that PageMaker graphics and text would butt up properly under PM.

The complexity of the metrics associated with text fonts can make accurate text display very tricky. In addition, the representation of font names and attributes is significantly different under the Macintosh, Windows, and PM environments, so font code had to be rewritten from scratch.

Font technology in general has been a hot topic recently, and there will undoubtedly be more changes in this area. The good news is that vendors are now seriously addressing these issues and are making progress.

Solutions to all these problems must address four basic device types: 1-to-1 screen-aspect ratios (such as VGA), other screen-aspect ratios (such as EGA), PostScript printers, and raster printers. No imaging model is perfectly device-independent. Thus, application requirements and device capabilities constrain the way the application uses the engine API.

We were pleased to find that PM's graphics programming interface (GPI) has a much richer set of capabilities than that of Windows. These features include new curve primitives, pick-correlation of mouse actions, line attributes versus pen objects, and redraw of complex objects by the engine itself. The GPI also provides a (somewhat daunting) hierarchy of viewing transforms. An application that runs on multiple platforms must hide platform-specific implementations. However, this process makes it difficult for the application to take full advantage of its features and capabilities. We are still addressing this issue.

A note of caution: The Windows Device Context (a collection of device and drawing attributes) is split into two handles under PM. Some functions in the GPI require the PM Device Context (a collection of device attributes), while others require the Presentation Space (a collection of drawing attributes).

PM can also associate multiple Presentation Spaces with a Device Context. Fonts are associated with the Presentation Space. The result can be changes to some function-interface definitions to provide each function with the proper handle.

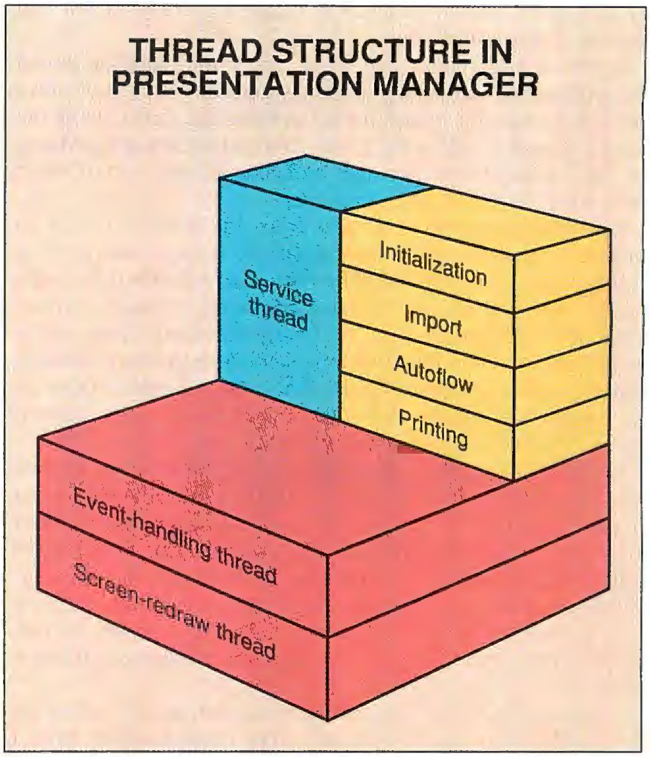

Figure 2: *Threads for event handling and screen redraw are always active. A separate service thread performs various actions that the user initiates.*

Developing Applications in OS/2

The four main features of OS/2 that affect development decisions are a larger address space, enriched graphics, multitasking, and multithreading. During the development of PageMaker, we had an opportunity to explore three of these areas, but we did not use the fourth, the graphics extensions provided by the GPI.

Most welcome in OS/2 development was the "free lunch" we enjoyed from the larger address space. It greatly reduces code swapping in PageMaker, resulting in an immediate boost in raw performance without extra engineering time or effort. In the design phase, we discussed various changes to our caching algorithms, based on the assumption of having more memory, but we implemented only some basic caching of bit maps and font metrics. There is still lots of room for enhancements in this area, such as in tuning file management, but we left that task for future versions.

With PageMaker for OS/2, the user can open multiple documents, a feature unique to this platform. Cutting and pasting between documents is simpler than in Windows. We implemented this feature by creating a separate process for each document window. Multitasking—using separate processes—facilitates background operations such as flowing text and printing. While this feature doesn't alter the raw performance of the application, users find it has a dramatic effect on their productivity because it frees them to work in one area while other operations proceed in the background.

You probably wouldn't want to edit three documents at once. However, there are times when you work on several things, and you must wait on things like printing, and you want to use your time efficiently. At other times, you are actively working on only one document but need to refer to other documents and possibly copy from them.

Just as on the physical desktop, there is a point at which juggling multiple tasks creates clutter and reduces productivity. But that point varies from person to person and situation to situation. With the ability to work effectively on multiple documents, you can choose what works best for you.

Achieving this same level of independent activity by implementing threads within one process would have required considerable synchronization of access to data structures; using multiple processes is much more straightforward. There is some overhead in this approach, since the cursor and other resources must be loaded separately, but the code itself is all shared. Thus, using separate processes was our preferred choice. PageMaker creates shared memory (another OS/2 feature), which is used by the different processes to coordinate their activities.

We also built multithreading into PageMaker for OS/2, a technique that is quite effective in improving the responsiveness of the application. Three threads are always active—an event-handling thread, a screen-redraw thread, and a service thread (see figure 2).

Generally, PM is less responsive if any input message requires too much processing. PM's guidelines state that no message should require more than $\frac{1}{10}$ second. For example, calling a subroutine to print a page while processing the `print` command message would prevent PM from dispatching any further messages to any applications, slowing performance.

To meet this criterion, long user operations in PageMaker—printing, importing data, and flowing text—are performed by a service thread. Program initialization is also largely performed by the service thread, which absorbs the idle time while the user invokes the new or open dialogue. A separate thread waits

continued

for new event messages. Each is handled quickly so PM can activate other applications.

Synchronizing the service thread and event-handling thread is complicated because the user may continue to type or move the mouse, which activates the event-handling thread while the service thread is still busy. If this conflict occurs, PageMaker for OS/2 filters these messages and accepts only certain basic ones, such as `resize` and `minimize`.

A private message is posted from the service thread to indicate completion of its task. Until this occurs, user activity in PageMaker is restricted. The program indicates this condition by disabling menu items and displaying a "busy" cursor, which looks different from the hourglass cursor. The user is free to switch to other applications, and when the busy cursor is moved to other windows, it will change to the appropriate cursor for that application. When there is an hourglass on-screen, the user cannot switch to other applications.

In PageMaker, we used a separate thread for screen redraw for two reasons. First, PageMaker doesn't limit the number of objects appearing on a page; thus, processing a redraw request can easily exceed the guideline of $\frac{1}{10}$ second. But more important, using a separate thread allows the user to abort drawing. In this case, when the user rescales a page, the redraw can proceed immediately. The program feels less responsive if it finishes the page at the old scale and completely redraws at the new scale.

Dynamic scrolling—redrawing the screen as the user drags the scroll thumb—is also possible. The event-handling thread monitors the scroll bar and draws the rulers (which redraw quickly and give immediate positional feedback to the user). The screen-redraw thread constantly tries to redraw the page and catch up.

Because responsiveness, in particular, gives users a sense of control over the application, they perceive the application as more of a tool than a master. We all like more speed—especially when it comes to screen display—but we generally accept reasonable delays. It is particularly frustrating, though, to experience unnecessary delays. The ability to abort a redraw operation and change course is very satisfying.

Implementing dynamic redraw without multithreading places a greater burden on the application developer to poll for messages at various points. Multithreading allows concurrent activities to be separated more naturally in the code. The GPI engine itself anticipates user multithreading and performs some of the necessary synchronization for the application, further simplifying the engineer's task.

Assessing the OS/2 Development Environment

In the early beta versions of OS/2, developers found it safer to build programs under DOS and use OS/2 only for testing. By the time OS/2 was released, however, there were more advantages to working in OS/2 entirely. Now, developers have come full circle, developing code on OS/2 and rebooting to DOS or Windows only for testing.

Being able to create multiple command sessions was one of the first things we appreciated about OS/2. This feature is useful to perform background compiles or network transfers and to preserve your current state. It is very easy to quickly switch from one session screen to another just to work in another directory with a new set of environment variables. Multiple sessions also help you to keep a train of thought during a compile—just switch to another session and keep working. Under DOS, programmers frequently juggle a mental list of things to do after the compile completes—and often forget one or two of these items while they wait.

Programmers will especially appreciate the larger data space available to compilers and linkers. No longer are they interrupted by the need to break up modules because a compile failed due to the definition of too many symbols. All the development tools run in protected mode and so have access to much more memory for internal table storage. Linking a large application, especially one containing debug code and debugger data, is an order of magnitude faster with OS/2 memory management than under DOS using virtual-disk scratch files.

Debugging in OS/2 using CodeView, Logitech's Multiscope, or one of the other available debuggers is much easier than either in Windows or on the Macintosh. Source-level debugging with these tools is a great improvement over using simpler products such as Windows Symbolic Debugger. Because of OS/2's multitasking feature, the debuggers intrude less on the target application. Due to the 640K-byte memory limit on Windows, we had never been able to efficiently debug PageMaker with CodeView.

Also, protected memory immediately flags many pointer errors. If the problem isn't obvious, the debugger can restart the program to find it. Some potentially nasty bugs become trivial to find and fix when the hardware gives you a helping hand. The same bugs on Windows can require many time-consuming reboots.

QuickHelp (in the software development kit) is also very effective in the OS/2 environment. It is handy to leave a QuickHelp window on the screen desktop for reference while editing source code. QuickHelp generally provides sufficient details of the parameters and options available for any system call, eliminating the need to shuffle through the sizable manuals. In OS/2, with a few keystrokes, you can access the application, debugger, source files, and reference manual. The cost for these luxuries is memory. Our development was done on 4-megabyte machines, but that configuration is the bare minimum. If you have 6 MB, you will experience considerably less swapping.

So what's wrong with OS/2 development? For one thing, your favorite TSR programs and tools may not yet be available. Many tools will run in the DOS compatibility box, but you can't invoke them yet from protected-mode command files. You may also be lacking driver support for various hardware or network options, a situation that may require booting DOS.

Finally, PM is conscientious about telling you that you made an error, but finding where you made it can sometimes be tedious. There is room for many more diagnostic tools to help clean and tune the code. On the whole, however, you will find OS/2 well worth investigating as a development environment.

Untapped Potential

PageMaker for OS/2 brings some of the benefits of OS/2 to the end user. But other advantages of OS/2, for both end users and developers, remain untapped. OS/2's architecture lays the groundwork for much tighter coordination among different tasks on a user's desktop. Some tasks will be invoked by explicit user action or result from links between documents. Others will run as background service tasks that are invisible to the average user except in some form of enhanced productivity.

Networking, too, will take place at various levels of user visibility. With the advent of more applications like PageMaker, OS/2 will achieve a critical mass and users will begin to tap this potential. ■

Peter Kron is a principal software engineer for Aldus Corp. (Seattle, WA). He was the technical lead in developing Aldus PageMaker for OS/2. He can be contacted on BIX c/o "editors."

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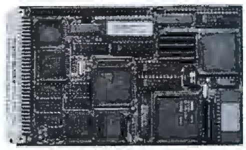

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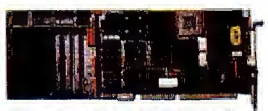

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MIX-AND-MATCH NETWORK ADAPTERS

Two upcoming specifications, NDIS and ODLI, will make it easier for you to create a network

Sharon Fisher

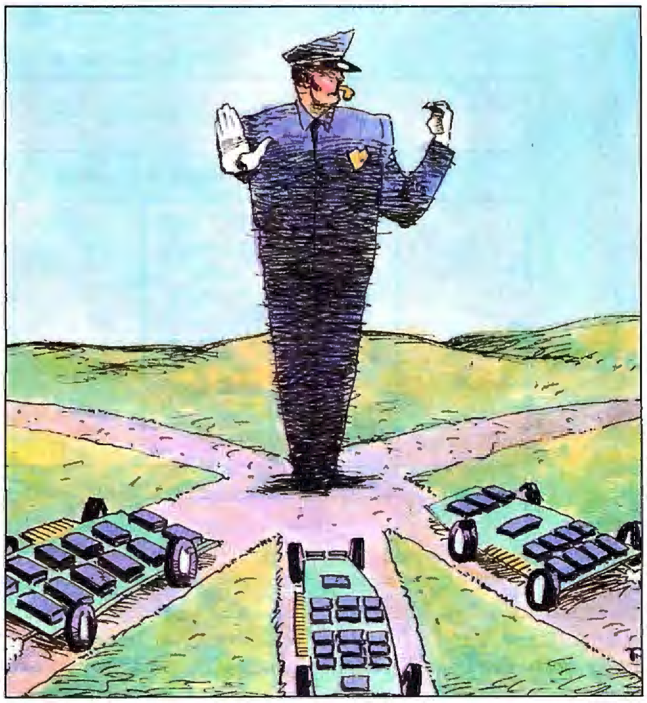
When you think of linking a PC to a network, you usually think of adapter cards and cables. When you set up a network, theoretically all you have to do is plug an adapter card into a PC, attach a cable that goes from the back of the card to the next PC or the network backbone, install the network operating system, and voilà, you're in business.

In reality, though, it's not that simple. The adapter card communicates with the network operating system through another piece of software known as the *driver*. The driver is usually written by the network operating system vendor, and often it not only is specific to the adapter card but must be written for other elements, such as the network protocol (e.g., Ethernet or Token Ring) that will be used.

In the past couple of years, the number of vendors producing adapter cards has increased significantly, and network operating systems have become a great deal more complex. These factors mean that vendors not only have to write more sophisticated drivers but have to do so for more adapter cards. Users have to keep track of more drivers, too. The problem increases geometrically.

Moreover, network operating system vendors naturally write drivers for the most popular adapter cards first (plus their own adapter cards, if they manufacture them). Thus, users who have purchased adapter cards from a small vendor or who have purchased the latest and greatest adapter cards may find that these cards are not yet supported by their network operating system.

To deal with this problem, network operating system vendors are developing specifications that allow them to write fewer drivers per adapter card (one or two drivers instead of dozens). With these standards, users will also be able to switch from one network protocol to another or even take advantage of simultaneous multiple protocol support. Users may find, though, that even if these issues are addressed, one significant problem will remain unsolved: Competing groups of vendors are currently proposing two similar—but not identical—specifications. This means users won't be able to buy a driver that will support both specifications.



The Network Driver Interface Specification

One group of vendors, led by Microsoft and 3Com, has proposed the Network Driver Interface Specification (NDIS). Currently in release 2.01, it was first proposed in the fall of 1988. While it is closely associated with Microsoft's OS/2 LAN Manager, it can also be used for adapter cards running under DOS.

The NDIS includes specifications for a Media Access

continued

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Control layer driver and a protocol manager. The Media Access Control layer is an Open Systems Interconnection (OSI) model sublayer that links communications between the physical layer and the software that runs on the network. According to the NDIS, transmitted data can be synchronous or asynchronous, while received data can be buffered by the adapter card or nonbuffered. Different versions of the drivers are required for DOS and OS/2.

A data packet comes in from the network via the driver. Either the full packet or just its header (depending on whether it's buffered or nonbuffered) goes to the protocol manager's vector module. The vector module asks each loaded protocol stack if the packet is of that protocol type. If it is, the protocol stack accepts it; otherwise, the packet passes on to the next protocol stack.

Shopping for NDIS

Users can obtain NDIS drivers in several ways. Microsoft's LAN Manager 1.0 was shipped with a number of drivers, mainly for most 3Com and IBM adapter cards. According to Microsoft, version 2.0 will include 12 to 15 drivers. These drivers will support all the 3Com and IBM adapter cards and also adapter cards from InterLAN, Tiara, and NCR. Other drivers will be included that at press time had not yet finished certification. Microsoft does not require this certification process, but most vendors are going through with it.

Microsoft will distribute drivers certified after release 2.0 is closed. It will dole out these drivers to OEMs through its BBS, or to users by Microsoft forums on on-line services such as CompuServe, GEnie, and Microsoft's own BBS.

In terms of protocols, Microsoft ships to its OEMs only the NetBIOS Extended User Interface, which, despite its name, is a programming interface. NetBEUI is Microsoft's implementation of NetBIOS; it's sometimes called JetBEUI, for its speed.

The company plans to have protocol stacks available for TCP/IP and OSI later this year through an unnamed third party. Also due this year is an AppleTalk protocol stack as part of a Macintosh connectivity package.

Microsoft provides support for the Advanced Program-to-Program Communication protocol, which is often used to link communications between PCs and IBM mainframes through its microcomputer-to-mainframe Communications Server. Also under development is an expansion of the NDIS specification, WANDIS, the wide-area network driver interface specification, which would support WAN protocols such as X.25.

You can obtain other protocol stacks through OEMs as part of their added value to the LAN Manager. These include another NetBEUI stack and Xerox Network System from 3Com (TCP/IP and OSI stacks are in the works); XNS and TCP/IP from Ungermann-Bass; and DECnet from DEC.

Users can load multiple protocol stacks under NDIS, but 3Com has also developed a way to load and unload its protocol stacks, which can help with the "RAM cram" problem many DOS users run into when they want to support multiple protocols. Sizes of protocol stacks range from 30K bytes to about 120K bytes. The protocol specification doesn't yet support the use of memory on intelligent adapter cards.

Open Data Link Interface

The other group of vendors is led by Novell and Apple Computer, who have proposed the Open Data Link Interface (ODLI; sometimes referred to as ODI or OLI). Development of ODLI, currently in release 3.0, began in early 1989. It's designed to work with NetWare or AppleTalk under either OS/2 or DOS.

ODLI has three parts: the multiple protocol interface (MPI), which communicates with the protocol stacks; the multiple link interface (MLI), which communicates with the adapter card driver; and the link support layer (LSL), which links communications between the protocols and the drivers. Different versions of the LSL are required for DOS, OS/2, and NetWare 386.

Here's the way ODLI works. A data packet comes in from the network via the driver. The LSL determines which protocol

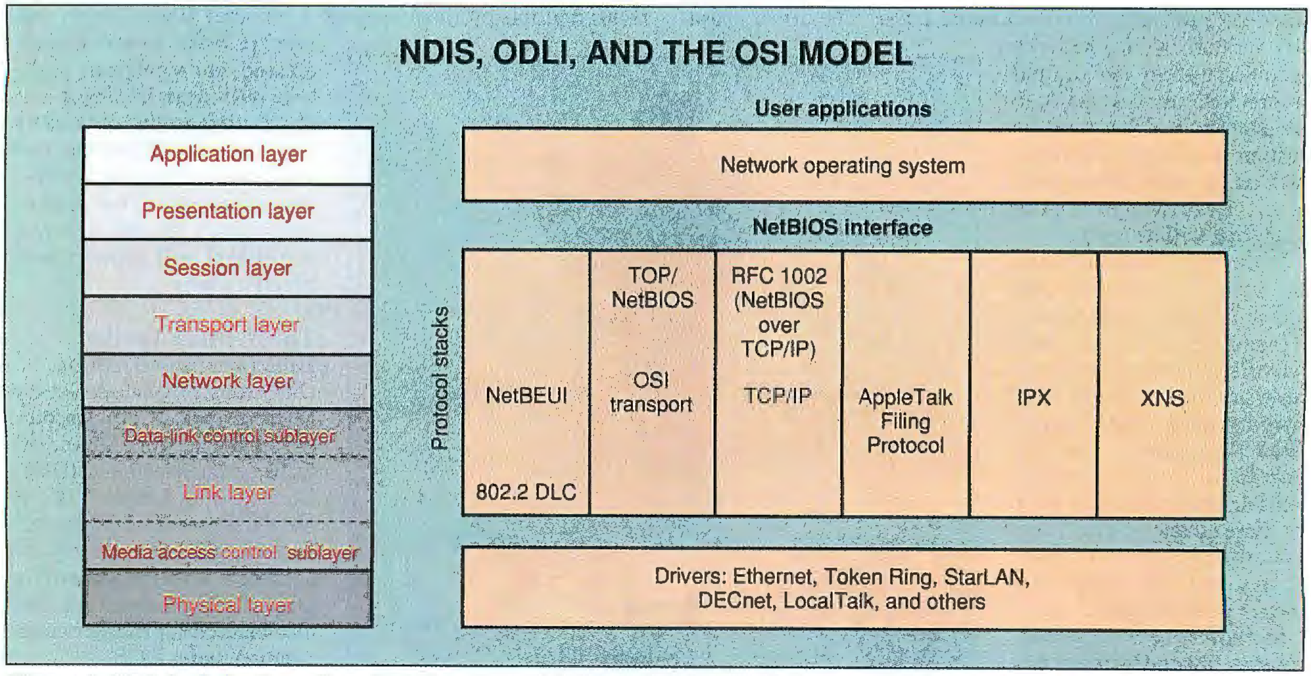

Figure 1: *With both the Open Data Link Interface (ODLI) and the Network Driver Interface Specification (NDIS), users can mix and match a variety of protocol stacks and network technologies, while having to use only one driver per card.*

stack the data packet is bound to and sends the data packet to that protocol stack, which processes it.

Shopping for ODLI

Drivers that support ODLI are currently available for adapter cards from Novell, IBM, and RX-Net. You can obtain drivers for one adapter card each from Proteon, 3Com, and Acer Technologies. Drivers being tested or under development include those for adapter cards from Olicom, Codenoll, Western Digital, Thomas-Conrad, and Gateway Communications, as well as for cards from Proteon, IBM, and 3Com.

Some drivers are bundled with the software, while the others are available in a $100 supplemental driver kit. The drivers will also be available from the adapter card vendors themselves.

In terms of protocols, only Novell and Apple currently support ODLI. Novell has a stack for its Internetwork Packet Exchange (IPX) protocol, which is based on XNS. Novell's San Jose, California, group, formerly Excelan, is developing protocol stacks for OSI, TCP/IP, and TCP/IP with the Network File System (NFS) (see figure 1). Ironically, before Novell purchased the company, Excelan had been slated to develop similar protocol stacks for NDIS.

Novell's Walnut Creek, California, group, formerly Kinetics, is developing protocol stacks for the AppleTalk Filing Protocol and AppleTalk. Except for the OSI protocol stack, which is not yet scheduled for release, the additional ODLI protocol stacks are due to be available in the third quarter of this year.

Users can load and unload protocol stacks. An ODLI protocol stack will generally require more memory—the ODLI IPX stack requires 4K to 5K bytes more than the bound IPX stack in previous use. Execution can be up to 5 percent slower. ODLI also supports the use of memory on intelligent adapter cards.

LSLs are bundled with the appropriate software—NetWare 386, the OS/2 Requestor, or the DOS Client Workstation Kit, scheduled to be included in the next release of NetWare 386.

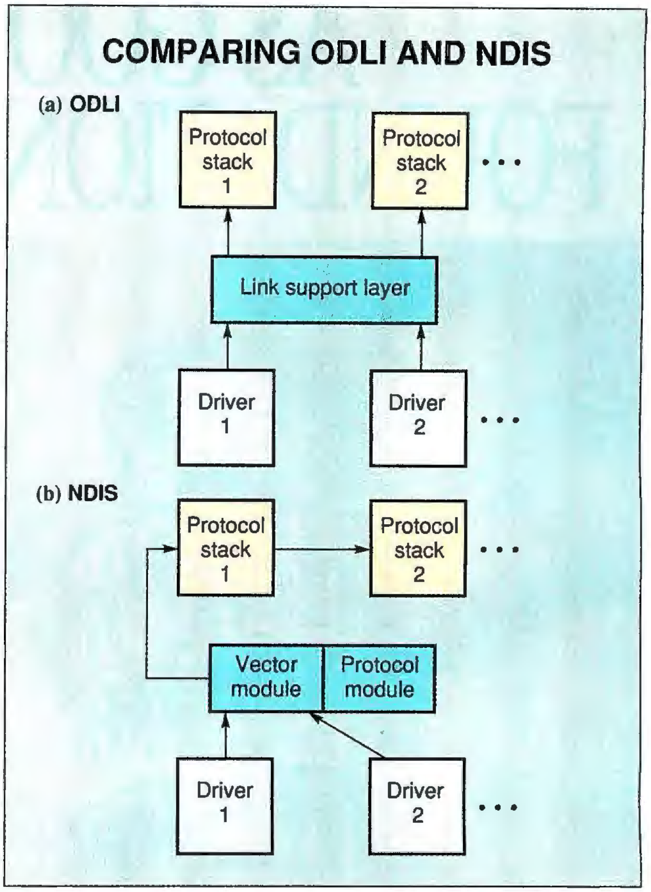

Figure 2: (a) *ODLI's link-support layer matches the packet to the stack, while* **(b)** *NDIS queries each protocol stack individually.*

NDIS vs. ODLI

The two specifications are fundamentally similar, according to the competing vendors themselves and the adapter card vendors who are developing drivers for both (see figure 2). Under NDIS, vendors need to write two drivers: one for DOS and one for OS/2. Under ODLI, vendors might need to write three drivers: one each for DOS and OS/2 clients, plus one for NetWare 386 servers. Consequently, vendors still end up having to develop multiple drivers. Therefore, users still have to wait for vendors to clear up their driver backlog and keep track of multiple drivers.

Tiara, for example, has written an ODLI NetWare 386 server driver for its Ethernet adapter cards. It is now writing ODLI and NDIS drivers for the same adapter cards under OS/2 and is planning on developing DOS versions. After that, Tiara will go through the same process for its Token Ring cards. Because of this workload, the company must turn to outside contractors. Similarly, Western Digital has two separate teams producing NDIS and ODLI drivers, which means that the programmers can't leverage their work between the two specifications; thus, it may take longer for drivers to be available for users.

The major difference between the two specifications is probably the link support layer of ODLI versus the chained protocol stacks of NDIS. Where the LSL routes the packet to the proper stack, NDIS routes the packet from one protocol stack to the next until one of the protocol stacks recognizes the packet's format. Novell says this gives ODLI stacks a performance advantage. 3Com denies this, noting that most packets will go to the primary protocol stack and will suffer no degradation (checking other protocol stacks takes about 60 instructions, or approximately 1 microsecond).

Why Not Join 'Em?

Why don't the two competing camps get together on a single specification? One standard would allow adapter card manufacturers to write just three drivers—DOS, OS/2, and NetWare 386—rather than five. Vendors have probably discussed the issue, but nothing has yet been announced.

On the other hand, such a universal specification would probably mean that vendors who had already written to one of the two existing specifications would have to rewrite their drivers yet again to support the merged specification. This could mean a further delay to users.

Matching adapter card drivers, network operating systems, and protocol stacks remains a somewhat complex issue—one that so far puts the burden on the user's shoulders. As support for both specifications becomes more widespread, however, the burden may be eased.

This support is likely to be a process that evolves over the next couple of years. But gradually, with NDIS and ODLI (or some merged descendant), users will be able to run multiple protocols while keeping track of only one or two drivers. ■

Sharon Fisher is a San Francisco–based freelance writer specializing in computer communications. She can be reached on BIX as "sharonfisher."

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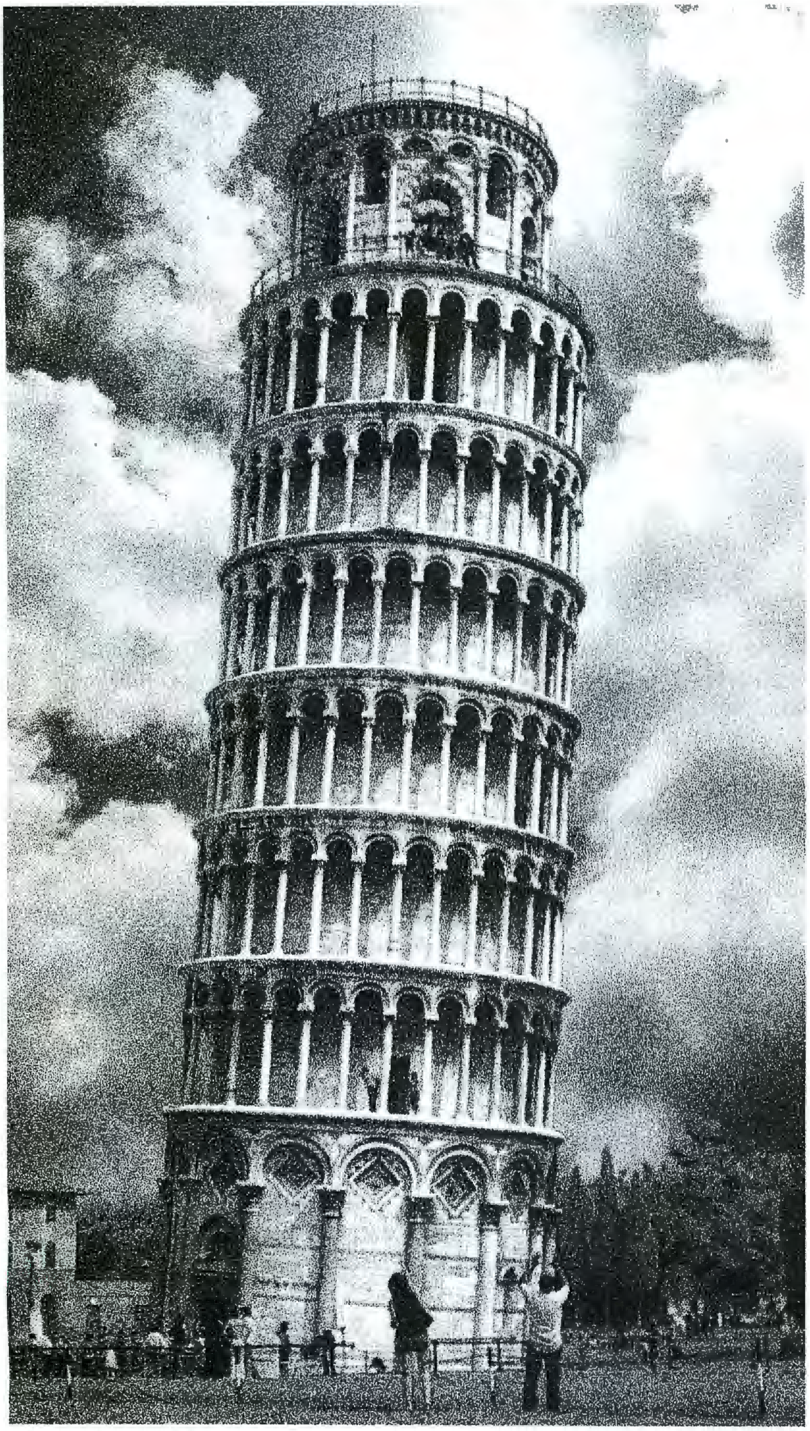

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THE QNX OPERATING SYSTEM

A real-time Unix-like operating system for the low-end PC

Tom Yager

PART One

Although DOS, its heirs (e.g., OS/2 and Windows), and 286/386 Unix are firmly ensconced as the leading operating systems for PCs, other options do exist. This month, we begin a six-part series on alternate operating systems for PCs.

Unix is powerful. Even those who don't care for it are willing to admit that. Along with that power, however, comes some serious shortcomings: It commonly requires lots of disk space and memory, it can be difficult to install and maintain, and it doesn't run well on anything less than a 386. These problems have placed Unix effectively out of reach for users of thousands of 1-megabyte, 286-based systems still in use. While they are no longer state of the art, these machines are far from obsolete.

QNX, from Quantum Software Systems (Kanata, Ontario, Canada), brings to the 286, and even the 8088, many of the benefits of 386 Unix. Multitasking, an advanced file system, multiuser support, networking, and software development tools are all there. Perhaps most important, a QNX application will run identically on an 8088, 286, 386, or 486. That same application can also be made to use the files, devices, or CPU of any other system on a network.

Getting Around

QNX sports a command structure most similar to Unix, but with some peculiar twists. While Unix command-line options are most often specified with a leading hyphen and a single letter, QNX extends its syntax with + and = characters. A `dir` command might look like this:

```
dir +count -sort p=*.txt
```

The first character of an option (count, sort) can often be used in place of the entire word. The p= option is another QNX oddity. The QNX command shell handles some limited expansion of wild cards, but many QNX commands (like `dir`) have explicit options for specifying file-matching patterns.

The full-screen editor, `ed`, is fashioned after Unix `vi`, but it also has several QNX-specific quirks. Like `vi`, it is a *modal* editor, differentiating between distinct command and edit modes. The QNX editor feels strange if you're accustomed to `vi`. There are "gotchas," like the insertion of lines. You would expect an editor to open up a blank line if you position the cursor at the beginning of a new line and press Return. But to insert a blank line in `ed`, you need to use a function key.

The rest of the QNX command structure is also similar to Unix, but not identical. Familiar Unix command names, like `grep` (search a file for a pattern) and `ls` (list file directory), exist in QNX, but have options and behavior that have no relation to their Unix counterparts.

Size Isn't Everything

In almost every aspect, QNX is tiny. Working with what Quantum calls its "microkernel architecture," the memory requirements of the operating system can amount to as little as 135K bytes. Of this, the kernel occupies a scant 10K bytes. This leaves ample room for applications, even with only 512K or 640K bytes of memory. Because its needs are so minuscule, it will run in both protected and real modes.

Memory consumption is as slim as it is because QNX is more modular than most operating systems. The kernel is small because it does so little. Most of the work is handled by special tasks, called *managers*, that run with user (application) tasks.

Administrative tasks are specialized. In keeping with the rest of the QNX architecture, the file and device managers communicate by passing messages (see "Multitasking for the Masses," February BYTE). In addition to files and devices, there are tasks that manage graphics, networking, DOS, and even the tasks themselves. When functionality is added to the operating system, as with QNX Windows, it, too, takes the form of a manager.

Because each action taken by the operating system passes through one or more managers, any component of the system

continued

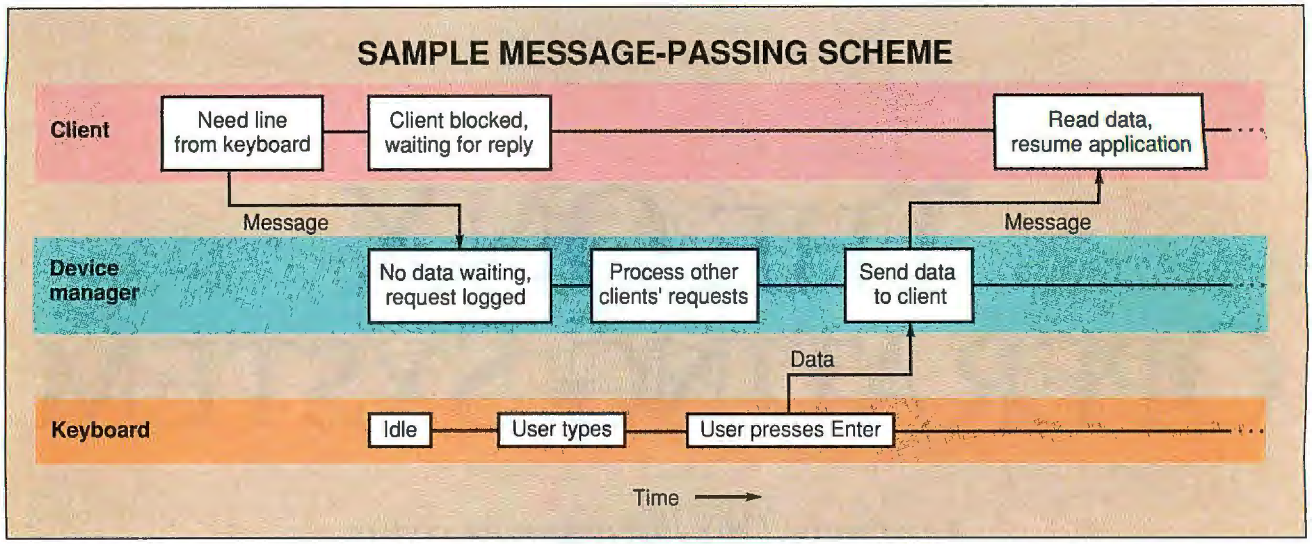

Figure 1: *A message generated by a client task requests a line of characters from the keyboard and waits. The device manager watches the keyboard and quietly accumulates characters until the user is finished. The application is then awakened and is given the characters through a message.*

can be changed without affecting the others. As long as a manager continues to accept and respond to messages in a predictable fashion, it can be augmented or replaced with little or no impact on the operating system.

Calling In for Your Messages

Administrative tasks aren't the only consumers of QNX's message-passing scheme, but they make the best example. Figure 1 shows a typical exchange of messages between a client (application program) and a manager, but it could just as easily apply to a conversation between two clients or two managers.

The figure shows a message, generated by a client, that requests a line of characters from the keyboard. The message is sent to the device manager, and the client stops running, or *blocks*, waiting for a reply. If the characters have already been read, the device manager packages the response into a message and sends it back to the client. Once the response arrives, the client unblocks and continues processing. If the device manager has to wait for characters, it remembers that a task is waiting for a line of input and keeps spinning on its other requests until the user presses Return. Then, it packages up the line and ships it to the client.

When a message is sent, the sender blocks until it gets a reply. If a message recipient dies before it responds, the task manager makes sure every task that's blocked is notified—tasks shouldn't lock up waiting for replies that will never arrive.

When a task blocks, it stops consuming CPU time, making that slice available to other processes. Every I/O request causes a user process to block, so overall response time in QNX is quite good. But there is more to QNX's quickness than this.

Let's Get Real, Man

Computers seem particularly well suited to controlling machines and other external devices. They can perform the precise counting, timing, and analysis needed to drive anything from a toy race car to a sophisticated manufacturing robot.

When someone spouts the phrase "real time," it often breeds confusion. Simply, it means this: When something needs the system's attention, the system will respond within a small, fixed period of time. Even if a dozen counters go off at the same time that a motor needs to be halted, and the machine operator also needs to be notified that it's time for a lunch break, a real-time operating system should be able to deal with it.

When a computer is asked to do only one thing, it's a cinch. All the system's resources can be dedicated to performing the task. But when tasks multiply, a scheme must be devised that allows each of them to share the system's resources efficiently.

If each operation along an assembly line represents a task in the computer, consider what mayhem can result if the system is off "thinking about something else" while one of the robots is positioning a product on the conveyor. If the robot's motor isn't stopped at precisely the right moment, it can overshoot its mark and drop the item on someone's head. Production and industrial control applications require split-second response.

As mentioned, QNX deals with situations like this by task switching many times per second. Even though it doesn't *really* pay attention to all these events at the exact moment they happen, it doesn't matter. A task has to wait only a few microseconds for its turn in line.

If a task is *very* important, like the robot tasks above, it is given a high priority. This is like having a permission slip to cut to the front of the line. This scheme is called *prioritized event scheduling*. It is the key factor that gives a real-time operating system its deterministic behavior (the predictability with which it handles events). Other multitasking operating systems, such as Unix, handle tasks with fairness as the major criterion for determining which task gets the next dance with the CPU.

The Lay of the LAN

Quantum has built networking into the base QNX in quite a simple and interesting way. Since all I/O is done through message passing, seamless LAN support is managed by allowing messages to be passed through LAN connections. As a result, a task on one system (even a manager) can access the files, devices, or even the CPU of any other system on the network.

QNX Net uses Arcnet as its transmission medium. Each card is branded with a numeric node ID (1–255). An on-board ROM modifies the system's boot sequence, allowing nodes to boot diskless from another node on the network.

Under normal conditions, a node's own hard disk, serial ports, and other devices are used by default whenever files are stored or modems dialed. By prefixing the name of a file or device with the ID of another system, you can use any resource to which you've been granted access. So, if you're on node 1, and you create a file called `/tmp/fred.txt`, other users can access that file by specifying `[1]/tmp/fred.txt`. Similarly, they can use your printer by sending output to `[1]$lpt`.

QNX maintains a table of access permissions, which allows users on other systems to use your devices and CPU. Any system with CPU access permissions can run programs on your system by starting a command line with your node ID. So, to run an accounting program on node 1, you might specify `[1] acct`. A space after the node ID is important; without it, the `acct` program on node 1's disk will be loaded onto your machine and executed locally.

Multiprocessing (running a program on multiple CPUs) can be built into applications. To illustrate this, Quantum provided an application called Team Make. It lets C program make procedures spawn multiple, parallel compiles across several nodes on a network. As you might imagine, this could make short work of a compile that includes dozens of source code files. As an example, it worked well, but it also proved to have excellent practical potential. QNX's LAN-transparent message passing makes a viable base for client/server applications.

In addition to QNX's proprietary networking scheme, Quantum and third-party vendors offer X.25, TCP/IP, and other options that empower QNX systems to connect with other hosts.

The Shape of Things to Come

Strangely, all this discussion about how un-Unix-like QNX is will be moot shortly. Quantum plans to make its next release of QNX compliant with the IEEE's POSIX operating-system standard. This standard is based mostly on Unix System V, so the new QNX will behave a lot like other familiar Unix implementations. QNX will still stand apart by maintaining its real-time capability and microkernel architecture, but everything else will look and smell like real Unix.

As an adjunct to the new POSIX QNX, Quantum will be releasing a graphical windowing environment called QNX Windows. Based on AT&T's Open Look appearance specification, this environment will allow developers to build complex applications that have clear, graphics-based front ends. The Open Look compliance extends only to the interface's appearance. None of the standard Open Look programming interface will carry into QNX Windows.

The move to POSIX compliance, coupled with the Open Look interface, may make QNX a more attractive prospect as a general-purpose operating system. It has a bird-like appetite for memory and disk space, and it is easy to install (10 minutes). There are hundreds of QNX applications available now, and the POSIX compliance will give other vendors reason to consider porting existing Unix applications to QNX. QNX is well suited to control applications through its real-time capability, modular structure, and networking. These attributes also make it a good choice for almost any application where response time is the critical factor. ■

Editor's note: *For more information on QNX, contact Quantum Software Systems, Ltd., at Kanata South Business Park, 175 Terrence Matthews Crescent, Kanata, Ontario, Canada K2M 1W8, (613) 591-0931. Next month, BYTE technical editor Ben Smith will look at the OS-9000 operating system.*

Tom Yager is a technical editor for BYTE. He can be reached on BIX as "tyager."

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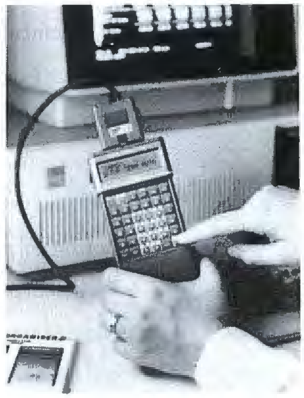

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BIX August Exchange News

■ **Amiga Exchange**—More than 50 people turned out to discuss the new Amiga 3000 with representatives from Commodore the night after it was announced. Regular CBix session are held on Monday, Friday, and Saturday nights. Watch system news bulletins for times. (join amiga.special/cbix)

Want a good look at Commodore's new CDTV? (join amiga.hw)

■ **IBM Exchange**—Talk about IBM until you're blue in the face.

Follow one user's adventures in making a working RS-232 cable. (join ibm.at/hardware and start at message 7735)

Get an inside look at some of the problems facing TSR programmers. (join ibm.pc/programming and start at message 2876)

Look through everything Windows 3.0 has to offer. (join microsoft)

Go round and round about hard-disk drives and have a graphic discussion on high-resolution VGA cards/monitors. (join ibm.pc)

Get the latest speculation about OS/2 version 2.0. (join ibm.os2)

Learn virtually anything you want to know about 386 virtual-mode programming techniques. (join ibm.dos)

Find out how the LAN-application performance of a system using HPFS compares with the performance of a system using the older FAT scheme. Know the current thinking on Netware 386? (join ibm.os2/lan, beginning with message 348)

Join other IBM users every weeknight at 10 pm (eastern) for a real-time chat. (join ibm.exchange/cbix)

BIX COMMUNITY CALENDAR AUGUST 1990

■ **Macintosh Exchange**—In August, the Mac Exchange revolves around the upcoming Boston Expo. We'll be bringing you announcements and watching for new product information. Our Boston correspondents will bring you the best of the Expo as it happens; along with the ongoing tutorials, discussions, and camaraderie that you'll always find in the Mac Exchange on BIX. All conferences of the Mac Exchange can be found on BIX by typing "show group mac.exchange." By the way, each of the conferences has its own focus for detailed discussions of subjects. We hope you'll join us!

■ **Telecomm Exchange**—Telemate has moved. There's a new place to have spirited discussion of this popular IBM shareware program. (join telecomm.pgms/telemate)

Tune into BIX 'ham.radio' conference and hear everything about amateur radio and computing. (join ham.radio)

■ **Tojerry Exchange**—Sciences and science-fiction in the classroom are hot topics in the Contact Conference. Learn how high-school students in Virginia are integrating interdisciplinary studies by creating futuristic human cultures and alien life-forms. (join contact/coti.jr)

■ **Writer's Exchange**—Richard Pini, author of Elfquest, the fantasy adventure comic book for people who hate fantasy adventure comic books, now has his own conference on BIX. Join the Elfquest Conference and find out if a comic book about wolf-riding elves can provide insight into self-publishing, the media, writing, drawing, and alternative lifestyles. (join elfquest)

Interested in getting into TV? Screenwriter Adam Rodman discusses how to write a TV or movie script and work with actors and directors. (join writers/screenwriting)

Want to know more about getting a high profile in high tech? High-tech public-relations specialists provide interesting insights about their trade. (join writers/panel.talk)

BIX Conference News and Events

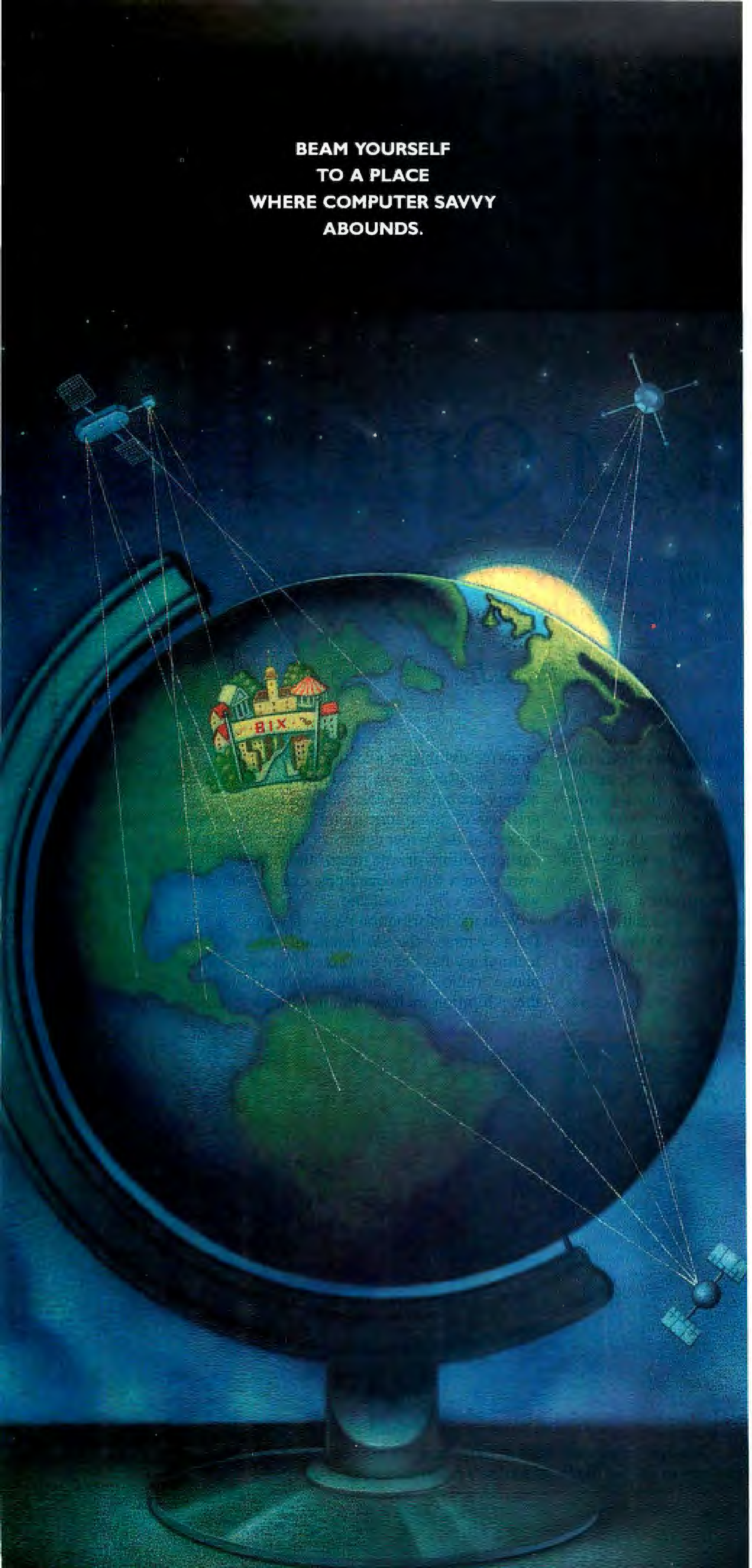
Can ICON and REXX be considered new programming languages? In the 'other.lang' conference, you can talk about these and other languages such as Logo and SNOBOL. CBix sessions held are held weekly. (join other.lang)

Interested in 'C' compilers for the AMD 29000? You're not alone. (join cpus/risc starting at message 823)

Interested in objectivism and/or the thought and writing of Ayn Rand? (join philosophy/ayn.rand)

Want to explore adaptive systems like voice synthesis, OCRs, Braille desktop publishing, and word predictors? (join handicapped)

Going on remote control? Find out about programs that let one workstation remotely control another. (join lans. Source code in long.messages, messages 35 and 36. Discussion in lans/other begins at message 2320.)



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BIX

MUSEUM QUALITY

Zeke, and personal computers as a species, are enshrined in a new Smithsonian exhibit

Wayne Rash Jr.

Even as we live out its final years, we can see that the twentieth century will be known for, among other things, our progress in moving information. Where once history was made by our ability to shape and build, now we toy with the very fabric of knowledge itself—the information from which it is made.

The ability to move, store, and shape information, and the effect of that ability on the people who use the information, are the focus of the new Information Age exhibition at the Smithsonian Institution's National Museum of American History in Washington, D.C.

The Information Age exhibit is the Smithsonian's largest interactive exhibition and the first permanent exhibition to address the uses to which computers and communications technology are put. Previous exhibits have been oriented toward the artifacts of communications (e.g., TV cameras) but have not looked at the larger issues of their effect on society. Nor did earlier exhibits devote much attention to computers. Computers were so new that no one knew exactly what to make of them, or what their effect would be.

With the Information Age—designed by IBM and Electronic Data Systems—the Smithsonian's lack of attention to computer technology has been corrected. Along with the telegraph, telephone, radio, TV, and the first mammoth digital computers, the exhibition includes the machines that started the personal

Zeke II, a CompuPro computer that Jerry Pournelle used to write many of his books and BYTE columns, finds a place in history as part of the Smithsonian's Information Age exhibition.

PHOTOGRAPHY: RICHARD STRAUSS, SMITHSONIAN INSTITUTION © 1990

computer revolution, as well as information about the people behind those machines. Early microcomputers on display literally range from A to Z: from an Apple I (perched on a 4-foot stack of BYTE magazines) and an Altair 8008 to the CompuPro named Zeke II used for years by columnist Jerry Pournelle to write his books and his columns for BYTE. It's sobering to see displayed at the Smithsonian a computer that you last saw installed in someone's office.

The Information Age exhibition also includes more recent designs, including the original IBM PC and Macintosh, and a Sun workstation. Apparently, newer devices are still waiting to be validated by history. Nevertheless, those newer devices play an important role in the exhibition. Unlike many exhibits of computer technology that are static and ignore the promise of the technology, the Information Age exhibition takes advantage of the capabilities of both computers and communications.

Scattered throughout the exhibition are over 40 visitor workstations designed specifically for use by museum-goers. The workstations use touchscreens that let visitors choose what they want to do. Some of the workstations have audiovisual displays that allow visitors to choose one of four programs to watch. The videodisks attached to these stations provide program material that is significantly better than the films, slide shows, and videotape common in other museums.

Other visitor workstations are more interactive. When entering the exhibition, you pick up a bar-coded brochure. Then, as you pass through the exhibition, you identify yourself to the interactive workstations (by presenting the bar code) and then perform the activity supported at each station. The interactive workstations are linked by a Token Ring LAN running Novell NetWare 286, which tracks your progress through the exhibition. At the end of your visit, the exhibition's computer provides a printout of your activities from a Xerox laser printer.

At one workstation, you answer questions that will compare you to census data. Another lets you use a fingerprint-reading computer. Still others let you use the computer that broke the Enigma code in World War II, practice currency trading, and even try your hand at being a 911 emergency services dispatcher. While the exhibit does not include the actual systems used in these applications, the interactive workstations are a good compromise, considering the need to move people through the exhibition quickly. The workstations offer good simulations—good enough that I was able to make 38,000 (simulated) dollars in 1½ minutes of currency trading. Unfortunately, some of the exhibits, such as the one on cryptography, were limited and could leave some visitors disappointed.

According to the Smithsonian, the exhibition's concluding area was designed to be updated periodically to keep up with current technology. When the show opened, this area included a do-it-yourself CAD system and an exhibit on computer graphics. The graphics were displayed on a wall-size screen and were very impressive.

The opening of the Information Age exhibition shows that computing and communications have entered the mainstream of American life. Once, we who worked with these machines were considered unusual; now we see that our presence has become pervasive. And information, that insubstantial stuff that is our craft, has named an age. ■

Editor's note: *For further information on the Information Age exhibition, contact the National Museum of American History, Smithsonian Institution, Washington, DC 20560.*

Wayne Rash Jr. is a contributing editor for BYTE. You can reach him on BIX as "waynerash."

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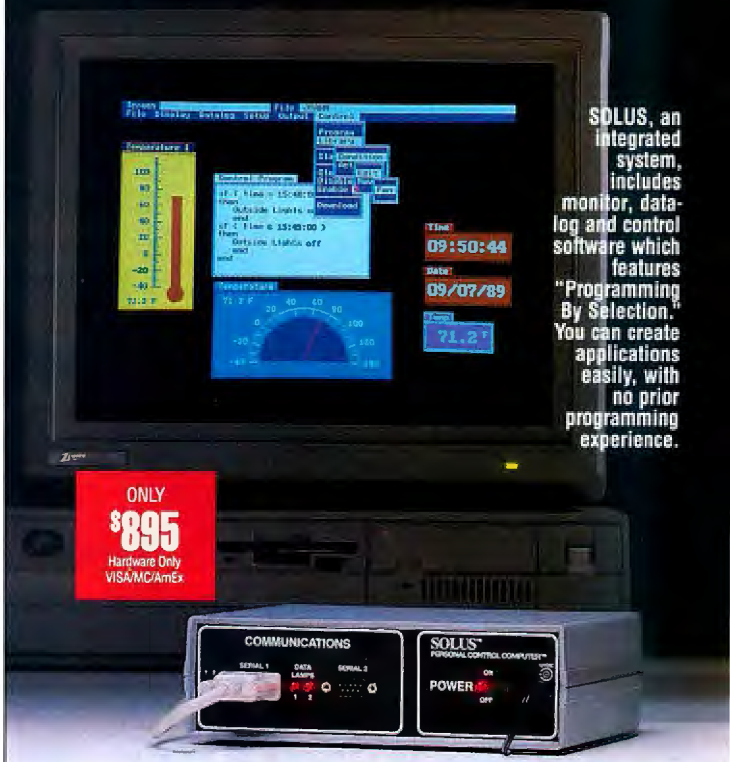

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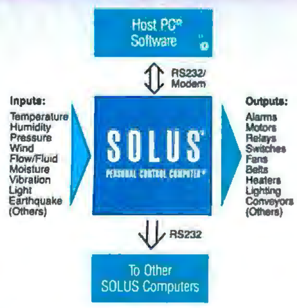

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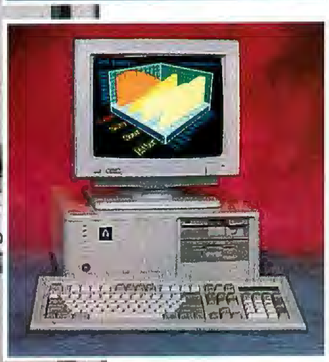

PC MAGAZINE

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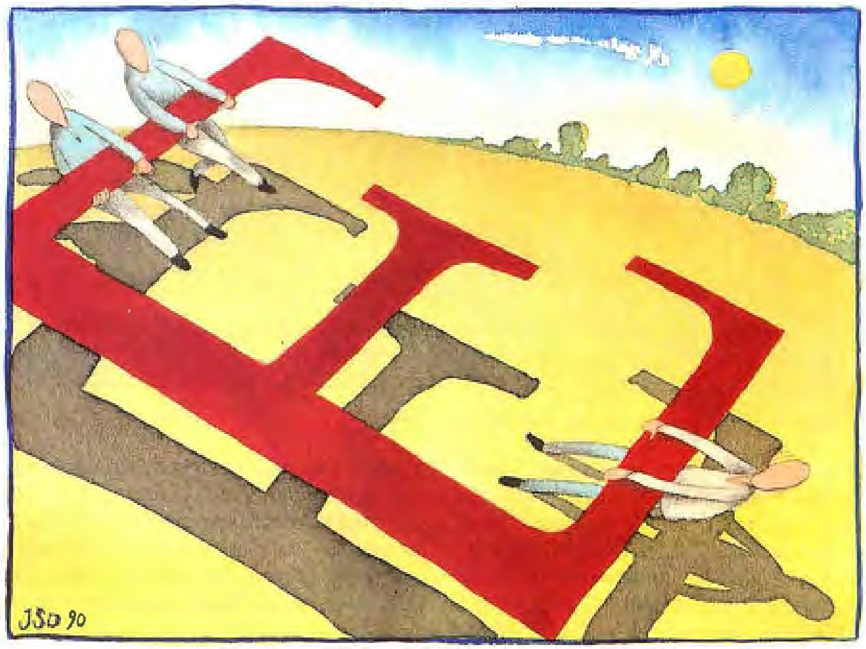
FONT WARS

Adobe Type 1 and TrueType battle for the future of digital type



Early this year, an unlikely coalition—Microsoft and Apple—took on Adobe, maker of PostScript, in a fierce standards war involving not only technological sophistication but turf and marketing muscle. The object: dominance of the world of fonts and font-rendering technology. I'll delve into the details of the two competing standards—Adobe's Type 1 fonts and Microsoft and Apple's TrueType—and discuss the strengths and weaknesses of each of them.

Font Formats Through the Ages

The first printing presses used blocks of hand-set, movable type. Each letter was individually cast, and lines of characters were held together using composing sticks. At the beginning, printers made their own type. Later, the creation of type, or *typefounding*, became a craft all its own. The type produced during this period, primitive though it was, was usually interchangeable with type from other foundries. A printer could match fonts from different makers pretty much as he saw fit.

Unfortunately, portability began to disappear in the early to mid-twentieth century, when vendors of automatic typesetting equipment intentionally made their machines incompatible with fonts produced by other companies. This, they reasoned, would allow them to reap huge profits by selling typefaces.

Because automatic typesetting equipment was so much more efficient than hand-set type, and because the use of proprietary font libraries became standard industry practice, this ploy worked. In fact, it worked so well that some vendors—such as Linotype—went so far as to make the fonts for one model incompatible with its other models. Thus, customers were forced to pay again for every font if they changed machines. To make matters worse, some customers found that they could not assemble a library of all the fonts they needed on a single make or model of machine, because no one vendor supplied them all.

To those of us in the computer industry who have watched entire markets unanimously reject incompatible solutions, it might seem foolhardy to continue such practices in the modern-day world of digital typesetting, in which fonts, like all things digital, are just bits. Alas, many did. Vendors of digital typesetters didn't just make their fonts machine-specific; they encrypted and even serialized them. Each copy of a font was keyed to the serial number of one machine and would work on no other.

PostScript, introduced by Adobe in 1984, diverged from these proprietary tactics by creating a standard set of fonts that could be reproduced on a wide range of printers with similar-looking results. Still, Adobe kept one of the most important parts of its technology proprietary. The Type 1 font format, which allowed hinted fonts to be rendered quickly on PostScript printers, was a closely guarded secret until March of this year.

Adobe Goes Public

Originally, a type foundry wishing to produce Type 1 fonts had to license special tools from Adobe and pay a royalty on every copy of every font it produced. (This is somewhat akin to paying a royalty on every program you produce with a compiler—a practice that has justly vanished in the last two decades.)

Adobe relented and published a specification for the Type 1 format (see the text box on page 290), but only after two

continued

ILLUSTRATION: JOHN DYKES © 1990

The Adobe Type 1 Encryption Scheme

Adobe Type 1 fonts use a two-level encryption scheme to protect the global hints, subroutines, and outlines. The Charstrings that describe the outlines—already tightly encoded as streams of bytes—are encrypted with a Data-Encryption-Standard-like algorithm; any subroutines they share are also encrypted this way. This first level of encryption is called Charstring encryption. The encrypted Charstring information is then combined with global font information and encrypted yet again, producing a long string of hexadecimal digits. This second level of encryption is called "eexec" encryption, after the PostScript verb that uses the output.

Figure A diagrams the encryption/decryption algorithm, which is the same for both levels.

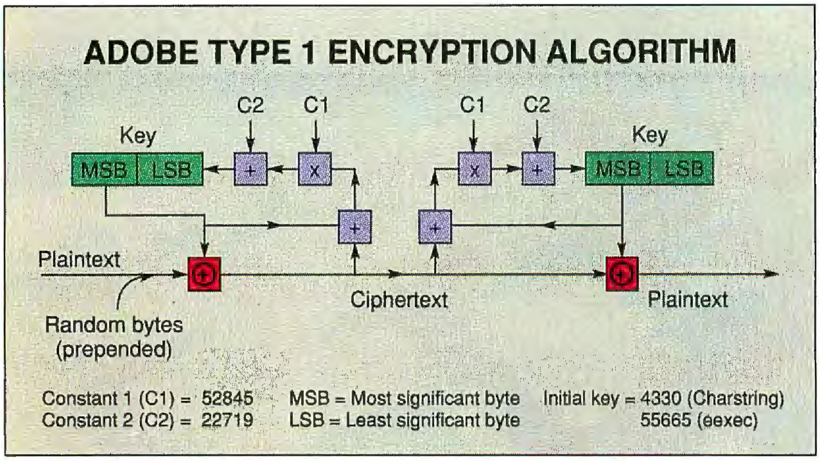


Figure A: *The Adobe Type 1 encryption algorithm uses a pseudorandom-number generator whose output depends not only on previous values of the key, but also on the text that's passing through. Random bytes are prepended to the plaintext before encryption so that the resulting ciphertext will be different every time. The decoder needs only to know how many of these bytes there are to remove them.*

things occurred. First, some type foundries (such as Bitstream) successfully reverse-engineered the format and were producing Type 1 fonts. Second, Microsoft and Apple, seeing an opportunity in the public's resentment of this closed technology, promoted a public font format code-named Royal (now TrueType).

Adobe could not have hoped to stop users from moving toward a publicly available, non-Adobe standard while its own format was still private. By wisely choosing to reveal the details of Type 1 fonts, Adobe may have done what was necessary to retain many customers it might otherwise have lost. What's more, it may slow the acceptance of the new standard, which, at this writing, is untried and not part of any shipping commercial product.

Font-Rendering Technology

Now that neither is secret, the battle between these two font formats is one of technology and marketing. But to understand the technical side of the controversy, you need to understand a bit about font rendering—the process in which the archetypal, or ideal, form of a character is approximated by a finite number of fixed pixels on a computer screen or printed page.

In the days of movable type, each letter of each font was designed, drawn, and scaled by hand. And, contrary to what you might expect, you can't create larger or smaller versions of letters by simply enlarging or reducing those drawings. Certain parts of a character—in particular, stems and serifs—require special treatment.

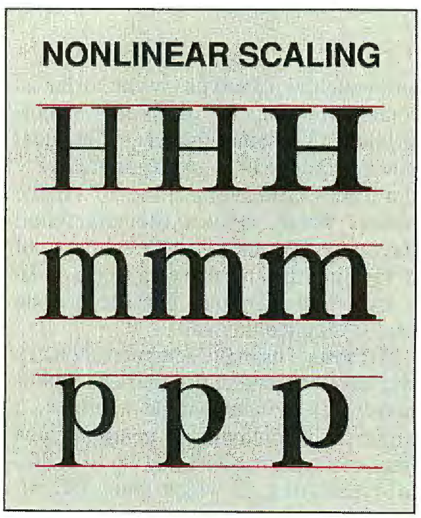


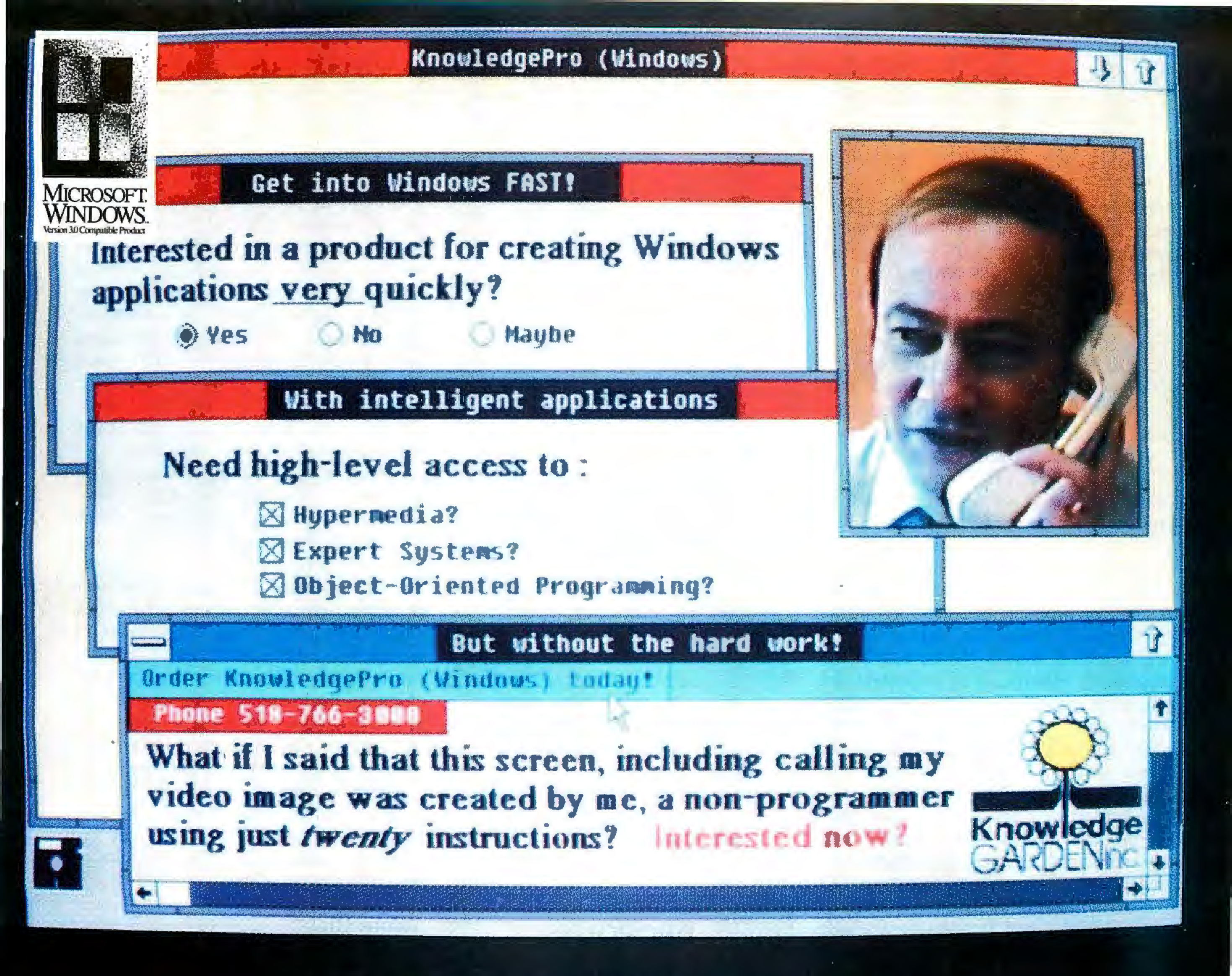
Figure 1: *These letters, originally of different point sizes, have been enlarged to equal cell heights to show how their proportions vary. The result is more pleasing to the eye than simple scaling.*

Figure 1 shows how some fonts change as they're scaled. Notice that the heights and widths of features vary at different sizes, as do the locations of characters within their cells. These distortions improve the appearance of the characters. Experience has shown that the human visual system finds unequal horizontal and vertical scaling factors more aesthetically pleasing than equal ones.

Adjusting for the quirks of human perception is one of the most subtle aspects of the typographer's art. As John Collins, a founder of Bitstream, puts it, "The essence of typography is regularity." Yet, paradoxically, the letters must be made irregular to be perceived as regular. For instance, in the font BYTE uses to print this column, the bottoms of the "o," "t," and "s" in the word "fonts" descend ever so slightly below the bottom of the "n." (If you don't believe this, use a straightedge to see for yourself.) Were the extra height not added, the rounded base of these letters would appear to sit slightly above the baseline.

For digital printers and displays, characters must also be rasterized. Character shapes may be represented by bit maps (bit-mapped fonts), vectors (stroked

continued



Un-retouched VGA screen image. Special hardware required for motion video.*

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fonts), or outlines (outline fonts). (For more information on the first two techniques, see "The ABCs of Digital Type," November 1989 BYTE.)

The most basic approach to creating characters in an outline font is as follows: First, scale the ideal outline of the character to the right size. Then, turn on each pixel whose center falls within the outline. However, since this naive approach doesn't account for human perception, it can produce ugly results.

Figures 2 and 3 illustrate some common problems of scaled outline fonts. In figure 2, the stems of a lowercase "n" rasterized at low resolution are different thicknesses, making it grossly asymmetrical. In figure 3, the uppercase "R" has a hole, or dropout, because the outline just misses the centers of the pixels where the rightmost stem joins the rest of the character. Finally, it is important for similarly shaped characters within a font to be rendered in similar ways. If the "m" isn't shaped a lot like the "n" in the same font, for instance, a reader will perceive that something is wrong.

Thus, if we want to use scaled fonts to produce quality screen images and printer output, we need to make the computer more conscious of aesthetics. To make stem widths symmetrical, serifs of equal lengths, and features comparable from character to character, we need to devise a way of telling the computer more about the desired end result. This is called *hinting*, and it lies at the heart of modern font-rendering technology.

There are many rasterizing and hinting systems, most of them proprietary. Among the best known are Intellifont (AGFA CG), Fontware and Speedo (Bitstream), FontMaker (Sun), Nimbus (URW), Nimbus Q (The Company), Adobe Type 1 (Adobe), and TrueType (Apple and Microsoft). I'll focus on Adobe Type 1 and TrueType.

Adobe Type 1

Adobe Type 1 fonts (or font programs, as Adobe calls them) use a simple subset of PostScript to draw the outline of each letter, and two levels of hints. The outlines are drawn by small snippets of code, while the hints are mostly declarative in nature—that is, they give information to the rasterizing code but are not code themselves. The rasterizing program itself, which may be part of a PostScript interpreter or a separate entity (as in the case of Adobe Type Manager, or ATM), is called Type 1 BuildChar.

A Type 1 font contains several levels of information that BuildChar can use to render a font. At the highest level, it provides global hints (font-level hints, in Adobe parlance). These contain information that applies to every character in the font, including the desired heights of uppercase and lowercase characters, the distance rounded edges are allowed to overshoot past flat ones, and the desired stem widths (important for small type). There's also information that helps the rasterizer make fonts within the same family (e.g., Times Roman and Times Roman Bold) look very much alike.

The next level contains chunks of code that produce the character shapes themselves. These small procedures, which are called Charstrings, are highly compressed strings of bytes. The 24 documented rendering commands implement a very small subset of PostScript—just barely enough to trace the outlines of characters. Some draw lines and curves, while others call subroutines, perform division, begin and end character definitions, and give character-level hints. Most of the commands use numbers on a stack as arguments. All but one of the Charstring drawing commands specify relative, rather than absolute, motion. That way, it's easy to incorporate the commands into subroutines that can be used throughout a font.

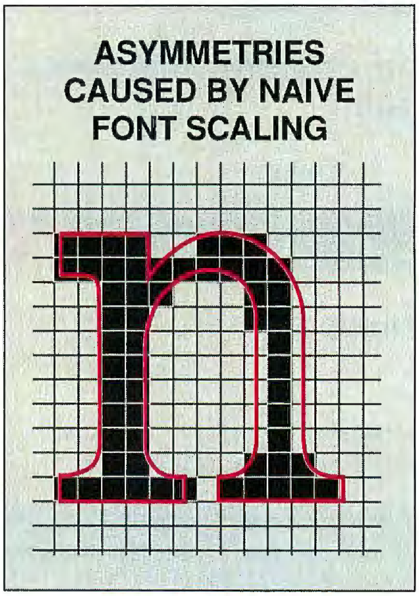

Figure 2: *When a simplistic algorithm is used to scale fonts, ugly asymmetries may appear. This lowercase "n" has uneven stems and serifs because the scaled outline (itself symmetrical) doesn't quite match up with the pixel grid.*

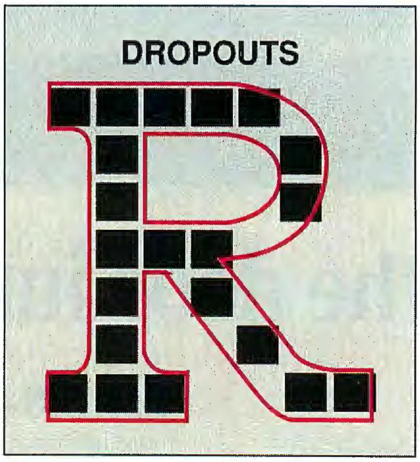

Figure 3: *The "R" has a missing pixel, or "dropout," due to a poor fit between the character outline and the grid.*

Adobe Hints

The lowest level of description within an Adobe Type 1 font is character-level hinting, which relies heavily on the concept of a stem. Each character of a Type 1 font is said to consist of vertical strokes (called vertical stems) and horizontal strokes (called horizontal stems). The two main strokes of the letter "T" are considered to be stems; so are the perpendicular serifs at the ends. Interestingly, stems in Type 1 fonts don't have to be horizontal, vertical, or straight. The top and bottom halves of an "O" could be considered horizontal stems, and the left and right halves might be considered vertical stems.

Stem hints let the rasterizer adjust the stem widths of different characters within the font to render them more uniform. They also help to establish the locations of the top and bottom of each character.

Figure 4 shows how horizontal and vertical stem hints might be applied to a "T" in a serifed font. Note that the stem zones are specified as pairs of x- or y-values; they extend all the way across the character. If a letter doesn't have serifs, a font designer may add "ghost stems"—that is, stem hints that don't correspond to actual stems—to help the rasterizer find the top and bottom of the character (see figure 5).

Adobe Type 1 fonts implement two other kinds of hints: dotsection hints, which help to render dotted characters, and the Flex mechanism, which flattens out shallow curves at low resolutions to make letters look less jagged.

Finally, there's one other mechanism that can be used to improve the rendering and scaling of fonts: 'hybrid fonts. In a hybrid font, the rasterizer uses one of two sets of outlines, depending on the resolution of the output device. The high-resolution outlines usually have subtle details that the low-resolution ones leave out. Adobe's Optima is a hybrid font.

How well do Adobe's hinting mechanisms work? Clearly, well enough for thousands of satisfied users of PostScript printers. However, type designers argue that non-Latin and ideographic characters (e.g., kanji), which don't have uniform stems like Western alphabets, are not well served by the Adobe hinting mechanisms. Adobe itself recommends that very complex symbols and logos be implemented as Type 3 fonts. These generate each character by means of an ordinary PostScript program. Unfortunately, Type 3 fonts won't work with ATM, so they cannot be used as screen/printer fonts on machines with ATM. They also take much longer to render than Type 1 fonts and have no built-in hinting mechanism.

Some type foundries also complain 2that it's tough to convert the font formats they use in-house to Type 1—mainly because the underlying data structures and algorithms are so different. Finally, typographers have found that they must predistort, or *regularize*, their outlines—possibly throwing away some of the subtleties of their designs—to get good results from Adobe's rasterizers. Bitstream, for instance, uses regularization (and possibly hybrid fonts) in its Type 1 products, but abandons Adobe's character-level hints altogether. Still, despite its drawbacks, Adobe's Type 1 font format produces good output in many applications. Well-entrenched and heavily supported by big names such as IBM, Type 1 is likely to endure as a standard for the forseeable future, no matter what else comes along.

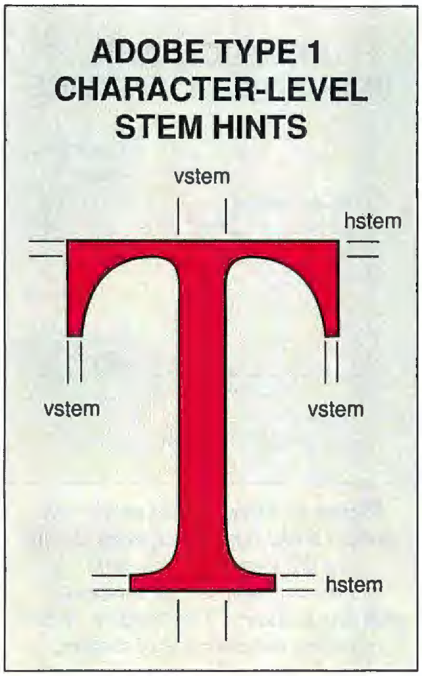

Figure 4: *Adobe Type 1 fonts use character-level stem hints to specify where stems are. These hints help the BuildChar rasterizer apply global information, such as preferred stem widths, to individual characters.*

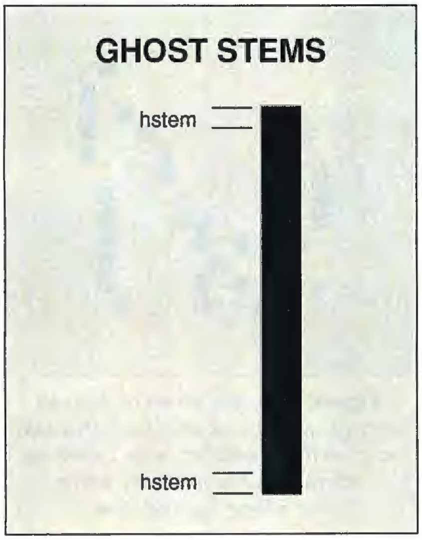

Figure 5: *This sans-serif "I" has "ghost stems." By specifying stems where they don't really exist, the font designer can force BuildChar to apply global hints about capital letter height and baseline alignment to the character.*

Enter TrueType

TrueType, developed by Apple, has a very different format from that of Adobe Type 1. Instead of creating yet another high-level hinting paradigm, TrueType attempts to provide low-level primitives with which all the other schemes—including Adobe's—can be implemented. The developers make an analogy to low- and high-level computer languages: It's easier to compile either C or Pascal to assembly language than to translate between C and Pascal.

Both TrueType and Type 1 fonts begin with outlines, but the similarity ends there. While Type 1 fonts use programmatic outlines and declarative hints, TrueType does exactly the opposite. Outlines are expressed not as drawing instructions but as collections of control points—that is, points that guide the drawing of curves called quadratic B-splines. These curves, when connected, form the character outline. The hinting code that accompanies the outline influences the final result by moving the points; a simple rasterizer then takes over and creates a bit map. This is the overall philosophy of TrueType: to make the rendering system more flexible by placing more intelligence in the hinting code and less in the rasterizer.

TrueType's emphasis on manipulating outlines leads to an unusual instruction set. TrueType's stack-oriented pseudo-machine performs many functions that, while they may be low-level to a font scaler, are extremely high-level compared to conventional assembly language. To understand them at all, you must understand TrueType's somewhat sophisticated grid-fitting paradigm.

Suppose you want to move a point on the outline of a character to a new position on the x,y plane. How do you specify which way and how far to move the point? The most obvious way is to give simple displacements in the x and y directions. However, what a font designer really wants to say when hinting a font is probably more like this: "I want to move this point in this direction until it lines up with these other features."

TrueType implements this more useful kind of movement by integrating the concepts of a freedom vector and a projection vector. The freedom vector specifies the direction in which a point is to move, and the projection vector specifies a direction (not necessarily the same one) in which the distance the point has moved is to be measured. Figure 6 shows how this works. Point A is moved along a freedom vector, which makes a 45-degree angle with the horizontal, but the distance of movement is measured along the projection vector (which happens to be horizontal in this example). All the work needed to move a point in this way can be accomplished with a single TrueType instruction.

Now, suppose you want to move another point—or a whole group of points—

continued

along with the first point, to maintain the original geometric relationship between the points. You can do this by telling TrueType to make the first point a *reference* point. It then takes only one more TrueType instruction to move one or many other points in the same way as the first. Thus, if you wanted to move the whole right-hand side of a letter uniformly upward and outward, you might apply a movement like the one in figure 6 to all the points in that part of the outline.

Another single instruction can find the intersection of two lines (defined by their endpoints) and place an outline point at that spot. Yet another instruction adjusts an angle so that the lines emanating from it will look as smooth as possible. And it takes only one command to activate the dropout control feature, which scans the character for contours and makes sure they don't have gaps in the final bit map. Some TrueType instructions that you might want to apply to many points have a built-in looping capability. You set a variable called Loop to indicate the number of successive points to be affected by an instruction, just as you'd set the CX register in an 8088 to control the number of bytes that a string primitive processes.

TrueType implements several mechanisms to handle character drawing at low resolutions. The ControlValues table can be used to force stems and other features to uniform widths at small sizes, and special conditional instructions can remove features altogether if there's no room to draw them. Finally, as a possible last resort, the TrueType format provides a way to tell the rasterizer to "give up" and use a set of hand-tuned bit maps instead. While this is not an ideal solution, it obviates the need to write lots of special code for very small font sizes.

So far, TrueType doesn't sound much like an "assembly language." Yet, bundled in with TrueType's sophisticated graphics instructions are primitives you would expect to see in a low-level language, such as jumps, calls, and conditional branches.

Unlike Type 1 font programs, TrueType programs have access to a wide variety of mathematical operations: addition, subtraction, multiplication, division, negation, rounding, and Boolean operations. This means a TrueType program can do the calculations associated with any hinting system. There's even a debugging instruction that will show the top of the stack in a font-development system.

In short, TrueType is not really one language, but two: a basic stack-oriented language and a group of special high-

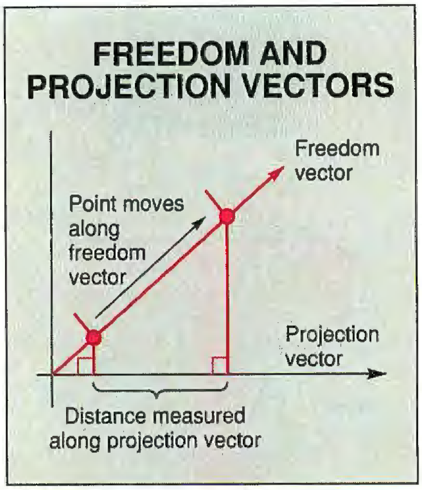

Figure 6: *Freedom and projection vectors make it easy to specify a hint of the form "Move a point in this direction so that it lines up with this feature." The freedom vector controls the direction of motion, while the projection vector controls how distance is measured.*

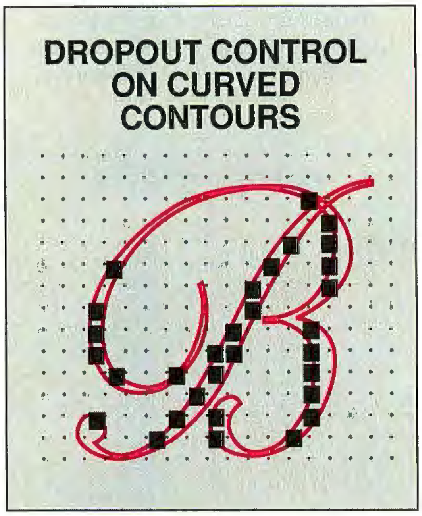

Figure 7: *Simple forms of dropout control, which look only for horizontal and vertical contours, won't work on characters like this one, which has a long, curved stem.*

level routines to manipulate outlines. Still, because the outline-manipulation facilities afford more direct control than Adobe's limited selection of hints, it's easier to recast your own hinting strategy in this language.

The TrueType specification, which documents the 112 1-byte instructions and the file format, doesn't take pains to explain the fundamental philosophies behind TrueType or show how the instructions are used. It's therefore tough going for those who aren't intimately familiar with hinting and font rendering. Fortunately, few users will need to learn the intricacies of these instructions. More than half a dozen companies—including Bitstream, URW, Altsys, The Company, and Monotype—are creating tools that will automatically "compile" fonts into TrueType format. Thus, like programmers of RISC machines, most font designers may never have to deal with the instructions that make up TrueType fonts.

Pluses and Minuses

TrueType, despite glowing reports from many experts, still has some shortcomings. First, it produces larger files than most other formats, including Adobe Type 1 and Bitstream's Speedo. Second, the dropout control mechanism may need improvement. As documented, it's only capable of scanning for horizontal and vertical contours and filling dropouts in them; diagonal lines with dropouts might not be fixed (see figure 7). But adding clever code to correct this runs counter to the fundamental philosophy of TrueType, which is to put the intelligence in the fonts rather than in the rasterizer.

Finally, while the battle against encryption has pretty much been won on the Adobe Type 1 front, it may surface again in TrueType: The specification states Apple's intention to provide font vendors with a tool that creates encrypted TrueType fonts.

On the plus side, TrueType provides tools to implement hinting rather than mandating a single hinting scheme. As such, it will allow users to take advantage of improvements in the technology without buying new equipment (the Type 1 rasterizers in most printers are burned permanently into ROM).

Early versions of TrueType have been shown to render certain kinds of output much faster than Adobe's Type 1 code. You must, of course, view these early tests with some skepticism. The pages used in Microsoft's demonstrations, which contained "waterfalls" of increasingly larger text, don't reflect real-life situations and may have been chosen to exploit quirks of the two systems.

The code for the TrueType rasterizer itself is small, allowing it to be included in application programs or even translated to PostScript and downloaded to a printer. And because it supports double-byte character sets and nonlinear scaling, TrueType provides good support for ideographic character sets.

Finally, while Adobe must keep some details of its rasterizer secret so that it can stay in business, Microsoft and Apple will reveal exactly how TrueType works, and they plan to include it free of charge in Presentation Manager, Windows, and System 7.0. (The fact that fonts and page-description languages are not the main product of either company gives them an advantage in this respect.)

Efforts are currently under way to develop cartridges that support TrueType (and Microsoft's PostScript clone, TrueImage) on Hewlett-Packard LaserJet printers. Microsoft has even announced that it plans to bundle a run-time version of the TrueType rasterizer with its C compiler, so programmers can create DOS programs that use TrueType.

At this writing, TrueType is still "vaporware." Not a single TrueType rasterizer or font has been shipped to the general public, while Adobe Type 1 fonts can be had from many sources. When TrueType products do become available, users will at last be able to decide for themselves if there's a practical advantage to moving to TrueType.

The Future

In an ideal world, font designers could buy tools that would accept their artwork and create complete, perfectly hinted fonts with no further intervention. Users could then buy a copy of the font in a universal format that could be used with any computer, application program, or GUI, regardless of manufacturer.

Current technology (and corporate policies) haven't arrived at this stage yet, but with the opening of the Adobe Type 1 standard and the advent of TrueType, we're getting closer. It may not be long before font wars and proprietary font technology are as much a relic of the past as Gutenberg's hand-cut metal type. ■

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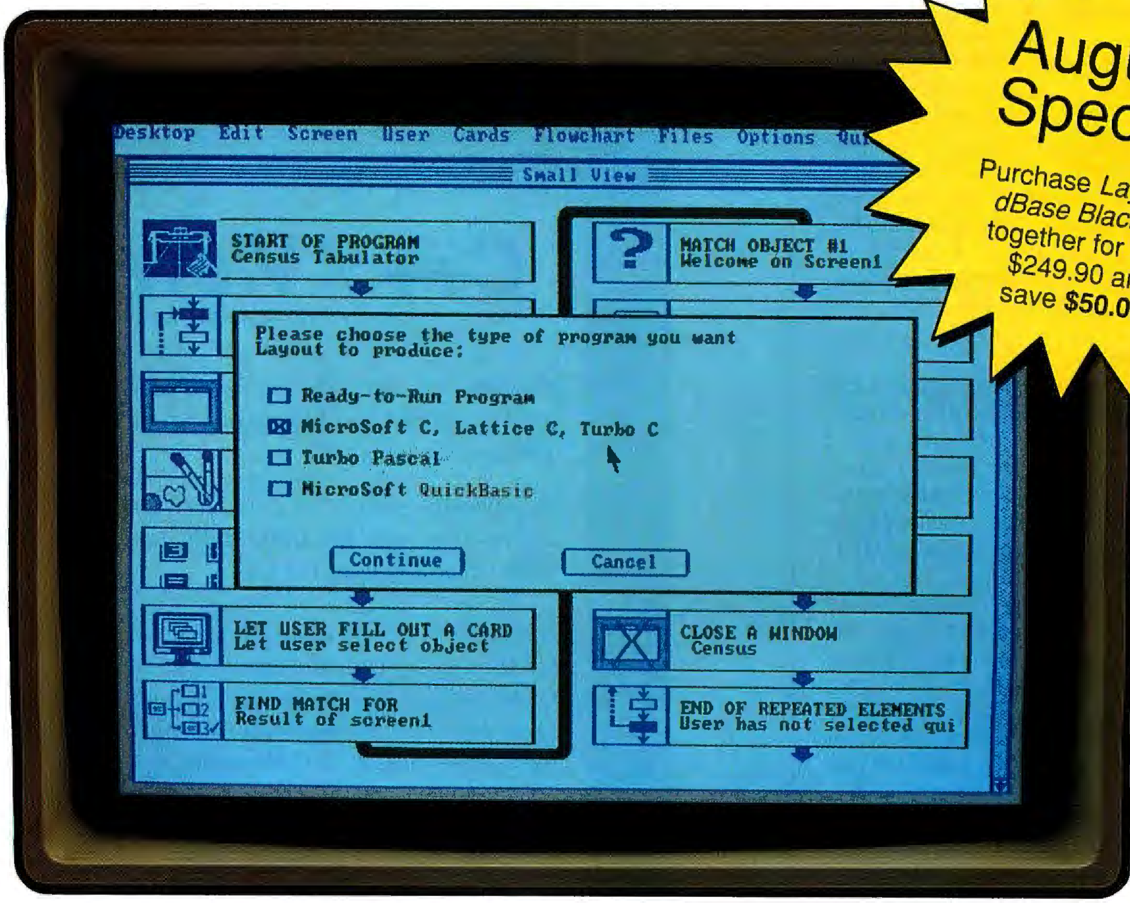

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HIGH-PERFORMANCE POSTSCRIPT

Put the typesetting compute load on your printer and still get good performance

Last month, I looked at some tricks for special PostScript effects and some of the strengths of PostScript as a general computing language. These tidbits should have whet your appetite for some more serious PostScript secrets that will let you turn your printer into a high-performance typesetting machine.

Gonzo Justification

I overwhelmingly prefer to work in raw PostScript in a non-WYSIWYG, standard ASCII text-file environment. I find that this gives me far more control and lets me explore many PostScript-as-language applications that might not be at all obvious in a screen-oriented or page-making environment.

One of my ongoing projects is working on my *gonzo justify routines*, where I've attempted to produce the highest possible text-justification quality consistent with 300 dots per inch. These routines let you fill and justify a line with any number of chosen regular, italic, boldface, superscripted, subscripted, or custom font selections. As many as six stages of progressive microjustification get used.

First, all characters are spaced out by a minimum and selectable fixed kerning, eliminating the collisions common at very small point sizes. Second, spaces get stretched out from their compressible limit up to their normal value. Third, up to one additional pixel is added to each character to improve 300-dpi readability. Fourth, the spaces get stretched out to an upper aesthetic limit. Fifth, the characters are stretched out to an upper pleasing limit. Sixth, and finally, if all else fails, spaces are stretched as far as is necessary to complete the fill.

Other gonzo features are individually selectable character kerning, tabbing, programmable preset keystoning, fully automatic drop caps, last paragraph line stretch, and hanging punctuation. In hanging punctuation, dashes, periods, and commas lean out into the right intercolumn spacing. While seldom seen, hanging punctuation can dramatically improve 300-dpi filled and justified text.

These gonzo routines are fully programmable, which lets them emulate just about anything in a simple and direct manner.

IBM PC and Clone Interface

Since PostScript is device-independent, it easily works with any host computer, including all the PC clones. Yes, the LaserWriter works beautifully with any of these machines. It even includes a free secret and automatic two-host network that does not require AppleTalk or any fancy cables.

Virtually all clone problems are due to end-user misinformation. First and foremost: Don't ever, under any circumstances, use a clone parallel printer port to interface a PostScript printer! To do so deprives you of receiving crucial return error messages, denies you interactive operation, prevents any host recording, and outright eliminates around 90 percent of the more useful features of PostScript as a general-purpose language, while making your printer drivers unbearably klutzy and primitive.

Instead, save all your PostScript routines as standard ASCII text files to disk. Then pick up those text files with a suitable communications program (e.g., Crosstalk) and use them in a two-way interactive COM1 environment. A good baseline environment is 9600 bps, 8 data bits, 1 stop bit, no parity, full duplex, and XON/XOFF handshaking activated. Note that a simple COPY to the COM1 port also will not give you any of the essential return error messages. There are at least six cable options between clones and the LaserWriter. The baseline option I recommend for DB-25 to DB-25 plugs for RS-232C standards is the following:

1 to 1
2 to 3
3 to 2
short left 4 and 5
short right 4 and 5
6 to 20
20 to 6
7 to 7
8 to 8

When RS-423 is being used, the RS-232C data-out line goes to RXD−, and RXD+ gets grounded. Failing to ground RXD+ is far and away the most common mistake made here. Similarly, the TXD− drives the RS-232C data-in line, and no connection is made to TXD+.

After you are reliably receiving your return error messages, you might want to install a persistent printing error trapper. Details on this are in the Adobe green book and on most PostScript BBSes.

Getting your PostScript communications up and running the first time can be extremely frustrating. Many communications programs will not change their parameters in real time. If something does not work during your initial setup, always do a cold reboot, and make sure your PostScript printer displays a solid green or is idle before you try to talk to it.

Pixel Line Remapping

A six-element linear transformation matrix in PostScript gets you from user space to device space. This lets you do all the usual translation, rotation, and scaling operations. For example, any square can be converted into another square of any size, to a rectangle, a parallelogram, a point, or a line, at any rotation angle anywhere on (or off) your page.

continued

There are times and places when you want to go beyond linear transformation and make the more complex *nonlinear* transformations on the fly. Obvious examples include perspective and the style of lettering used in *Star Wars*, or mapping images onto apparently nonflat surfaces. A perspective letter is generally trapezoidal, thus requiring a nonlinear transformation.

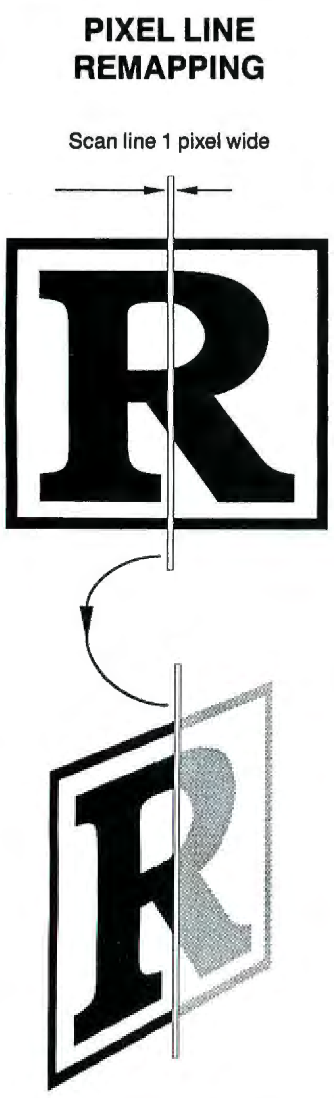

Figure 1: *Pixel line remapping gives you powerful nonlinear transformation tools that let you map any image onto many complex surfaces.*
(a) *The "flat" image gets broken down into one horizontal or vertical pixel line at a time. Each line will then be selectively translated, rotated, and scaled as needed to* **(b)** *get pasted when and where required on the final image. Nonlinear transformations are far more powerful than ordinary linear operations, but they are much slower.*

I've come up with a sneaky and slow scheme that I call *pixel line remapping*, which lets you map almost anything onto strange or unusual surfaces. Figure 1 shows how it works. Figure 2 shows two examples of its use.

With pixel line remapping, you first create a flat image that you wish to transform nonlinearly. This is an ordinary PostScript image, so you do not need access to anything special (e.g., the font paths). You then scan this flat image a single pixel line at a time. Each individual pixel line gets picked up and then translated, scaled, and/or rotated before final page placement.

There are two mapping routines, one for vertical scanning and another for horizontal scanning. Each successive scan line is shown shorter, higher, and to the left of its position in the original image. In figure 2b, horizontal scanning is used to produce a *Star Wars*–style logo. Each new line is shown shorter and below its position in the original. In figure 2a, a label is wrapped around an isometric or perspective can. Lines left of center are shown above and to the right of the original, while lines right of center are shown above and to the left of their original positions on the flat label.

Processing speed varies with image size and pixel resolution, being fastest for graphics, an intermediate speed when repeatedly showing only one single font size, and rather slow when continuously changing the font size on the fly.

The parameter resolution adjustment in listing 1 lets you handle scaling or do rough drafts much faster. If this value is too high, you get dropouts. If too low, you are wasting your time and may get a slightly rattier final result.

For the ultimate in any nonlinear transformations, you can also do *pixel point remapping*, but this can take forever on larger images. Until you include that good old "Uh? Compared to what?" factor, pixel point remapping lets you map anything onto any surface, however complex.

Pseudocompiling

PostScript is often wrongly accused of being a slow language. Most often, the speed measurements are done using a non-PostScript application running on a non-PostScript host, creating nonoptimized mechanical code, and communicating over a glacially slow communications channel. PostScript is considerably faster than most people assume.

I am very big on *book-on-demand* publishing, where a single title gets produced for each and every customer order. Long page-makeup times are intolerable here, because each book self-collates on a page-by-page basis. My 6000-character, three-column, gonzo-justified text with headers, footers, and one or two fairly complex figures typically requires a page-makeup time of between 0 and 4 seconds, using an Apple IIe as a host! Thus, I consider all the "speed tests" made in PostScript printer reviews to be totally ludicrous.

One crucial speedup secret involves getting your communications up to a decent rate. AppleTalk is not significantly faster than an honest 9600-bps serial channel for most users, most of the time. Many communications setups involve excessive "Hi, how's the wife and kids?" handshaking. I use a custom-crafted and honest 57,600-bps serial channel going out the game paddle port of my IIe. My handshaking overhead is *zero*, since new characters are received during the interbit delay times. Two ultimate communications speedups are to use a local SCSI hard disk drive or directly download your PostScript code over a SCSI channel.

At any rate, the real secret to speeding up any interpreted language is to compile it instead. Outside of PostScript's rather restrictive bind command, which can sometimes give you a 15 percent or so speedup, a true compiling of your PostScript code can get rather tricky for most users. But there are all sorts of *pseudocompiling* games you can play that can give you dramatic speed improvements.

Pseudocompiling is useful only for images that you want to reuse at least once in the future. The trick here is to make all your calculations only once, save *only the results* from those calculations, and return them to your host for recording and later reuse. The key rule is to save and reuse only genuinely needed information. Pseudocompiling can be done either manually or under intelligent program control.

Another pseudocompiling stunt is to never change a font more than once per page. Since it usually does not matter in which order things go down onto your reprinted PostScript page, you put all your regular text down first, all your italic text, all the boldface, the headlines, and so on.

To do this, you use a custom routine that saves all your strings with their font, position, and message information into a bunch of dictionaries. After your first pseudocompiling run, you dump these dictionaries back to your host for recording and later reuse.

Pseudocompiled code can also get modestly compacted with no significant speed penalties. Tricks like a simple formatting operator, dropping leading zeros, and dropping the number of significant bits to those actually required can further shorten (and thus speed up) your run-time files.

Adobe's Distillery is one example of a useful yet automated pseudocompiling program. The PostScript code for a pseudocompiler of mine that includes font ordering is included with the listings available with the gonzo code.

Proc Caching

I'll wrap things up here with a little-known PostScript speedup trick that can apply to any image you want to reuse at least once at the same size.

The trick is called *proc caching*. It can give from a 12-to-1 to a 7,000,000-to-1 speedup of all your PostScript run times. The amazing thing is that proc caching is more or less free. All you have to do is make several minor changes in your programming style. Proc caching can also capture entire-page bit maps and let you save permanently fast results for later use. Proc caching seems well suited for smaller images that involve long make-ready times due to use of irregular clipping, repeated randomizing, pixel remapping, curve tracing, multilayer buildups, extensive math calculations, nonlinear transformations, or other slower or intricate operations.

PostScript includes a powerful *font cache* that converts most font characters into a bit map the first time they are used. Thus, the initial *s* of a given size in your document is done as a descriptive outline procedure. Those results are transferred to the font cache as a bit map and saved. Repeat use of the *s* character in the same size comes from the bit map and is typically several thousand times or more faster.

Figure 2a uses a vertical pixel line remapped "wraparound" font, convenient for applying to circular surfaces. In this example, proc caching gives you a 5000-to-1 speedup on any future reuse of this image at the same size.

All you have to do to proc cache is convert any complex or slow PostScript routine into one or more characters in a custom font. Then you simply let the font-caching mechanism do its thing.

There are at least four ways to use font caching. If you define your custom font on the fly, the cache will go away with your current job. This is handy for 12-up business cards on older machines with limited memory.

If, instead, you persistently download your custom font, your speedup will remain as long as printer power is applied. If you have a hard disk drive attached to your IINTX or other PostScript laser printer, the fast image will remain until the next time the drive blows up.

Finally, you can easily read the font cache on your hard disk and return it to

continued

Listing 1: Star Wars–*style lettering is achieved by scanning the original text with horizontal scan lines and then translating the pixels with a tilt factor (see figure 2b).*

```
/resolutionadjust 1 def % raise to debug;
                        % lower to eliminate any stripes

/hpixellineremap {0 1 resolutionadjust mul pixelprocht
 300 mul 72 div cvi {/slinenum exch def save /snap1 exch def
 mark mappingproc newpath 0 slinenum 72 mul 300 div moveto
 pixelprocwidth 0 rlineto 0 72 300 div rlineto pixelprocwidth
 neg 0 rlineto closepath clip newpath pixelproc cleartomark
 snap1 restore} for } def

/pixelproc {5 5 moveto 0 134 rlineto 222 0 rlineto
 0 -134 rlineto closepath stroke 20 15 moveto (FREE FONT) show
 20 57 moveto (FREE FONT) show 20 99 moveto (FREE FONT) show} def

/mappingproc {pixelprocwidth 2 div 0 translate
 tiltfactor pixelprocht mul dup slinenum add div dup scale
 pixelprocwidth 2 div neg 0 translate} def

% /// demo - remove before use. ///

/AvantGarde-Demi findfont [40 0 0 40 0 0] makefont setfont

/pixelprocht 140 def       % total scanned height
/pixelprocwidth 230 def    % total scanned width
/tiltfactor 8 def          % the smaller the flatter

gsave 150 300 translate hpixellineremap grestore showpage quit
```

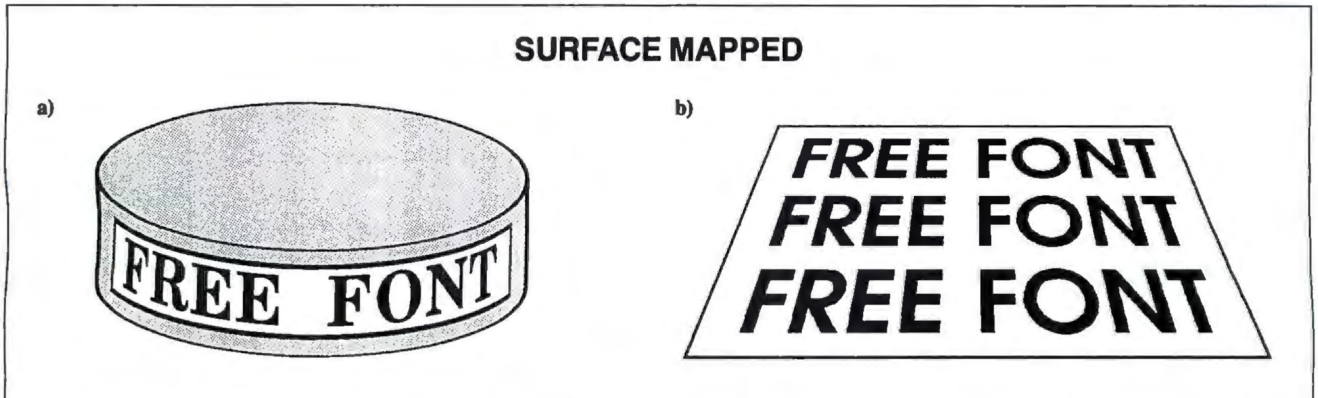

Figure 2: (a) *This vertical pixel line remapping example prints in 70 seconds on a LaserWriter IINTX. By proc caching, or preconverting the image into 2 characters in a custom font, the repeat imaging time drops to 14 milliseconds, a 5000-to-1 speed improvement.* **(b)** Star Wars–*style lettering is one of the most popular uses for horizontal pixel line remapping. Each pixel line is shown somewhat shortened from the flat original. (See listing 1 for the method.) Since pixel remapping applies to any image, you do not need access to your font paths.*

your host for recording, giving you a permanent bit map that can stay fast forever.

Most newer PostScript printers control their font cache with the following line:

```
mark M N setcacheparams
```

The *N* value here is the maximum number of bytes allowed in the bit map of a single character. Multiply this by 8 to get the number of bits allowed per character. The *M* value decides which of two caching strategies will be used. Bit maps of less than *M* bytes will get cached as a real bit map; those greater than *M* but less than *N* will instead get run-length encoded. Run-length encoding needs less memory than a full bit map, but it typically executes six times slower.

To guarantee a real bit map, simply define *M* as larger than *N*. Characters needing a bit map larger than *N* bytes will not get cached at all.

The allowable size of *M* depends on your printer and how much memory is in it. The simplest method to find your maximum is to keep increasing *M* until you get a limit-check error.

Naturally, you will want to open up *M* as wide as you can to let you proc cache your larger images. A 3-MB IINTX lets you proc cache images up to 4 square inches, while a full 12-MB IINTX handles images up to 16 square inches.

These size restrictions might seem somewhat limiting, but note that the slow portions of many images are typically rather small, and that you can use as many characters in your custom font side by side to build up any size image at all. As few as six characters can capture your entire-page bit map on a full IINTX.

Several minor gotchas are involved in proc caching. Your routine has to be well enough behaved to allow its definition as a custom font character. Each character in a font is allowed only as a single color or a single shade of gray. Thus, you'll need an additional custom character for each color change in the original image.

In figure 2a, only the label itself gets proc-cached. One proc-cached character gets used as a white background mask, erasing the color of the can; a second proc-cached character puts the label on top of the erasing white mask.

The PostScript code for figure 2a is available, so you can start exploring proc caching on your own. For additional information on proc caching or any PostScript topic, you can contact me.

Learning PostScript thoroughly will open your eyes to some amazing possibilities, including book-on-demand publishing with just a simple 300-dpi PostScript printer. By tuning your PostScript techniques, you can turn this machine into a high-performance machine without further investment in hardware. ■

Editor's note: *The PostScript code for the gonzo routines is available (along with other code in this column) in a variety of formats. See page 5 for details.*

Microcomputer pioneer and PostScript authority Don Lancaster (Thatcher, AZ) is the author of 26 books and countless articles. He maintains a no-charge PostScript help line at (602) 428-4073. The best time to call is from 8 to 5 (MT) on weekdays. He can also be reached on BIX c/o "editors."

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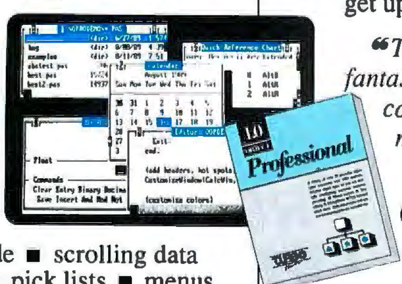

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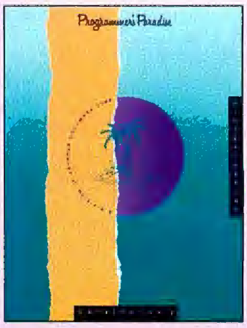

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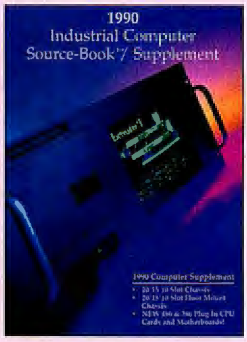

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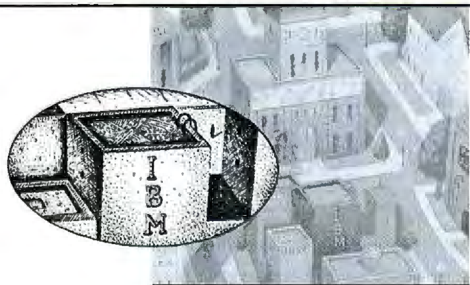

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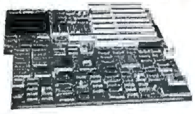

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421000A9B-70	70ns, 1Mx9	$139.95
421000A9B-80	80ns, 1Mx9	$119.95
421000A9B-10	100ns, 1Mx9	$113.95
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6264LP-15	150ns, 64Kx1 (CMOS)	$4.95
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- UL listed

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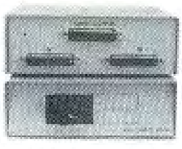

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• Programs all current EPROMs in the 2716 to 27512 range plus the X2864 EEPROM • RS232 port for connection to computer (required) • PC Software included

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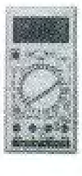

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- Fully IBM AT Compatible
- Free! DR DOS (Disk Operating System) Software Included
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- AMI BIOS ROMs Included
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(See Right)

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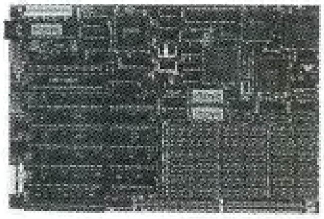
SL90

Jameco 16MHz 80286 Motherboard



- Baby size motherboard
- Expandable to 1MB RAM using 256KB DRAM chips or 4MB using 1MB DRAM chips
- Additional 1MB with 256KB DRAM SIPs or 4MB with 1MB DRAM SIPs for a total of 8MB
- Uses 100ns DRAMs
- 8/16MHz hardware or keyboard selectable operation
- AMI BIOS ROMs included
- 16MHz CMOS Harris CPU
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- Size: 13" x 8.5"

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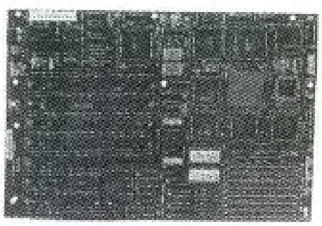
Jameco 20MHz 80386 Motherboard



- Baby size motherboard
- Expandable to 2MB RAM using 256KB SIPs, 8MB using 1MB SIPs (Please note the minimum RAM expansion is 4 SIP Modules at a time)
- Uses 100ns SIPs
- Includes battery pack
- 8/20MHz keyboard selectable operation
- AMI BIOS ROMs included
- Shadow RAM for fast BIOS and video performance
- Adjustable bus speeds and wait states
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- Fujitsu 101-Key (Enhanced) Keyboard

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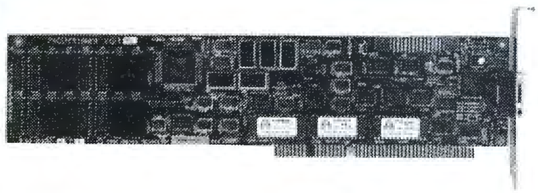
Jameco IBM PC/XT/AT Compatible Cards



JE1057

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JE1062	RS232 Serial Half Card (PC/XT/AT)	$29.95
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Relisys 14" Multiscan monitor and 16-bit VGA card package (640 x 480 max. resolution)

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Relisys 14" VGA monitor and 16-bit VGA card package (640 x 480 max. resolution)

JE2061 VGA Monitor & VGA Card.................. **$629.90**

JE2061

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9600E Pictured

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2400B Jameco 2400 Baud **$99.95**

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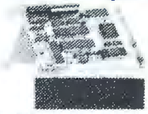

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M8438XT 30MB (68ms) 3.5"HH.........**$299.95**

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CP3104 100MB (25ms) 3.5"HH **$699.95**

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- 1MG x 8 - 100ns $67
- 1MG x 8 - 80ns $72
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- 256 x 8 - 100ns $39

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- (2MG) $299
- Super (1MG) $359
- Sport 286 (4MG) .. $1179

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PART NO.	1MG	4MG
386/25-33-SX	$105	--
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386C	$95	$375
PART NO.	1MG	2MG
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Wkstation 386	--	$249
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- 34F2933 - 4MG Memory Module $699
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- 6450604 ...... $220 For 70E61/121,50Z & 55SX *10 or more units $210

256 x 9 (FOR PS/2)

- 256 x 9 - 120ns $36
- 30F5348 (Kit-2ea) $72

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- 1MG x 9 - 100ns $95
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- 256 x 1 - 120ns $2.00
- 256 x 1 - 100ns $2.25
- 256 x 1 - 80ns $2.75
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- 256 x 4 - 80ns $9.00

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- 64 x 1 - 100ns $2.49

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- 64 x 4 - 120ns $2.50
- 64 x 4 - 100ns $2.75
- 64 x 4 - 80ns $3.50

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- 51258 - 80ns $3.00
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Module for 70E61/121 50Z & 55SX 2MG x 9 - 80ns 1-9 UNITS **$220**

10 or more units **$210**

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MODEL		2MG		8MG
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Portable386				$1250	
PortableLTE	$219	$325		$495	
SLT/286		$325			

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5 YEAR WARRANTY

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RAMQUEST EXTRA The only Multifunction card that provides up to 8MG and two serial ports on one board for the IBM PS/2 Models 50, 60 & 80. Guaranteed EMS 4.0 and OS/2 compatible. Easy to install with only 4 key-strokes. Uses 256 and/or 1MG SIMM's...... **$229**

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BOCARAM/AT Provides up to 2MG LIM EMS 4.0 and/or 4MG of extended, expanded or backfill memory. For 16 bit bus. Operates up to 16MHz. Uses 256K D-RAM/with 0K ...... **$140** with 512K **$199**

BOCARAM/AT PLUS Provides up to 8MG of extended, expanded or backfill *memory*. Operates up to 33MHz and is set thru software. Uses 1MG D-RAM/ with 0K ...... **$140** with 2MG **$349**

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- 2 & 2D (0K) ...... $ 89
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- 2 & 2D (4 MG) $345

2P & 3

- 2P & 3 (0K) ...... $ 109
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TINY TURBO 286 Low cost, high speed, half slot PC/XT - Accelerates your PC/XT with a 8MHz 80286 microprocessor. 80287 Math chip socket **$229**

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- 1 game port
- 101 keyboard
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- 2:1 HD/FD controller
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- 1 1.2MB floppy disk drive
- 1 parallell port
- 1 serial port
- 1 game port
- 101 keyboard
- 200 watt UL approved power supply
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- 80386-**25mhz**
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- 1 serial port
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MODEL/DESCRIPTION		BASE	MONO	CGA	EGA	MONO VGA	COLOR VGA	VGA SYNC
88-12	1 / (1) 360K Floppy Drive	**$399**	$499	$619	$808	$577	$899	$998
640K	2 / (2) 360K Floppy Drives	$469	$569	$689	$878	$689	$969	$1,068
12 MHZ	20 / 22MB,45MILS,MFM.3.5"	$649	$749	$869	$1,058	$869	$1,149	$1,248
	30 / 33MB, 45MILS, RLL, 3.5"	$679	$779	$899	$1,088	$899	$1,179	$1,278
286-XT	1 / (1) 360K Floppy Drive	**$499**	$599	$719	$908	$719	$999	$1,098
1 MB RAM	2 / (2) 360K Floppy Drives	$569	$669	$789	$978	$789	$1,069	$1,168
10 MHZ	20 / 22MB,45MILS,MFM.3.5"	$749	$849	$969	$1,158	$969	$1,249	$1,348
	30 / 33MB, 45MILS, RLL, 3.5"	$779	$879	$999	$1,188	$999	$1,279	$1,378
286-12	1 / (1) 1.2MB Floppy Drive	**$699**	$799	$919	$1,131	$885	$1,199	$1,325
1 MB RAM	20 / 45MILS,MFM,1-1,KL320	$899	$999	$1,119	$1,331	$1,085	$1,399	$1,525
12.5 MHZ	20 / 38MILS,MFM,1-1,ST125	$979	$1,079	$1,199	$1,411	$1,165	$1,479	$1,605
0-WAIT	30 / 38MILS,MFM,1-1,ST138	$1,039	$1,139	$1,259	$1,471	$1,225	$1,539	$1,665
Norton SI-14	40 / 60MILS,IDE,1-1,WD	$1,029	$1,129	$1,249	$1,461	$1,215	$1,529	$1,655
Speed-16Mhz	40 / 38MILS,RLL,1-1,MS8450	$1,079	$1,179	$1,299	$1,511	$1,265	$1,579	$1,705
Exp. to 4MB	40 / 20MILS,IDE,1-1,CONNERS	$1,099	$1,199	$1,319	$1,531	$1,285	$1,599	$1,725
AWARD BIOS	65 / 38MILS,RLL,1-1,PTI	$1,119	$1,219	$1,339	$1,551	$1,305	$1,619	$1,745
DIP DRAM	85 / 20MILS,IDE,1-1,CONNERS	$1,269	$1,369	$1,489	$1,701	$1,455	$1,769	$1,895
EMS 4.0	120 / 20MILS,IDE,1-1,CONNER	$1,509	$1,609	$1,729	$1,941	$1,695	$2,009	$2,135
	200 / 16MILS,IDE,1-1,CONNER	$2,179	$2,279	$2,399	$2,611	$2,365	$2,679	$2,805
	320 / 16MILS,ESDI,1-1CDC	$2,979	$3,079	$3,199	$3,411	$3,165	$3,479	$3,605
286-16	1 / (1) 1.2MB Floppy Drive	**$799**	$899	$1,019	$1,231	$985	$1,299	$1,425
1 MB RAM	20 / 45MILS,MFM,1-1,KL320	$1,019	$1,119	$1,239	$1,451	$1,205	$1,519	$1,645
16 MHZ	20 / 38MILS,MFM,1-1,ST125	$1,069	$1,169	$1,289	$1,501	$1,255	$1,569	$1,695
0-WAIT	30 / 38MILS,MFM,1-1,ST138	$1,139	$1,239	$1,359	$1,571	$1,325	$1,639	$1,765
Norton SI-18	40 / 60MILS,IDE,1-1,WD	$1,129	$1,229	$1,349	$1,561	$1,315	$1,629	$1,755
Speed-22Mhz	40 / 38MILS,RLL,1-1,MS8450	$1,169	$1,269	$1,389	$1,601	$1,355	$1,669	$1,795
Exp. to 4MB	40 / 20MILS,IDE,1-1,CONNERS	$1,189	$1,289	$1,409	$1,621	$1,375	$1,689	$1,815
AMI BIOS	65 / 38MILS,RLL,1-1,PTI	$1,209	$1,309	$1,429	$1,641	$1,395	$1,709	$1,835
SIM Modules	85 / 20MILS,IDE,1-1,CONNERS	$1,359	$1,459	$1,579	$1,791	$1,545	$1,859	$1,985
	120 / 20MILS,IDE,1-1,CONNER	$1,599	$1,699	$1,819	$2,031	$1,785	$2,099	$2,225
	200 / 16MILS,IDE,1-1,CONNER	$2,269	$2,369	$2,489	$2,701	$2,455	$2,769	$2,895
	320 / 16MILS,ESDI,1-1,CDC	$3,079	$3,179	$3,299	$3,511	$3,265	$3,579	$3,705
286-20	1 / (1) 1.2MB Floppy Drive	**$899**	$999	$1,119	$1,331	$1,085	$1,399	$1,525
1 MB RAM	20 / 45MILS,MFM,1-1,KL320	$1,119	$1,219	$1,339	$1,551	$1,305	$1,619	$1,745
20 MHZ	20 / 38MILS,MFM,1-1,ST125	$1,169	$1,269	$1,389	$1,601	$1,355	$1,669	$1,795
0-WAIT	30 / 38MILS,MFM,1-1,ST138	$1,239	$1,339	$1,459	$1,671	$1,425	$1,739	$1,865
Norton SI-22.5	40 / 60MILS,IDE,1-1,WD	$1,229	$1,329	$1,449	$1,661	$1,415	$1,729	$1,855
Speed-24 Mhz	40 / 38MILS,RLL,1-1,MS8450	$1,269	$1,369	$1,489	$1,701	$1,455	$1,769	$1,895
Exp. to 4MB	40 / 20MILS,IDE,1-1,CONNERS	$1,289	$1,389	$1,509	$1,721	$1,475	$1,789	$1,915
AMI BIOS	65 / 38MILS,RLL,1-1,PTI	$1,309	$1,409	$1,529	$1,741	$1,495	$1,809	$1,935
DIP DRAM	85 / 20MILS,IDE,1-1,CONNERS	$1,459	$1,559	$1,679	$1,891	$1,645	$1,959	$2,085
EMS 4.0	120 / 20MILS,IDE,1-1,CONNER	$1,699	$1,799	$1,919	$2,131	$1,885	$2,199	$2,325
Shadow RAM	200 / 16MILS,IDE,1-1,CONNER	$2,369	$2,469	$2,589	$2,801	$2,555	$2,869	$2,995
	320 / 16MILS,ESDI,1-1,CDC	$3,179	$3,279	$3,399	$3,611	$3,365	$3,679	$3,805
386SX	1 / (1) 1.2MB Floppy Drive	**$999**	$1,099	$1,219	$1,431	$1,185	$1,499	$1,625
1 MB RAM	20 / 45MILS,MFM,1-1,KL320	$1,219	$1,319	$1,439	$1,651	$1,405	$1,719	$1,845
16 MHZ	20 / 38MILS,MFM,1-1,ST125	$1,269	$1,369	$1,489	$1,701	$1,455	$1,769	$1,895
0-WAIT	30 / 38MILS,MFM,1-1,ST138	$1,339	$1,439	$1,559	$1,771	$1,525	$1,839	$1,965
Norton SI-22.5	40 / 60MILS,IDE,1-1,WD	$1,329	$1,429	$1,549	$1,761	$1,515	$1,829	$1,955
Speed-25 Mhz	40 / 38MILS,RLL,1-1,MS8450	$1,369	$1,469	$1,589	$1,801	$1,555	$1,869	$1,995
Exp. to 8MB	40 / 20MILS,IDE,1-1,CONNERS	$1,389	$1,489	$1,609	$1,821	$1,575	$1,889	$2,015
AMI BIOS	65 / 38MILS,RLL,1-1,PTI	$1,409	$1,509	$1,629	$1,841	$1,595	$1,909	$2,035
SIPP Modules	85 / 20MILS,IDE,1-1,CONNERS	$1,559	$1,659	$1,779	$1,991	$1,745	$2,059	$2,185
EMS 4.0	120 / 20MILS,IDE,1-1,CONNER	$1,799	$1,899	$2,019	$2,231	$1,985	$2,299	$2,425
Shadow RAM	200 / 16MILS,IDE,1-1,CONNER	$2,469	$2,569	$2,689	$2,901	$2,655	$2,969	$3,095
	320 / 16MILS,ESDI,1-1,CDC	$3,279	$3,379	$3,499	$3,711	$3,465	$3,779	$3,905

EXCEL *Personal Computers*

Less Monitor CGA MGA Card Included	14" AMBER W/ Tilt MGA 720x348 .31 Dot Pt	14" 4-Color W/ Tilt CGA 640x200 .51 Dot Pt	14" 16-Color W/ Tilt EGA 640x350 .31 Dot Pt	12" White VGA W/ Tilt 640x480 16 Bit 256K	14" VGA 256 — W/ Tilt 800x600 16 Bit 256K	14" XVG Colors W/ Tilt 1024x76 16 Bit 512K

MODEL/DESCRIPTION		BASE	MONO	CGA	EGA	MONO VGA	COLOR VGA	VGA SYN
386-20	1 / (1) 1.2MB Floppy Drive	**$1,299**	$1,399	$1,519	$1,731	$1,485	$1,799	$1,92
1 MB RAM	20 / 45MILS,MFM,1-1,KL320	$1,529	$1,629	$1,749	$1,961	$1,715	$2,029	$2,15
20 MHZ	20 / 38MILS,MFM,1-1,ST125	$1,579	$1,679	$1,799	$2,011	$1,765	$2,079	$2,20
0-WAIT	30 / 38MILS,MFM,1-1,ST138	$1,649	$1,749	$1,869	$2,081	$1,835	$2,149	$2,27
Norton SI-22.5	40 / 60MILS,IDE,1-1,WD	$1,639	$1,739	$1,859	$2,071	$1,825	$2,139	$2,26
Speed-24 Mhz	40 / 38MILS,RLL,1-1,MS8450	$1,689	$1,789	$1,909	$2,121	$1,875	$2,189	$2,31
Exp. to 8MB	40 / 20MILS,IDE,1-1,CONNERS	$1,709	$1,809	$1,929	$2,141	$1,895	$2,209	$2,33
AMI BIOS	65 / 38MILS,RLL,1-1,PTI	$1,719	$1,819	$1,939	$2,151	$1,905	$2,219	$2,34
SIPP Modules	85 / 20MILS,IDE,1-1,CONNERS	$1,869	$1,969	$2,089	$2,301	$2,055	$2,369	$2,49
EMS 4.0	120 / 20MILS,IDE,1-1,CONNER	$2,109	$2,209	$2,329	$2,541	$2,295	$2,609	$2,73
Shadow RAM	200 / 16MILS,IDE,1-1,CONNER	$2,779	$2,879	$2,999	$3,211	$2,965	$3,279	$3,40
	320 / 16MILS,ESDI,1-1,CDC	$3,589	$3,689	$3,809	$4,021	$3,775	$4,089	$4,21
386-25	1 / (1) 1.2MB Floppy Drive	**$1,499**	$1,599	$1,719	$1,931	$1,685	$1,999	$2,12
2 MB RAM	20 / 38MILS,MFM,1-1,ST125	$1,779	$1,879	$1,999	$2,211	$1,965	$2,279	$2,40
25 MHZ	30 / 38MILS,MFM,1-1,ST138	$1,849	$1,949	$2,069	$2,281	$2,035	$2,349	$2,47
0-WAIT	40 / 60MILS,IDE,1-1,WD	$1,839	$1,939	$2,059	$2,271	$2,025	$2,339	$2,46
Norton SI-27	40 / 38MILS,RLL,1-1,MS8450	$1,889	$1,989	$2,109	$2,321	$2,075	$2,389	$2,51
Speed-36 Mhz	40 / 20MILS,IDE,1-1,CONNERS	$1,909	$2,009	$2,129	$2,341	$2,095	$2,409	$2,53
Exp. to 8MB	65 / 38MILS,RLL,1-1,PTI	$1,919	$2,019	$2,139	$2,351	$2,105	$2,419	$2,54
AMI BIOS	85 / 20MILS,IDE,1-1,CONNERS	$2,069	$2,169	$2,289	$2,501	$2,255	$2,569	$2,69
SIPP Modules	120 / 20MILS,IDE,1-1,CONNER	$2,309	$2,409	$2,529	$2,741	$2,495	$2,809	$2,93
EMS 4.0	200 / 16MILS,IDE,1-1,CONNER	$2,979	$3,079	$3,199	$3,411	$3,165	$3,479	$3,60
Shadow RAM	320 / 16MILS,ESDI,1-1,CDC	$3,789	$3,889	$4,009	$4,221	$3,975	$4,289	$4,41
386-25	1 / (1) 1.2MB Floppy Drive	**$1,769**	$1,869	$1,989	$2,201	$1,955	$2,269	$2,39
4 MB RAM	20 / 38MILS,MFM,1-1,ST125	$2,039	$2,139	$2,259	$2,471	$2,225	$2,539	$2,66
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0-WAIT	40 / 60MILS,IDE,1-1,WD	$2,089	$2,189	$2,309	$2,521	$2,275	$2,589	$2,71
Norton SI-36	40 / 38MILS,RLL,1-1,MS8450	$2,139	$2,239	$2,359	$2,571	$2,325	$2,639	$2,76
Speed-44 Mhz	40 / 20MILS,IDE,1-1,CONNERS	$2,159	$2,259	$2,379	$2,591	$2,345	$2,659	$2,78
Exp. to 16MB	65 / 38MILS,RLL,1-1,PTI	$2,179	$2,279	$2,399	$2,611	$2,365	$2,679	$2,80
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SIMM	120 / 20MILS,IDE,1-1,CONNER	$2,569	$2,669	$2,789	$3,001	$2,755	$3,069	$3,19
EMS 4.0	200 / 16MILS,IDE,1-1,CONNER	$3,229	$3,329	$3,449	$3,661	$3,415	$3,729	$3,85
32K CACHE	320 / 16MILS,ESDI,1-1,CDC	$4,039	$4,139	$4,259	$4,471	$4,225	$4,539	$4,66
386-33	1 / (1) 1.2MB Floppy Drive	**$2,719**	$2,819	$2,939	$3,151	$2,905	$3,219	$3,34
4 MB RAM	20 / 38MILS,MFM,1-1,ST125	$2,989	$3,089	$3,209	$3,421	$3,175	$3,489	$3,61
33 MHZ	30 / 38MILS,MFM,1-1,ST138	$3,049	$3,149	$3,269	$3,481	$3,235	$3,549	$3,67
0-WAIT	40 / 60MILS,IDE,1-1,WD	$3,039	$3,139	$3,259	$3,471	$3,225	$3,539	$3,66
Norton SI-44	40 / 38MILS,RLL,1-1,MS8450	$3,089	$3,189	$3,309	$3,521	$3,275	$3,589	$3,71
Speed-58 Mhz	40 / 20MILS,IDE,1-1,CONNERS	$3,109	$3,209	$3,329	$3,541	$3,295	$3,609	$3,73
Exp. to 8MB	65 / 38MILS,RLL,1-1,PTI	$3,129	$3,229	$3,349	$3,561	$3,315	$3,629	$3,75
AMI BIOS	85 / 20MILS,IDE,1-1,CONNERS	$3,269	$3,369	$3,489	$3,701	$3,455	$3,769	$3,89
SIMM	120 / 20MILS,IDE,1-1,CONNER	$3,519	$3,619	$3,739	$3,951	$3,705	$4,019	$4,14
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64K CACHE	320 / 16MILS,ESDI,1-1,CDC	$4,989	$5,089	$5,209	$5,421	$5,175	$5,489	$5,61
486-25	1 / (1) 1.2MB Floppy Drive	**$4,619**	$4,719	$4,839	$5,051	$4,805	$5,119	$5,24
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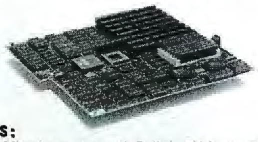

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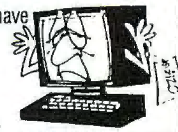

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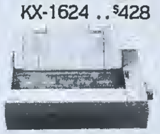

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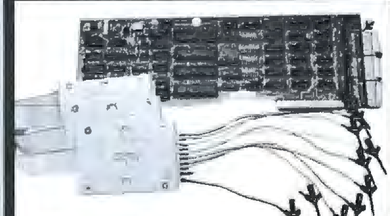

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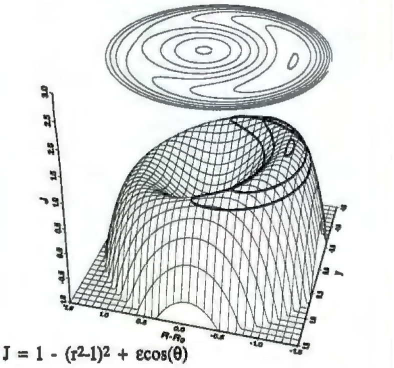

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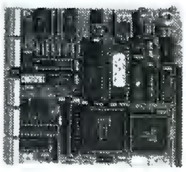

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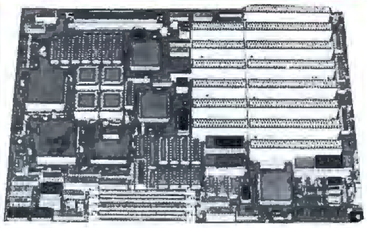

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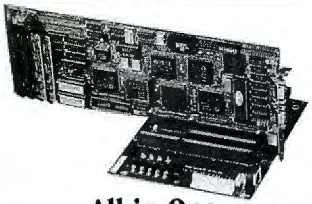

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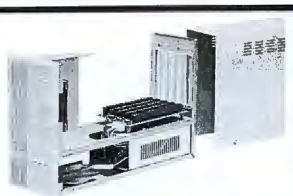

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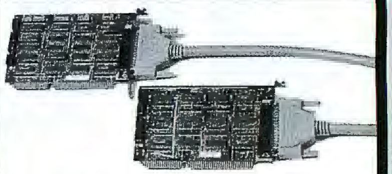

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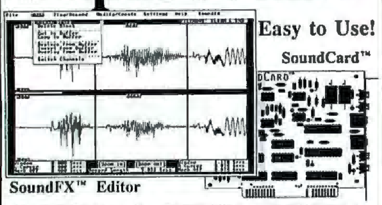

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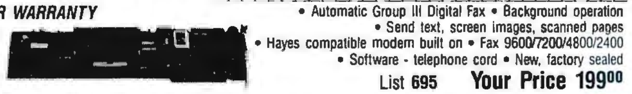

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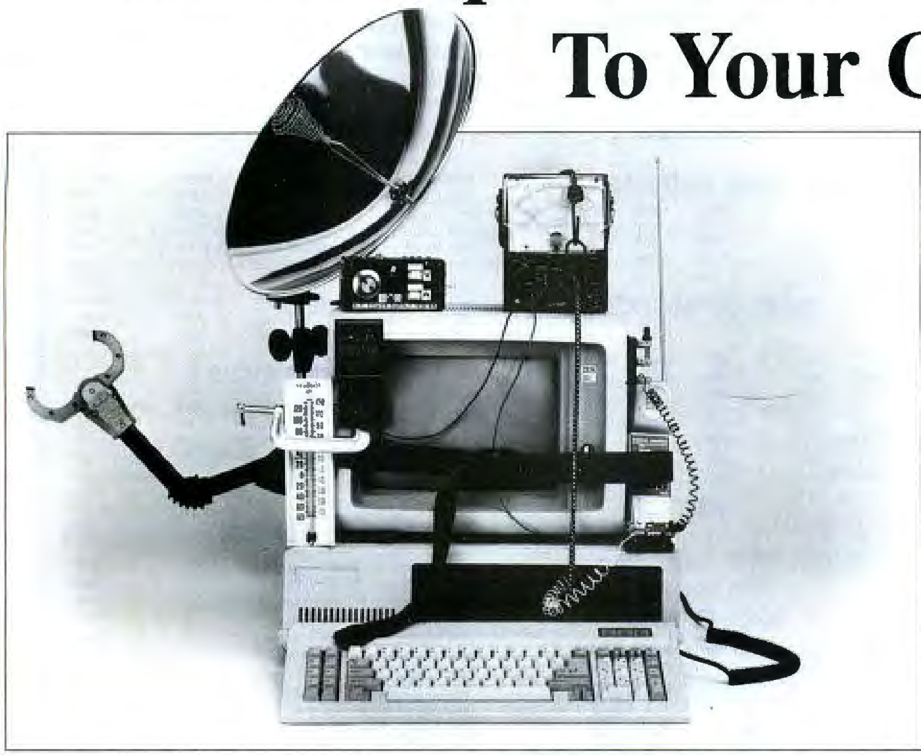

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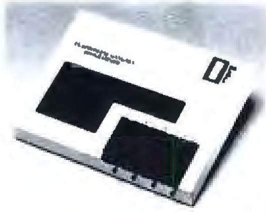

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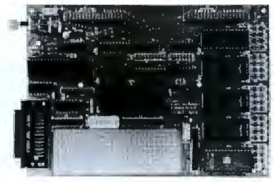

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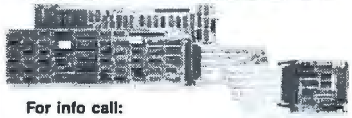

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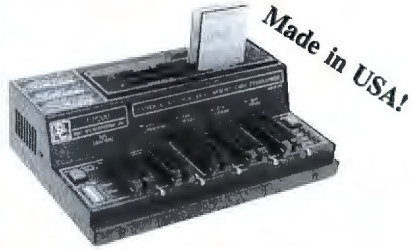

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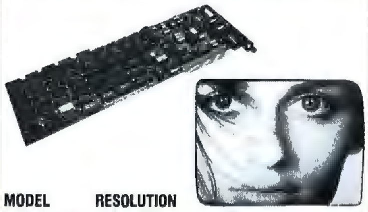

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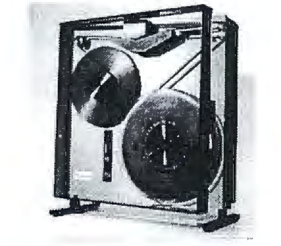

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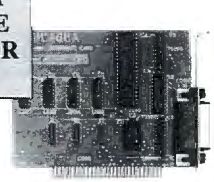

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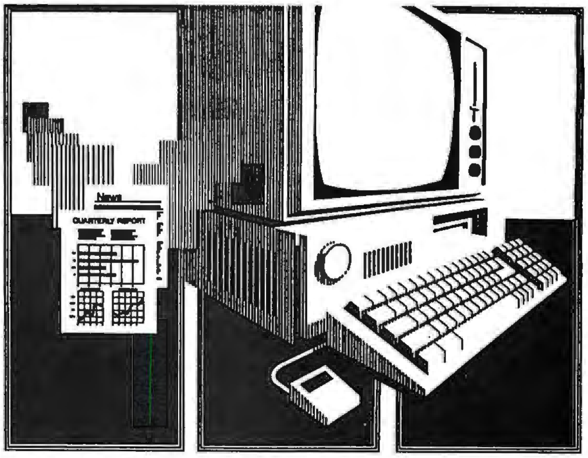

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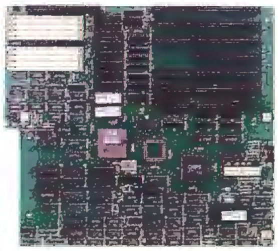

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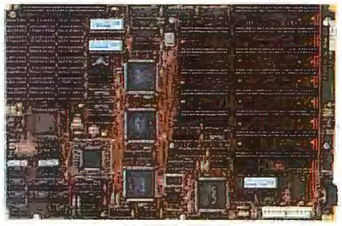

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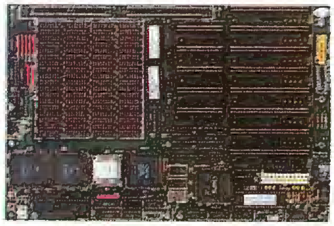

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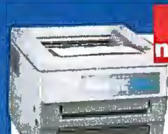

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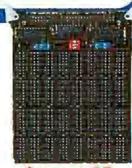

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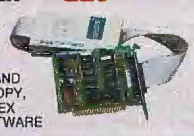

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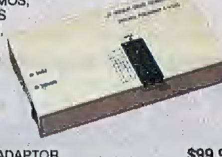

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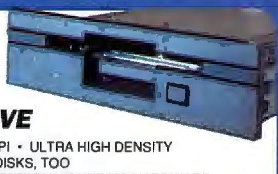

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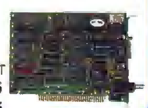

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Derick's HIGH-TECH SPOTLIGHT

NEW DIAGNOSTIC TOOL!

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You can try and make sense of the beep code (it will tell you up to 16 failure points if you know how to decipher it), but based on the Power On Self Test you have more options for diagnosing problems than the beep code can report.

That's why I've devised the P CODE. It's a compact card that plugs into any open slot, reading the data written to I/O port 80 and displaying its results in a hexadecimal code on two 7-segment displays. The data displayed translates to an exact point of system failure dependent on the system's operating BIOS.

There are much more expensive tools that do about the same thing, but for economy, flexibility and minimal power draw, this is the best solution I've seen!

Derick Moore, Director of Engineering

Note: JDR's POST CODE card is sold on the facing page.

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CHAOS MANOR MAIL

Jerry Pournelle answers questions about his column and related computer topics

Logitech Not for Lefties
Dear Jerry,

I perceive that you are right-handed.

In "A Matter of Style and Grammar" (January), you again express your enthusiasm for the Logitech TrackMan. You mentioned it once before at a time when a client had asked me to find him a good trackball.

Your comments led me to call Logitech. It turned out that the BYTE column got to me before Logitech had released TrackMan, but a very helpful woman in the company's sales department got permission to fax me a picture. I told my client to be patient until the release.

I see your point: It looks wonderfully logical. "You manipulate the ball with your thumb, while the fingers rest naturally on three mouse buttons." Try it with your left hand, please. Logitech's advice is to turn it upside down. You can try that, too, if you like. If it works, I'd like to know where your fingers screw onto your hand—perhaps at the wrist?

I'm right-handed, too, so I would probably love it. But my client...well, he's backwards.

Bob Reeves
Los Angeles, CA

Well, yes, I am right-handed, and, frankly, I don't intend to handicap myself if someone makes a device that works for me, even if it won't work for my left-handed friends!—Jerry

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. He can be reached c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, or on BIX as "jerryp."

Floppy Disk Drive Trauma
Dear Jerry,

It's 6:30 a.m., and I'm at the computer for my morning workout. Yesterday, BYTE came in the mail, and (as always) I promptly read your column. I'm responding to your comments in "The Installation Blues" (November 1989).

Two months ago, I decided to add a 3½-inch 1.44-megabyte floppy disk drive to my system, without abandoning either the 360K-byte or the 1.2-MB floppy disks in use. The day before BYTE came, I was reinserting the four-floppy disk drive controller card, reconnecting the drives, reevaluating all the switch settings, and reconsidering my decision. But I finally got it working.

My Leading Edge Model D2 (an AT clone) has a dual floppy disk drive controller on the motherboard. It is jumper-selectable to work as the primary or secondary controller, or it can be disabled. I bought another dual drive controller card, figuring that I'd run two floppy disks on the primary drives and two more on the secondary drives. However, this only produces a "General Failure" error when I try to access the secondary drives. Maybe you could tell me where to find what I need to make this option work. The two floppy disk drives on the primary controller work fine, but the two on the secondary controller card don't. DOS lets me get the drive-E prompt, but it cannot find the drive. I think I need a device driver specifically for the secondary controller card.

I exchanged the dual drive controller card for a four-floppy disk drive controller, figuring to just disable the motherboard floppy disk drive controller. The new controller card is a super-cheap Taiwanese model, which could be part of my problem. The single-sheet documentation that came with it calls the unit "F.D.C. PLUS," and that's all I can find for a manufacturer's name.

I could access only two floppy disks with the four-drive card in place. Norton's System Information utility didn't indicate that it found ROM for it. But when I removed my XT-type hard disk drive controller card, suddenly I had four floppy disk drives and a floppy ROM. Apparently the hard disk drive controller ROM at C800 doesn't end soon enough

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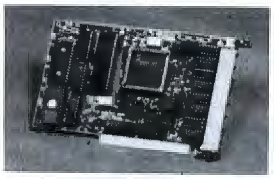

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to allow another ROM to appear at CA00 hexadecimal. Inspection of the memory contents supports this view.

The next thing I did was upgrade the hard disk drive controller card. I wanted a fast one. Also, I had to replace my BIOS ROM and DOS to be sure that the 1.44-MB floppy disk drive would be supported. I bought a bunch of floppy disks and backed up my Seagate ST251-1. Then I changed everything over, and (voilà!) it seemed to work.

One thing, though. My hard disk drive (C and D) now was drives E and F. This is a problem. I've watched the boot-up very closely, and this is what's happening: As BIOS starts up, drives A and B each light up in turn. If my CMOS configuration is incorrect, I get an error from the BIOS. (That's how I'm sure it's the BIOS that lights up the two drives.) Then the hard disk drive lights up briefly. Then I get a message from the four-floppy disk drive controller card:

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Then the four floppy disk drives light up in sequence, the computer beeps, CONFIG.SYS is loaded, and AUTOEXEC.BAT is run.

Apparently, DOS finds the four floppy disk drives before it finds the hard disk drive, and it assigns them letters in that order. I think if I had primary and secondary floppy disk drive controllers, with a device driver in CONFIG.SYS for the second one, then my hard disk drive would be C and D, with the extra floppy disks labeled as E and F. I'd like that much better.

Another thing. The 1.44-MB drive wouldn't work as drive D. I had to switch the units around and make it B. This appears to be a problem with my controller card rather than with the drive. Now drive D is a 360K-byte floppy disk, but the computer seems to think that it's a 360K-byte disk in a high-density drive. I'll accept that for now. At least it works.

You probably won't have all these problems if you expand one of your computers. But I had to unload all this on somebody, and your article came at just the right time.

Art Shipman
Westbrookville, NY

Wow. I'm glad I didn't have that much trouble. We had to do a bit of swapping, but the Northgate four-floppy disk drive controller works fine; I fooled with it awhile, and now Alex is using it. No problems.—Jerry ■

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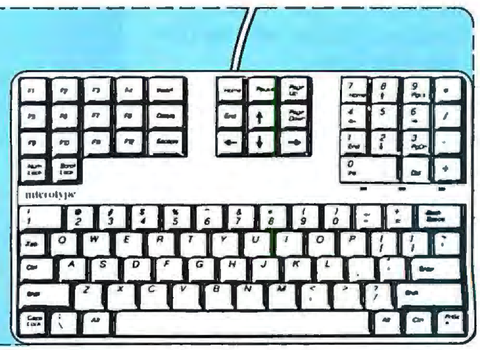

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PRINT QUEUE

Hugh Kenner

Of Minds and Men

A best-seller questions whether intelligence can be simulated by algorithmic means

Start with Zeller's congruence, a brief and fascinating summing of six fractions. Plug into it year, month, day; add the terms; divide by 7. The remainder (0 to 6) designates the day of the week. It is not fooled by the irregular length of months, nor by leap years, nor even by the fact that 1900 wasn't a leap year but 2000 will be. Christian Zeller published it in 1887, with a brief explanation. On today's computers, it's easy to program (write me for details). Now: Is a Zellerized computer behaving intelligently?

Well, certainly not *un*intelligently. It's rather impressive in coming up, zip, with an answer we'd either fumble after through tables, or else scribble our way toward, under Herr Zeller's guidance, for a couple of minutes, maybe getting a quotient wrong.

Next, consider an expert system, the kind I've discussed before (September 1989). It imitates the man who can troubleshoot by telephone, asking questions, letting each answer cue his next question. Whole industries can depend on such a man, as when a blast furnace gets tummy-rumbles at midnight, and a good expert system, arrived at by interviewing the expert, can mimic his mental processes pretty faithfully. Is such a system intelligent? American Express inclines to think so. It employs one to help its credit validators, who say that they like it, too.

Enter, at this point, a book like Robert J. Schalkoff's *Artificial Intelligence: An Engineering Approach* (McGraw-Hill, 1990, $46.95). A very good college text rife with Prolog and Lisp, it's soon asserting that "the goal of AI is the understanding of intelligence as a feasible computation." That's meant to leapfrog us past expert systems, "often mistakenly taken to be synonymous with artificial intelligence." So Schalkoff seems to be identifying "intelligence" with "feasible computation," and by page 493 (having left expert systems behind), he's quoting Lord Kelvin: "When you can measure what you are speaking about, and express it in numbers, you know something about it"; otherwise, "your knowledge is of a meager and unsatisfactory kind."

As would be my knowledge of what I'm doing as I write this review, very little of that knowledge being algorithmic, let alone numerical. I'm reminded of a conversation at MIT; science, the man was saying, is *rewarded* curiosity, in that the fit of some numbers can say you're right. Whereas the kind of thing I did (books about nonnumerical books) must forever be *un*rewarded, there being no way to, ah, verify any results.

Yet I trust I'll feel rewarded late this evening, savoring the result of what I set out to do at about 4:30. That began as a fairly complex mental glimmer, which I'm working now to instantiate in these sentences. I doubt if an algorithm could order the sentences, and I'm confident it couldn't have experienced the glimmer.

For help with such themes, let's turn to Roger Penrose, whose *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics* (Oxford University Press, 1989, $24.95) spent more weeks on the best-seller lists last spring than pop students of pop culture can think to account for. Penrose, who is Rouse Ball Professor of Mathematics at Oxford, has long been known to Martin Gardner fans; he invented the Penrose tribar, a wooden thing you can draw on paper but not fabricate, and the Penrose tiles, which can fully cover a plane but (unlike the hexagons on your bathroom floor) only in a nonperiodic way. You can sense how he's drawn toward the edges of possibility.

Well, the "Strong-AI" people have been telling us that in one direction at least, the possibilities they envision have no edge. Minds (said Marvin Minsky) are simply

ILLUSTRATION: GREG HALLY © 1990

"computers made of meat"; if my computer can execute Zeller's congruence, well, so too can my slow mind. Conversely, the machine on my desk can do many things we meatheads do, but much faster. Only a few decades back, meat still owned the turf; silicon could merely add and subtract. But silicon catches up, and (says Strong-AI) there's no limit. And of course it's not the silicon that catches up; it's the accumulation of algorithms.

Zeller, you see, had devised an *algorithm*: a finite sequence of specifiable steps, guaranteed to massage suitable inputs into one right output. That, and not its mere vehicle—brain or chip—is what carries the assurance that 8/13/90 coincides with a Monday. So if it's true that our machines are evolving toward a stage where they'll not merely say "Monday" but Think! Feel! Exclaim over Proust!, well, algorithms of unguessable complexity would seem to lie ahead. And right now, the algorithms they'll mimic are running in our brains, at levels we're unaware of. If so, "mind"—I'm not saying "brain"—must be a wondrously complex superalgorithm. Hence Strong-AI's hidden premise: *All our mental processes are algorithmic.*

But Penrose thinks not. His book is big and intricate and can't be summarized. I've seen some of the material before: for instance, John Searle's "Chinese Room," through the mail slot of which you're fed three strange Chinese characters. Following intricate but explicit English instructions, you process these through what you don't know is Zeller's congruence. You're guided to a Chinese phrase that you push back through the slot. Outside, Chinese sages marvel at your acumen: "Xing-Qi-Yi": Monday! So you've answered a question correctly with no idea of even what it was. Searle's point was, let us not call that "understanding."

Penrose won't have us believe, either, that mathematicians make their subject; no, they *discover* it. Example, the Mandelbrot set, waiting (like America in 1492) for an explorer to happen on it. (And as Columbus first assumed he'd landed in Asia, so Mandelbrot first thought he'd discovered a computer malfunction.) Once discovered, it's simply there, while we probe its never-ending complexity, using a computer "in essentially the same way that the experimental physicist uses. . . apparatus to explore the structure of the physical world." Which explorer, which computer, has no bearing on the findings.

And yet there are grounds for supposing that the Mandelbrot set contains delicate regions our present algorithms cannot find; also regions that would be beyond the reach of still better algorithms. With perhaps a nudge from Kurt Gödel, who showed that no deductive system can prove all the truths it contains, the notion of a superalgorithm is cracking. (Fermat's last theorem may be such an unprovable truth; if so, how did Fermat's mind arrive at it?)

Though the Mandelbrot set pertains to mathematical reality, it also overlaps the clouds and seahorse-tails of physical reality. The close fit between those two realities has often given cause for marvel; if the math isn't "elegant," it's likely kludged. That's Penrose's cue to go deeper into physical reality than you'd ever expect of a book on AI, via patient, lucid expositions of relativity and quantum theory. What he's heading for is that uneasy quantum domain where a particle can seem to be in two places at once; this in the same universe where no baseball can be in two places at once. Different scales seem to need different conceptual systems. Something wrong hereabouts?

Penrose thinks so. Quantum theory seems to be incomplete, its bifurcations likely contained by something more elegant and as yet unglimpsed. A chapter on the brain follows, and what we know about the brain seems grossly incomplete. Here, optical illusions can be telling; it's easy to confront us with a picture in which we "see" lines we're actually inferring. It's demonstrable, too, that some retinal cells at least are sensitive at the single-photon level; which brings us close to dat ol' debbil the Quantum. And "it seems to me that neither classical nor quantum mechanics—the latter without some further fundamental changes. . . can ever explain the way in which we *think*."

So where are we? The final chapter's title, "Where Lies the Physics of Mind?," hints that we're still trying to ask fundamental questions; so not so fast with those algorithms! Penrose's strategy here is to shift attention from "intelligence" to "consciousness." The former does hint at algorithmic explanations, as in Alan Turing's famous paper "Computing Machinery and Intelligence." Consciousness, though, is altogether trickier, and we seem to require it before we can speak of intelligence. We're all conscious, some of us seemingly more so than others. (Also, we're conscious *of*.)

As Penrose says, "Many parts of the mathematical world—some of its deepest and most interesting parts—have a non-algorithmic character. It would seem likely. . . that non-algorithmic action ought to have a role within the physical world of very considerable importance. I am suggesting that this role is intimately bound up with the very concept of 'mind.' "

So where, really, did Zeller's congruence come from? Much of it Zeller could have reasoned out. Y/4, that clearly pertains to leap years. But embedded in it is one very curious term, $(M + 1) \times 26/10$. With remainders duly truncated, that's the part that takes care of the five shortened months. Hard not to suppose that Zeller had an Aha! flash. Once he'd glimpsed it, proving it would work was easy.

Again, Penrose: "When I assert my own belief that true intelligence requires consciousness, I am implicitly suggesting. . . that intelligence cannot be simulated by algorithmic means, i.e., by a computer." Never mind the parallel computer; that's in principle equivalent to a serial; both are Turing machines. Never mind, either, the claim that an Aha! flash, the kind that precedes formal proof, emerges from some very complex algorithm; it takes Penrose but a page and a half (417–8) to make Gödel's theorem dispose of that.

As to conceiving ultimate programs, says Penrose, "How could one even *begin* to explain the substance of such problems to an entity that was not itself conscious?" Such an entity as a mere Cray, which—let alone set quantum theory straight—couldn't see how to start writing what you've just read. ■

Hugh Kenner is a professor of English at Johns Hopkins University. His reviews have appeared in publications like the New York Times *and* Harper's. *His recent books include* A Sinking Island *and* Mazes. *He can be contacted on BIX as "hkenner."*

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

THE TONGUES OF MEN AND MACHINES

Are computer languages created in the image of the language spoken by their makers?

The other evening, I was debugging a Pascal program when my young son asked me to check a composition for his German class. While red-penciling his grammar, I suddenly realized that the structure of the Pascal programming language is not all that different from the structure of the German language. But then, Professor Niklaus Wirth (the creator of Pascal) is a German-speaking Swiss—and that made me think: How far do programming languages reflect the linguistic backgrounds and cultural patterns of their creators?

Pascal and German are both highly structured languages, with an extremely rigid syntax; just look at how you have to set up a program or a procedure on the one hand or a sentence or a clause on the other. Both languages have lots of enforced redundancy (the whole idea of type is reminiscent of gender (and, as an aside, languages (e.g., Swahili) use up to six grammatical genders (unrelated to biology), quite apart from the question of number, tense, and mood (and perhaps of case, as well))).

The parentheses in the paragraph above are ridiculous, but they illustrate a concept important to both languages: blocks within blocks—not just the nesting of elements and operations as in Lisp strings, but conceiving and creating the elements themselves as separate entities. That's the whole idea of structured programming, and that's what tends to send students of both German and Pascal up the wall. As Mark Twain once remarked about reading a German newspaper, "When I got to page three I finally found the verb and for the first time learned what the man was talking about."

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Or let's take Prolog, which was invented here in France. Ever since Descartes, the French have been very strong on analysis (breaking a thing down into its component parts) but less interested in synthesis (building a new structure from random pieces). In a typical *débat*—a major sport in France, whether in the form of company meetings, TV interviews, discussions, or whatever—the pattern is analysis, followed by analysis of the analysis, and then analysis of the analysis of the analysis, and so on, down through several levels of recursion.

Prolog itself is essentially analytical: As the programmer, you do a detailed breakdown of the situation that you want to treat and define the point(s) of view that you want to use in regarding that situation, and then Prolog traces back through the analytical structure. It may simulate synthesis, but the thinking behind it is relentlessly analytical.

With regard to cultural orientation, one of Alain Colmeraurer's original illustrations of Prolog consisted of setting up the menu possibilities for a French dinner—various hors d'oeuvres, plats de résistance, fromages, desserts, and so on—and then showing how to restructure that menu according to various parameters such as calorie intake, number of guests, and desirable gustatory combinations. But there must always be a pre-analysis; random factors are forbidden.

Let's go over to BASIC, an American product. BASIC is a quickie do-it-yourself tool—"Let's get something working fast and don't worry about details, planning ahead, or how to update it later." And in the beginning there was COBOL, Common Business-Oriented Language, whose name explains it all.

This is all good old American practicality (the cultural side), but on the linguistic side, the U.S. speaks mainly English, an exceptionally rich and flexible language. English can treat subtle gradations of meaning—the grays, so to speak, as well as black and white, and even color sometimes here and there—and it was in the U.S. that fuzzy logic was first used as a basis for programming languages capable of handling gradations of meaning, partial truth, and indeterminacy.

Things are more subtle than that, however. Fuzzy logic was formalized by Professor Lotfi Zadeh of Berkeley, whose linguistic background is mainly Iranian, which is an uncomfortable mix of Indo-European and Semitic languages, somewhat as English is a mix of the Germanic and Romance families of Indo-European. At least one fuzzy programming language has also been developed in Japan—and Japanese, too, is a language with lots of subtle gradations.

I don't know how far you can carry this idea, but I am waiting for the programming language that is going to come out of China one of these days. Chinese is a very highly evolved language, one that has often run head-on against neighboring languages and so has rubbed off many unnecessary warts and scales (like English after it was exposed to the Vikings and the Normans, only more so). Chinese is capable of both ultra-telegraphic simplicity (normal daily speech) and outrageous subtlety (classical poetry). What a programmer who thinks in that language is going to come up with could be really interesting. ■

Richard Hans Pettersen is a consultant in computational linguistics. He lives and works in Paris. He can be reached on BIX c/o "editors."

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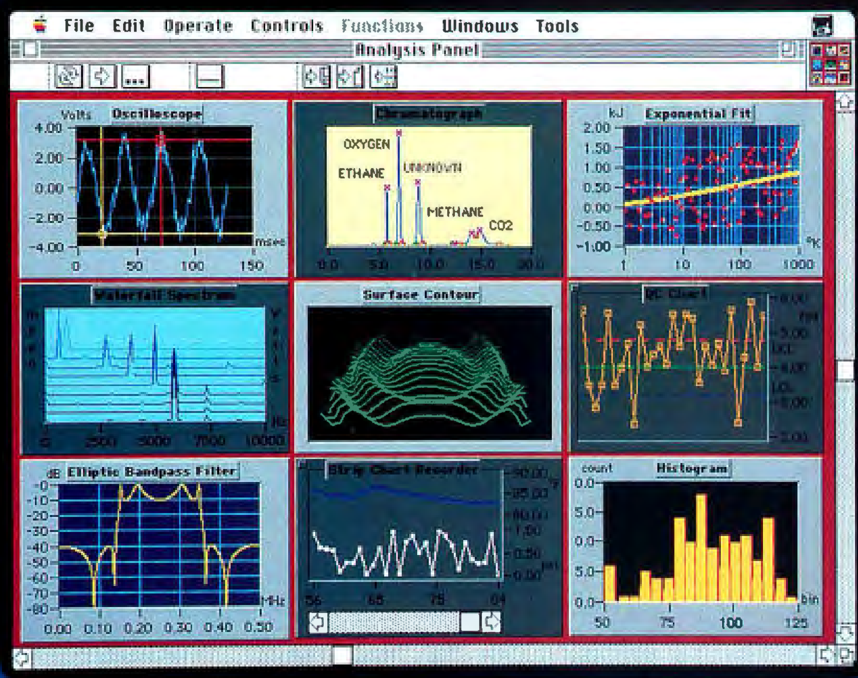

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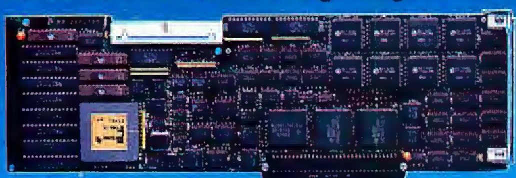

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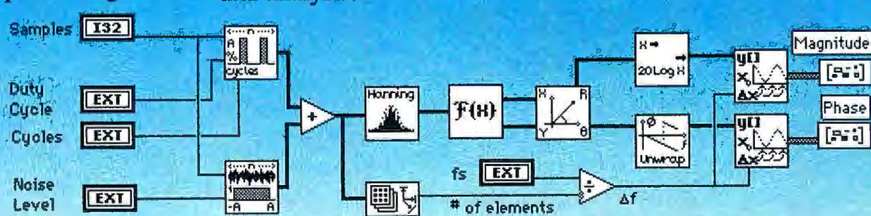

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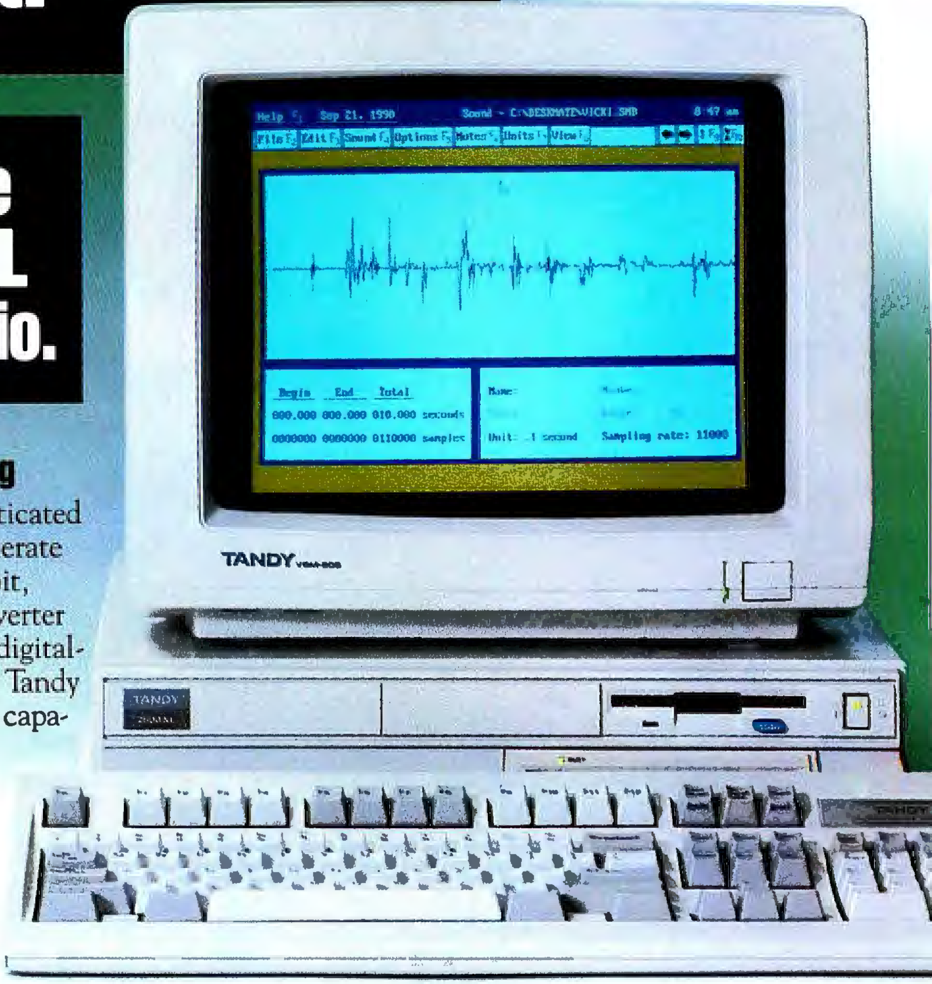

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