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PC WORLD

November 1985 \$2.95

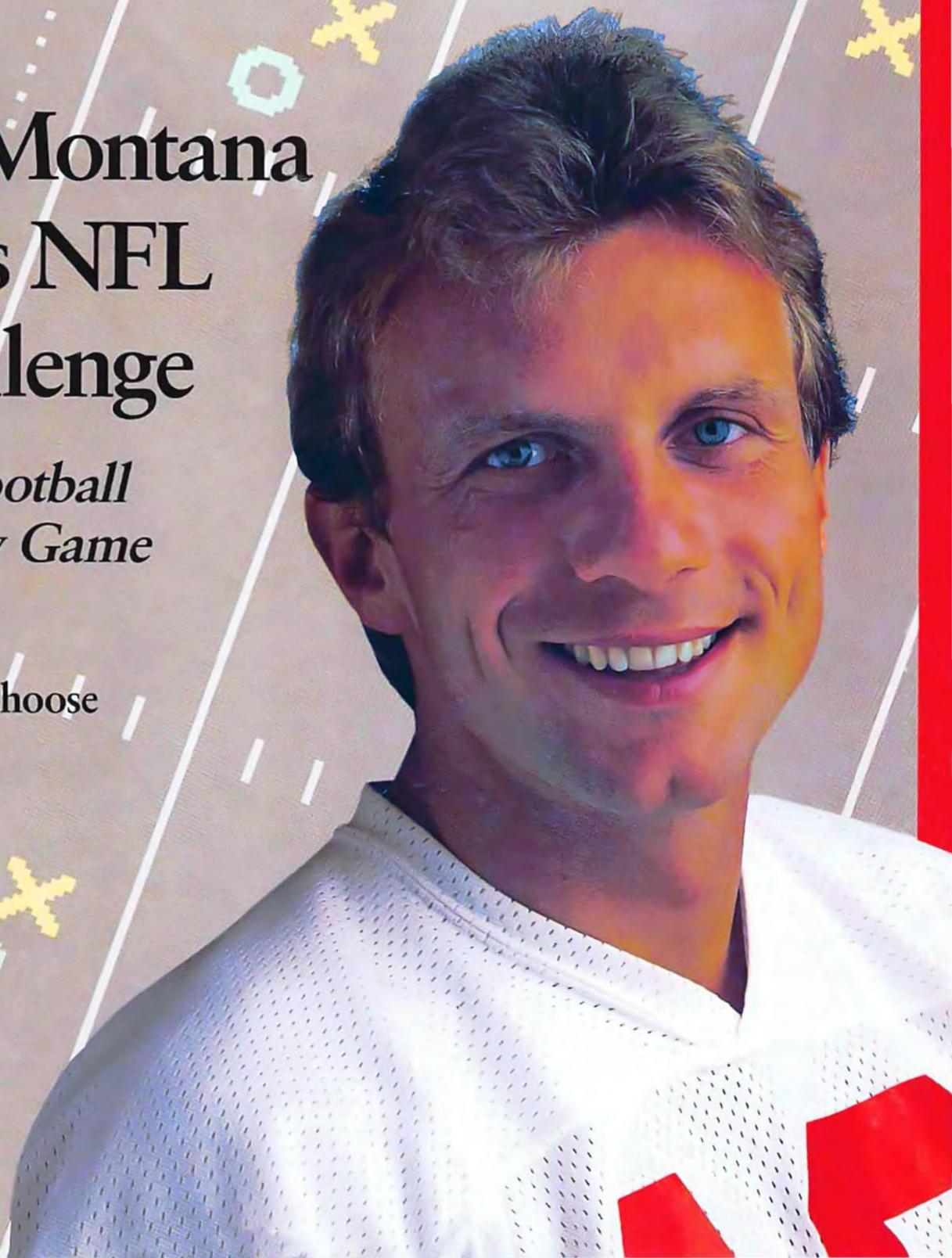
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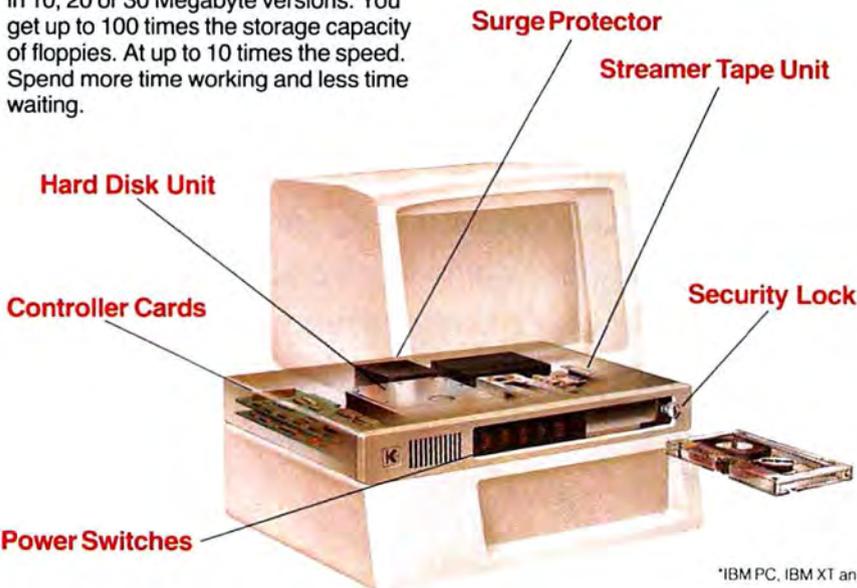
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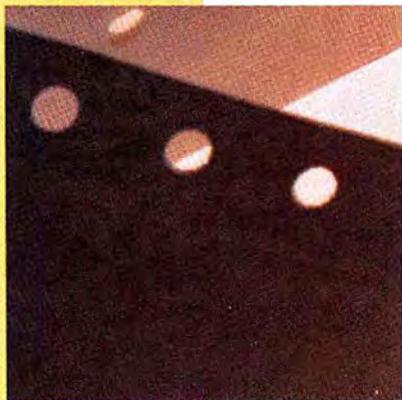
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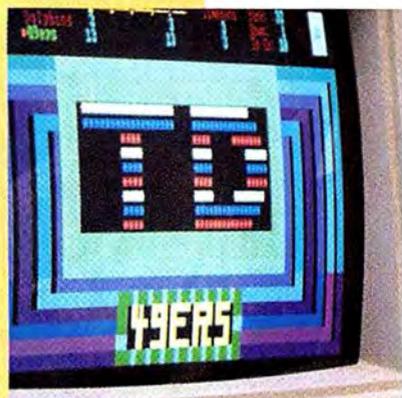
PC WORLD

The Comprehensive Guide to IBM Personal Computers and Compatibles
November 1985



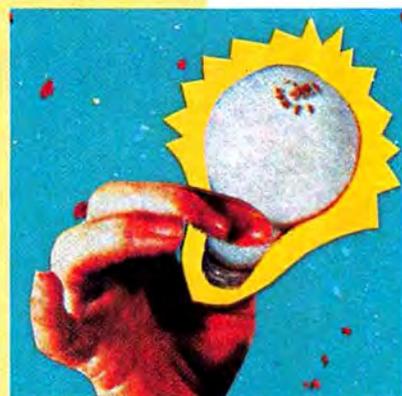
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PC WORLD

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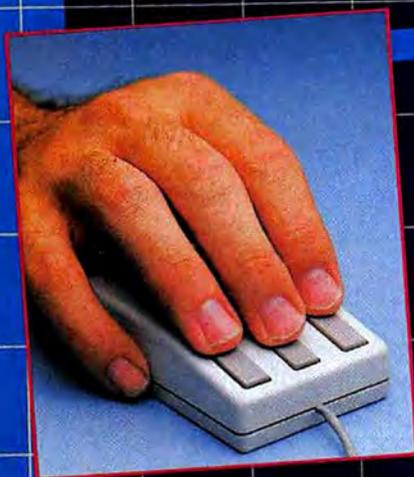
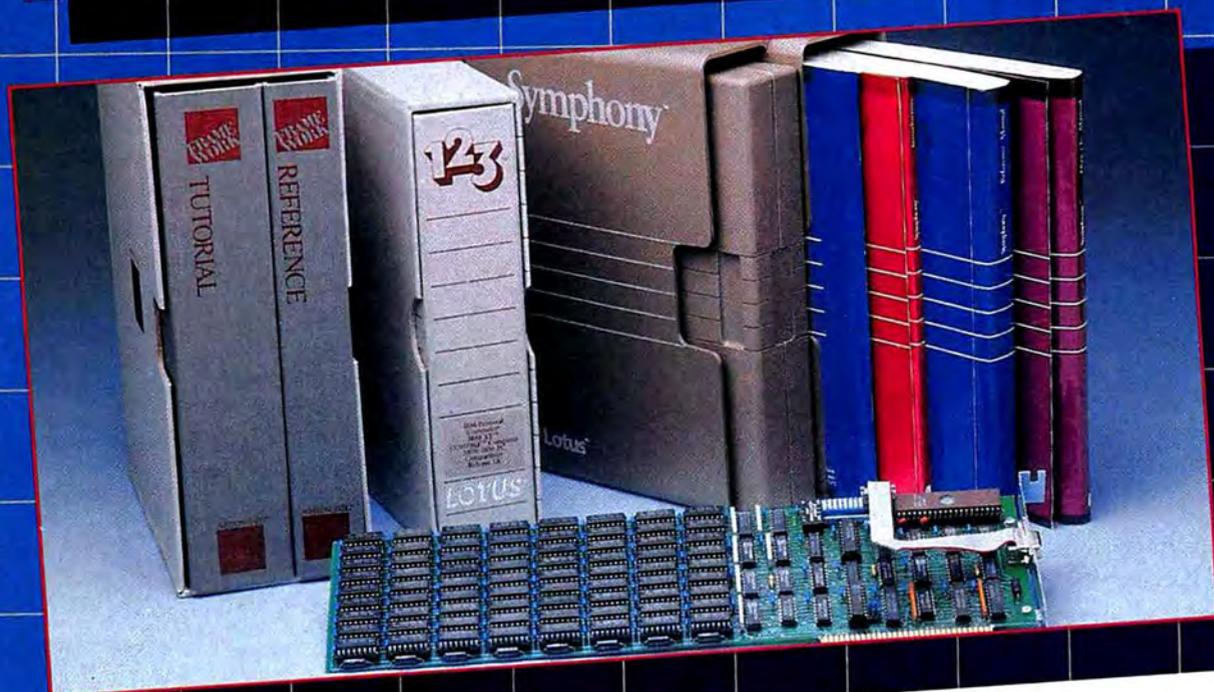
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Auxiliary Memory 1.2MB and 360KB diskette drives* 20MB fixed disk drive* 41.2MB maximum auxiliary memory*	Printers Supports attachment of serial and parallel devices
Keyboard Enlarged enter and shift keys 84 keys 10-foot cord* Caps lock, num lock and scroll lock indicators	Permanent Memory (ROM) 64KB Clock/calendar with battery*
Display Screen IBM Monochrome and Color Displays	Communications RS-232-C interface
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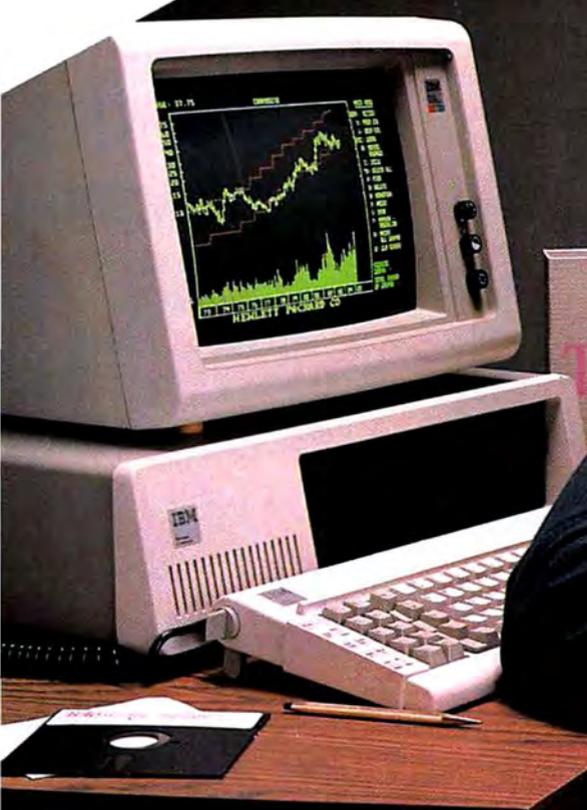
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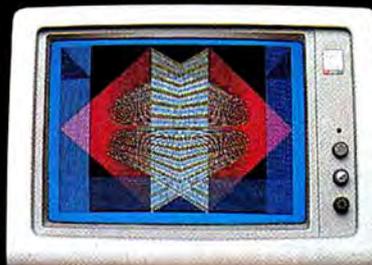
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16 COLORS, 320x200

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Runs an IBM or Compatible Color Monitor	✓	✓	✓			
IBM Monochrome Compatible and High Resolution, 720x348 graphics	✓	✓	✓		✓	✓
Runs Color Software on a Monochrome Monitor, Full Screen:	✓	✓	✓	✓		
—in 16 shades of green on the IBM Monochrome monitor	✓	✓	✓	✓		
—Runs Flight Simulator, PC Paintbrush, IBM BASICA commands and more	✓	✓	✓	✓		✓
—No patches or modifications needed	✓		✓	✓		✓
—Displayed in the IBM standard 9x14 character set	✓	✓				✓
Extended Text Modes:	✓		✓			✓
—132 columns by 25 rows in monochrome	✓		✓			✓
—132 columns by 44 rows in monochrome	✓		✓			✓
—132 columns by 25 rows in color	✓		✓			✓
Runs Lotus 1-2-3™ and Symphony™ in high resolution monochrome graphics:	✓		✓		✓	✓
—in 132 columns by 25 rows	✓		1-2-3 only			✓
—in 132 columns by 44 rows	✓					✓
Runs Lotus 1-2-3™ and Symphony™ in High Resolution color:	✓		✓			
—16 colors, 320x200	✓		✓			
— 4 colors, 640x200	✓		✓			
Software switchable for all display modes and monitors	✓		✓			
Software switchable display memory, 16K, 32K and 64K	✓		✓			
Disable Screen Memory	✓					
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Light Pen Connector (standard)	✓	✓	✓		✓	
Works in any PC-AT slot	✓			✓	✓	
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*Includes one serial port and clock/calendar

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A Case for Stand-Alone Computing



David Bunnell

Our publisher issues a caveat emptor to businesses considering local area networks and offers some tips on how to increase personal computer productivity.

Except in rare cases that yield actual cost benefits, PC local area networks (LANs) are ahead of their time: The technology just isn't good enough to warrant being on the market. Until the wrinkles in the systems are ironed out, installing a LAN today is equivalent to trading in your PBX for a bunch of tin cans and string. The distance between the fantasy of networks and their reality is incredible.

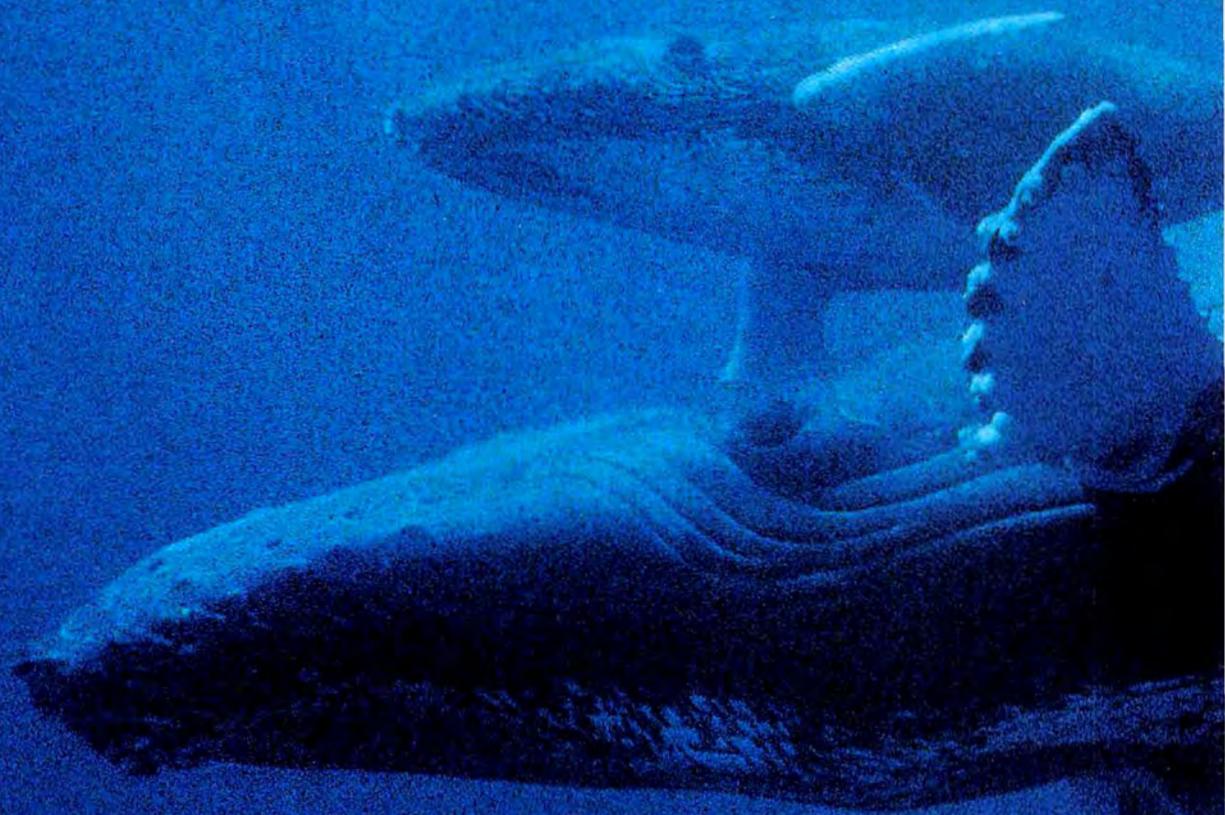
As though piling lead weights into a boat and wondering why it sinks, many computer companies continue hawking baseband and broadband networks that are hardware intensive and software deficient. Meanwhile, consumers are deprived of the luxury of experimenting with the new networks, because they are so expensive: An eight-station LAN could easily cost over \$30,000—about \$4000 per PC. The price for each additional LAN workstation would average around \$3000—depending on how much stand-alone capacity you're willing to sacrifice. And that's only the beginning of the bills. Untangling

the hardware puzzle requires the services of a network consultant. At the going rate of \$80 to \$120 an hour, setting up the system will set you back \$15,000 or more.

The search for software presents a new maze—some packages exist, but not many. I recently asked a LAN consultant what an IBM PC network could do, and his assessment of its current capabilities was, "Well, you can do electronic mail, accounting, and order entry. And soon there will be multiuser data base software." Not an encouraging list.

Spending several thousand dollars to implement an electronic mail system is ridiculous. It makes more sense to use a simple, non-threatening RS-232C network, which merely requires that cable be strung from PC to PC. It is simple to install and costs only about \$100 per user. Another alternative is to use modems and communications programs. *cc:Mail*, one of

(continues)



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the more advanced programs, allows you to send virtually anything, from text to graphics. Information can be transmitted directly between PCs or through a central, dedicated personal computer that acts as a server.

For now, only businesses or departments that depend on order-entry systems have valid justification for buying a PC network. These work groups probably find current networks worth the investment because coordinating data entry by several people is the key to effective customer service and the businesses' success.

The cost of networking is not strictly monetary, however. A great deal of time is also involved. Once a typical PC LAN is up and running, it requires a full-time system manager to organize files on the server, write utility and menu programs, administer files, handle backup and recovery, add new users, change passwords, and so on. In addition, anyone who installs a network today should expect to write off the hardware and software over a two-year period—so they can start all over again when the network becomes obsolete.

Despite the technological flaws and faults, the concept is commendable. The ultimate networking goal is to combine voice and data

on the same network. Computer enthusiasts have been dreaming about that combination for years, but as with LANs, the technology isn't here yet. There is a PC-compatible modem called Watson that digitizes voices and stores them on disk for playback. Reportedly, the recording matches the quality of an analog audio cassette. Watson also allows you to code and store messages for access by specific callers via phone or modem. In many ways this system is just a glorified answering machine, but it is based on a sounder, more enduring network philosophy than that backing IBM's network or 3Com's Ethernet.

Curiously, IBM is trying to stick its fingers in both pies: Alongside its network, Big Blue is pushing an integrated voice-data solution based on a twisted-pair cable. The IBM/Rolm Cedar PC and the AT&T UNIX-based PCs provide a glimpse of this technology's future. The systems fully integrate the personal computer with the telephone—a logical partnership. And with U.S. Telecom's nationwide network scheduled to debut in two years, many experts predict that twisted-pair cable will become the standard in three to five years.

But the best bet for potential networkers is to wait for a fiber optics cable standard. Fiber optics cables are virtually immune to interference and tapping. And the

(continues)

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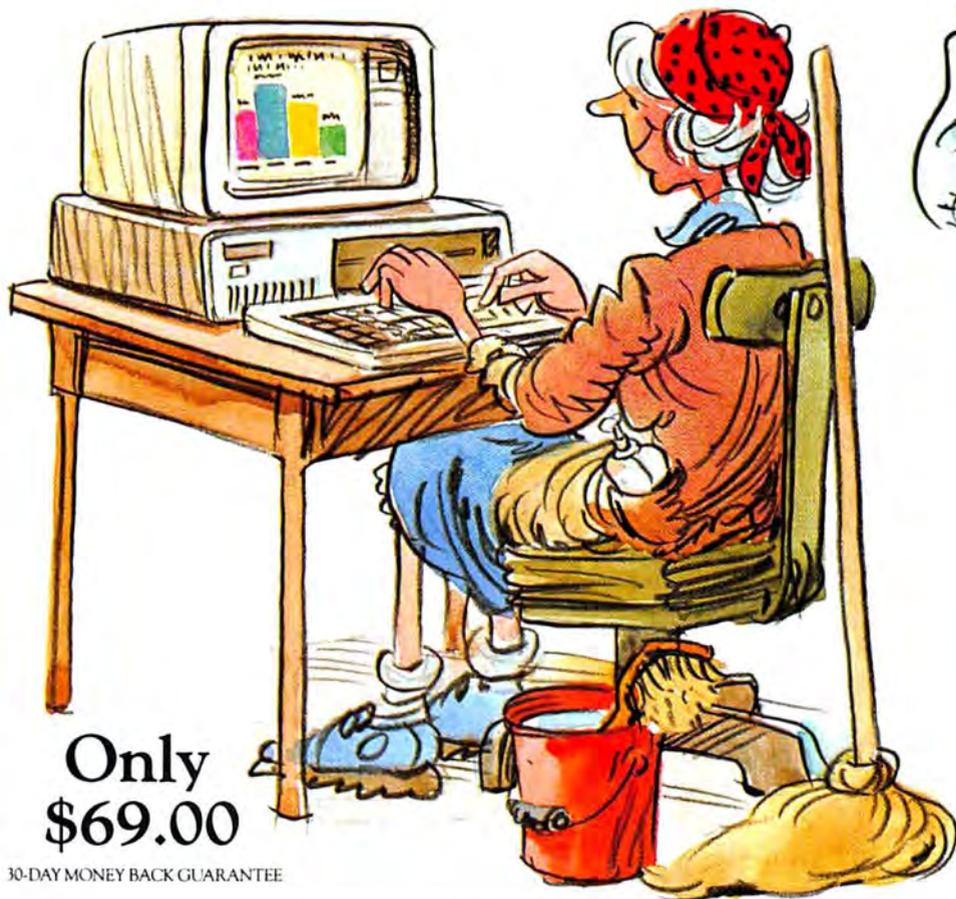
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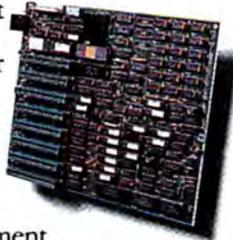
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bandwidth for fiber optics is sufficient to accommodate voice and data with video, delivering nearly unlimited throughput.

In the interim, astute businesspeople awaiting innovations can substitute for the LAN and its attendant system manager a personal computer manager. This person could dramatically increase productivity and make the PC investment pay off by supervising users and software implementation. For example, a frequent problem for managers in using spreadsheets is that they don't usually have the means or inclination to examine and verify underlying formulas. A good personal computer manager could easily create templates that have been tested for miscalculations and can be tailored to specific applications.

There is no reason that stand-alone computers can't be customized to meet the needs of most organizations: The hardware can be adjusted as easily as the software. And one additional staff member, the personal computer manager, can pull the pieces together and help your staff integrate programs and learn new skills.

So, if the networks don't work, why the continued enthusiasm? It's as though everyone's trying to go back to the future. In a few years LANs will become an exciting reality, but until the developers take off their lab coats, we're well advised to make the most of what we have.

(continues)

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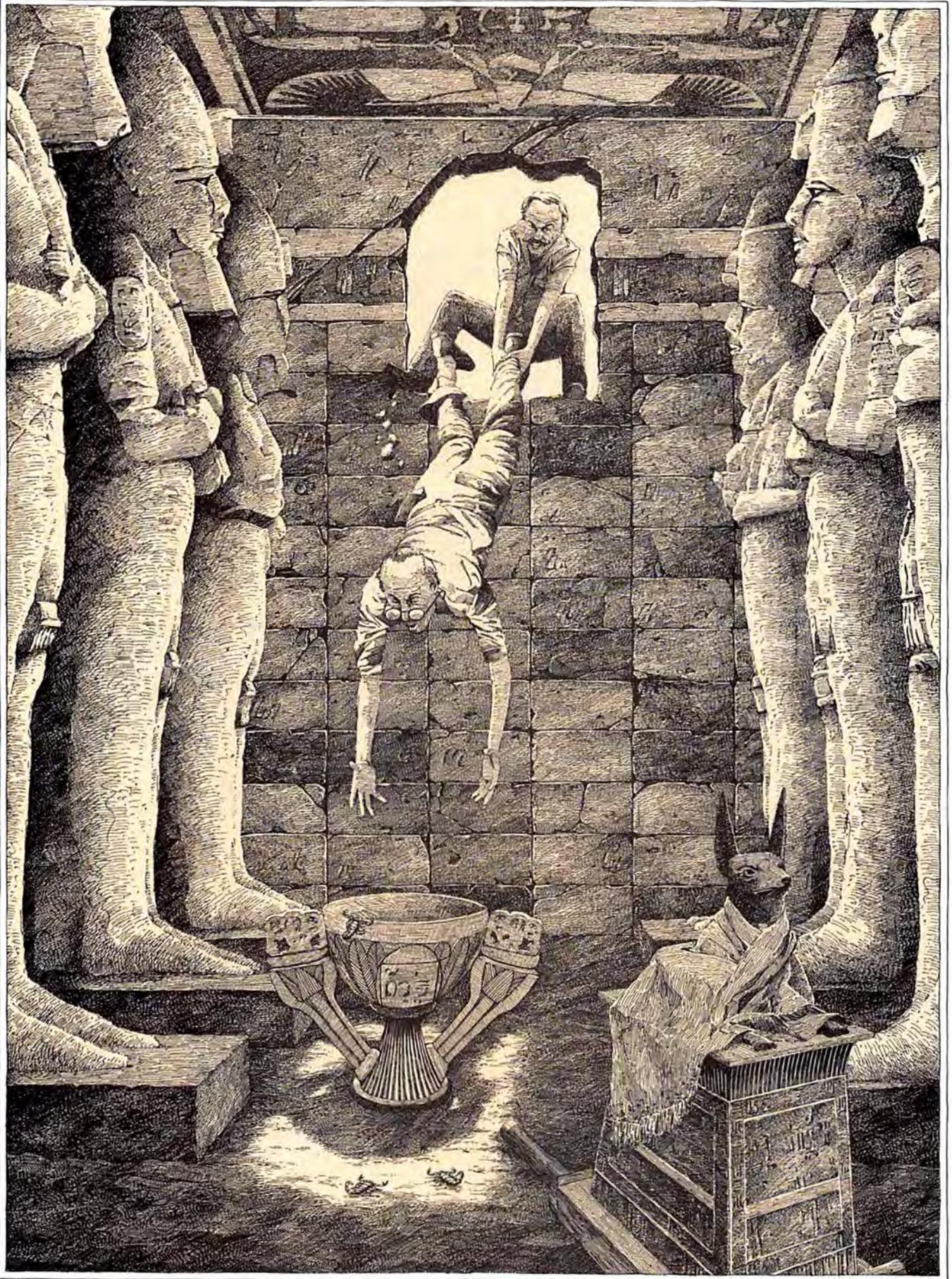
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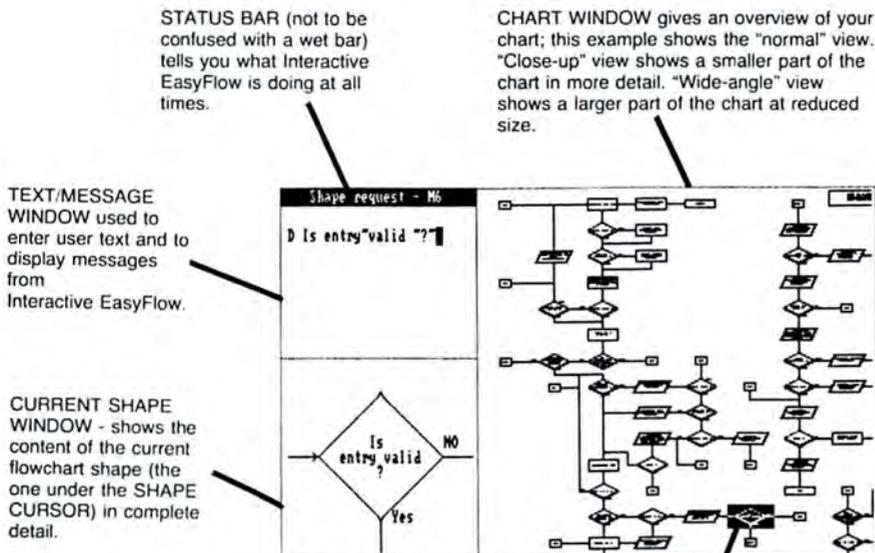
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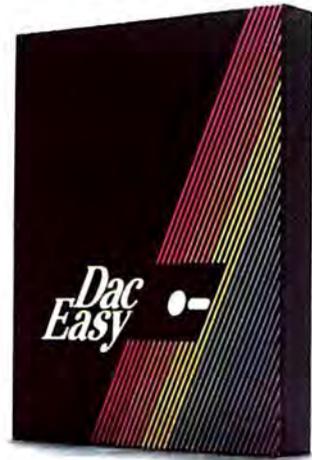
Philip D. Estridge, 1938-1985

Last month I announced the formation of the Andrew Fluegelman award in memory of our founding editor. On a similar note, a memorial scholarship fund has been established in the name of Philip D. and Mary Ann Estridge, who perished in a tragic airplane accident in Dallas on August 2, 1985, along with several other IBM employees. Philip Estridge, who founded the IBM Personal Computing Division, will be remembered as a giant in our industry. In just three years he guided IBM's personal computing business from \$0 to \$5 billion in revenue. This has to be one of the most amazing business success stories in American history.

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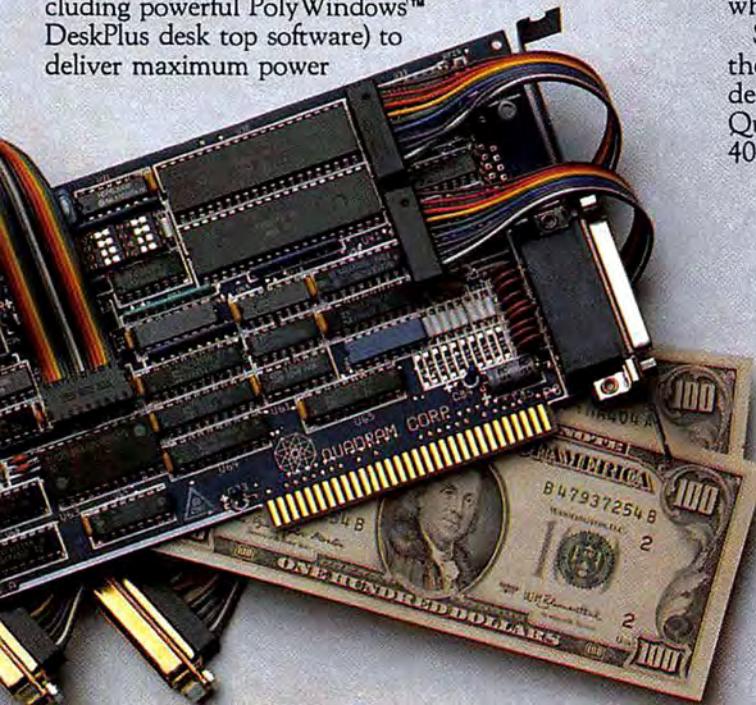
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Automating the intellect—but omitting intuition—invariably means giving birth to a contradiction in terms.

Artificial intelligence. The phrase evokes images befitting the most fanciful concoctions of sci-fi writers and Hollywood; indeed, only books and movies have thus far breathed any life into the notion. Applied to reality, the term *artificial intelligence* is wildly deceptive, responsible for least two sets of false expectations.

First, artificial intelligence (AI) implies the existence of an alien entity that can actually think—something like the computer HAL in the film *2001*. This view of AI has fostered the spectre of a vaguely defined bogeyman who does not exist and probably never will.

The second expectation is that computers will eventually understand what we *mean*—not merely what we *say*—when we communicate with them. While this idea seems less menacing than the first, it is just as misguided; the likelihood that software will ever be sufficiently “user-insightful” to fulfill this promise is minuscule.

Yet however unrealistic these expectations, more money has been squandered on artificial intelligence research than on any other area of computer technology. This research has assumed two apparently unrelated guises: expert systems and natural language software.

Expert systems embody the mechanization of human behavior in highly specialized environments. A chess-playing expert system, for example, is no more than a complicated pattern-recognition program for a finite number of possible patterns. Similarly, an expert system devoted to medical diagnosis deals with rules of inference developed by the medical profession to mimic the diagnostic process.

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(continues)

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difficult to develop. Creation of an expert system requires not merely expertise in a given discipline but a high degree of computer literacy as well. This body of knowledge must be codified into a software system composed of nodes (facts) and the rules of inference that connect them. But even the best expert systems must cope with certain logistical and temporal limits; none automatically absorbs newly discovered facts and the theories formulated to account for them.

Because expert systems don't do any original thinking—or manifest what we commonly regard as intelligence—they cannot rightfully be considered implementations of

AI. Indeed, an expert system at work is almost the antithesis of human reasoning applied to difficult problems; the expert system ignores intuition, our most important problem-solving tool. Without this key faculty, an expert system works only as well as a human “expert” of average capability—that is, someone who always follows established rules. Such a system will never match the performance of a truly superior intellect, someone who resolves problems through original thought and dismisses the familiar as a guide.

Natural language software represents another facet of AI. Such software seeks a more “civilized” meeting place between person and program. Some progress has indeed been made in this realm. Microrim's *Clout*, an English-language query system for the company's *R:base* series and a host of other programs, enables users to bypass the cryptic syntax of conventional query languages. Apple's *MacPaint* is a somewhat different example; it provides an icon-based interface with a pointing device and short menus that even children can use without a manual. Both products epitomize

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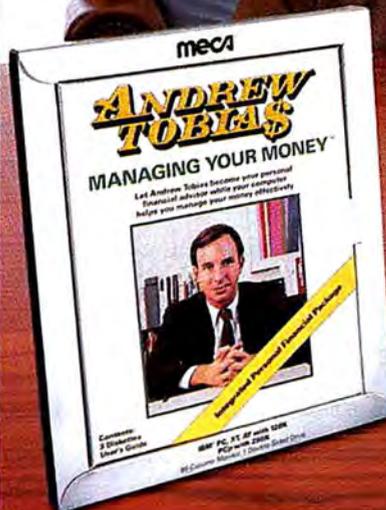
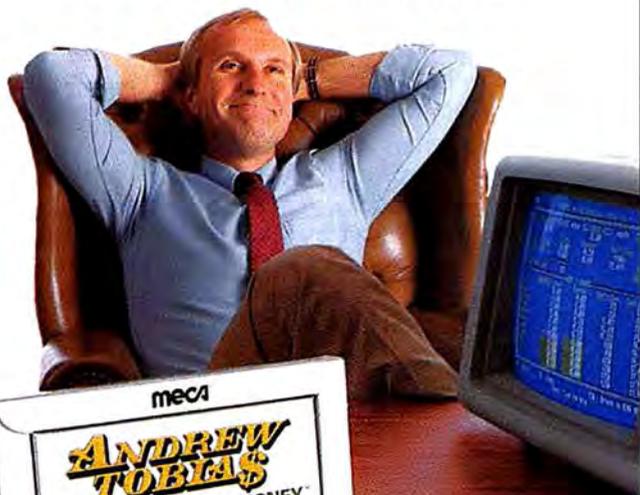
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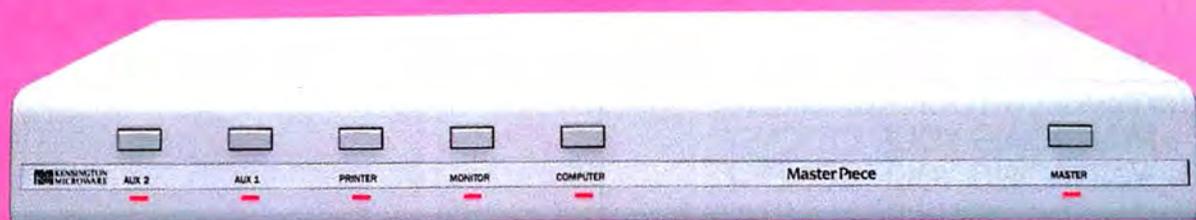
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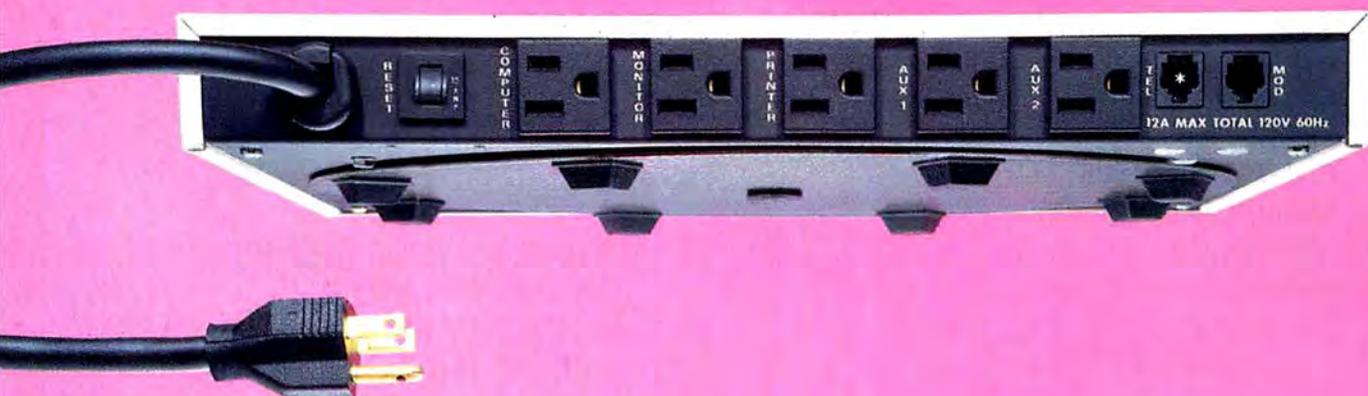
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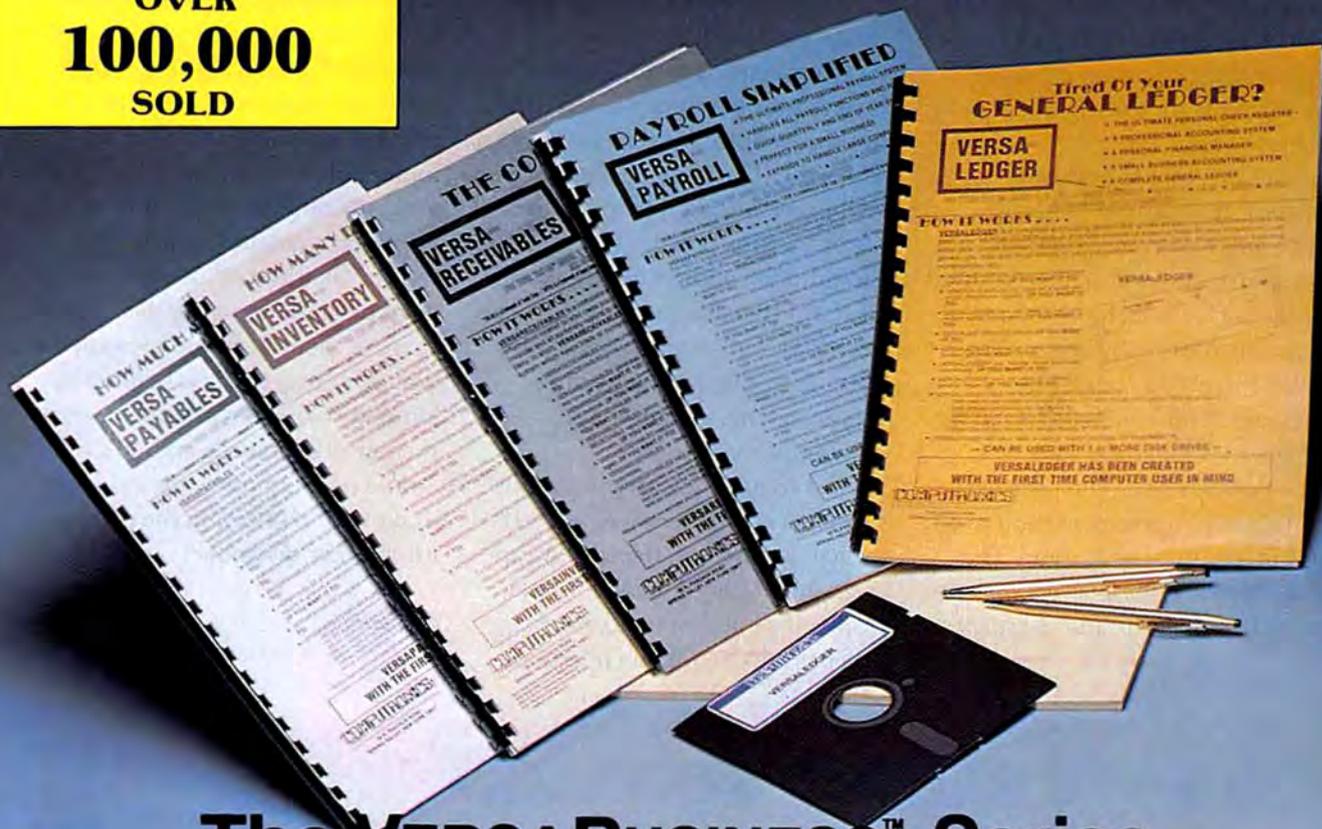
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software for the nonprogrammer, presenting the user with an immediately recognizable interface and encouraging communication with the machine on a more direct, friendly basis.

There's a major drawback to much of this natural language software, however. Although they seem fairly loose and unstructured on the surface, such programs in fact consist of many layers. Typically, there's the assembly-language foundation, followed by a high-level language such as C, then perhaps LISP, then the natural language implementation itself, and finally the application. The links between these layers are sufficiently numerous and complex to

constrain system performance, affecting both memory usage and execution speed. As the cost of memory continues to decline, the former problem may be overcome, but the outlook for the latter isn't so bright. The issue of speed may well prove intractable: if an application runs only half as fast as it should, the solution lies in making the CPU twice as fast or twice as powerful. Down either road, however, lie thorny problems of engineering and software compatibility.

As a result, the current crop of products is quite uneven, and efficiency depends on the specific application. Although *Clout* is relatively efficient despite its layering, other products are much less so.

For both expert systems and natural language software, progress is further encumbered by the absence of a set of general principles. Because developing an expert system does not reveal any immutable rules for preparing the next, it's difficult to see how work on expert systems can lead anywhere. To argue otherwise would be akin to maintaining that four years of medical training entitles a doctor to practice law before the Supreme Court. Synthesizing and then grafting one discipline's rules onto a piece of software has little to do with replicating the process for another discipline.

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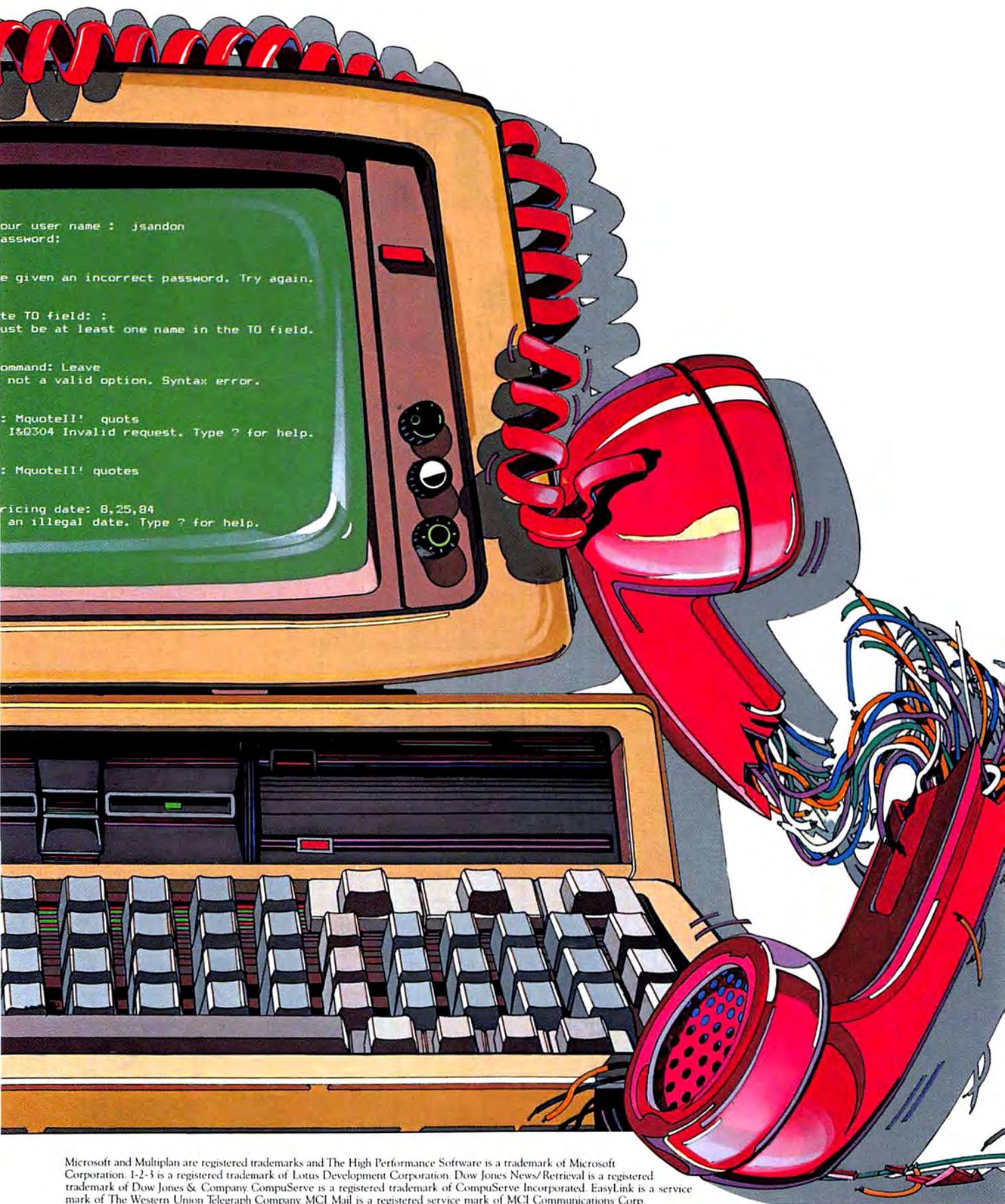
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The same is true of natural language software. While *MacPaint* and *Clout* illustrate the genre reasonably well, both are *ad hoc* examples at the application level. They were developed randomly and lack an underlying theory as a common base. The development of each new natural language application thus means retreating to the drawing board.

No fundamental structure has been developed for either of these so-called branches of artificial intelligence because there is as yet no adequate model of the human brain, of how human beings consciously (let alone subconsciously) solve problems. In school we certainly are not taught how to think; rather, we are exposed to existing knowledge in an organized manner. We do have some understanding of the rules of formal logic, but none whatever of those areas of reasoning we don't use consciously, such as intuition. Thus, not only do we not know how to explain what we think, some of our tools for reasoning haven't even been formally defined.

How can we mimic human thinking in a machine without comprehending the set of tools with which humans think? How can we develop a model for something we don't understand? Yet without such a model, the idea of artificial intelligence is a hoax. Moreover, efforts to translate intelligence into a computer program completely miss the vital

(continues)

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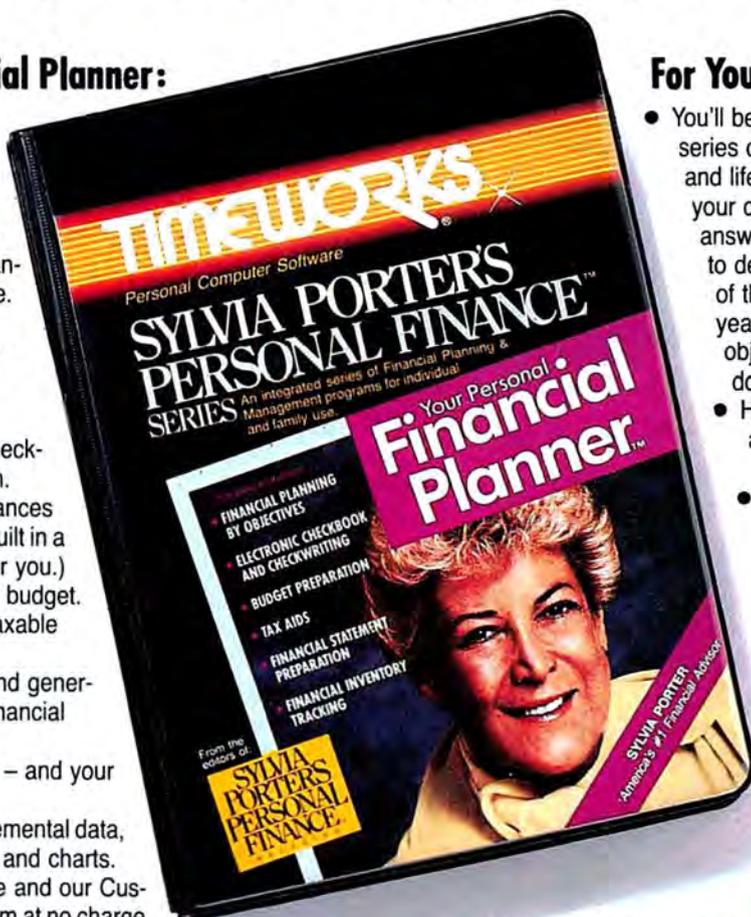
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8:03 am. You're into the spreadsheet. Phone rings. You kick in SideKick's Notepad—without leaving your spreadsheet. You talk. You listen to Frank. You make notes that tell you that Frank is upping the numbers from yesterday's order and he needs a new price and delivery date. He wants a meeting. Fast, but when? You have SideKick fire up your Calendar. Time agreed and noted—in SideKick's NotePad. Conversation ends. Your spreadsheet is still there.

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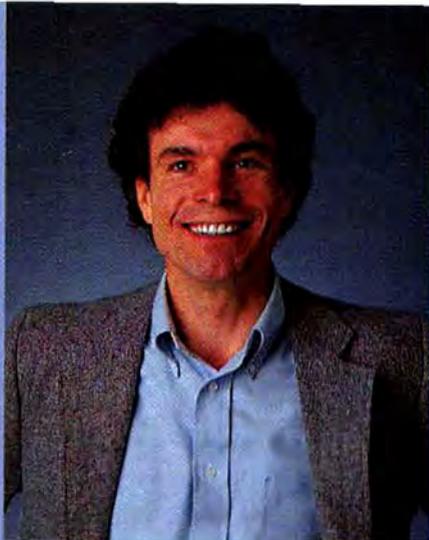
role of trial and error in human problem-solving. Indeed, mistakes can be more valuable than correct results; most momentous discoveries did in fact occur because someone inadvertently stumbled onto the right path.

Perhaps this view of artificial intelligence—a concept that has become the modern Holy Grail—is too pessimistic. But perhaps a thinking machine, even if attainable, simply isn't a reasonable goal. A machine endowed with humanlike intelligence will certainly still lack other human attributes—loyalty, for instance. Without loyalty to humans, intelligent machines would invariably compete with us for the world's limited resources. In any such competition, humans, with all our endearing frailties, could easily lose.

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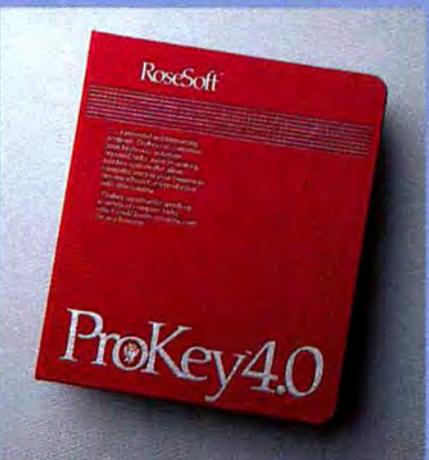
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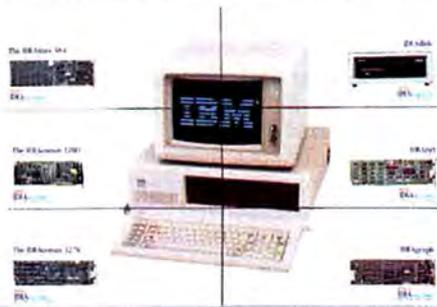
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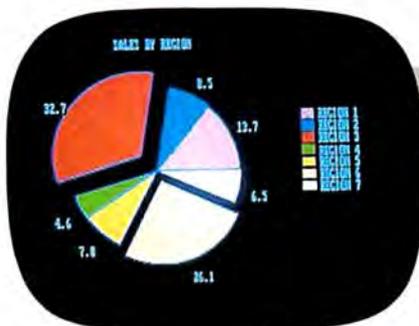
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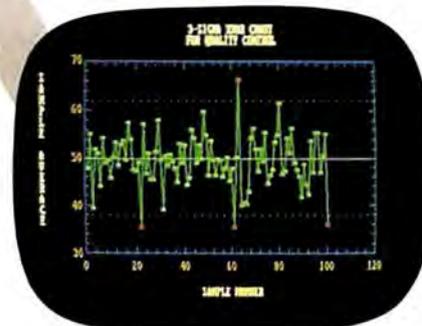
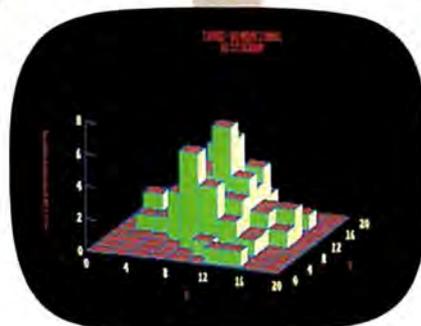
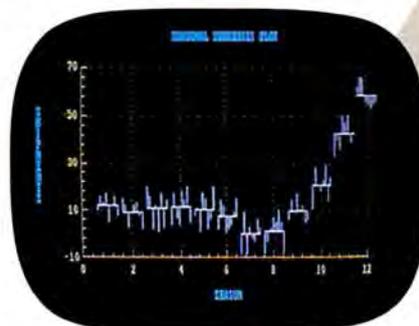
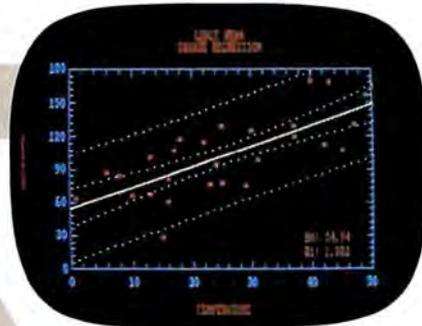
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7	12.4	3720	1	14.4	2782	16250
8	20.2	2030	1	11.9	2712	27800
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Apple IIe, IIc (8502)	*	N/A	N/A	N/A	N/A
Macintosh	4th Qtr.	N/A	N/A	N/A	N/A
CP/M-80 2.2, 3.0	*	*	*	N/A	N/A
TRS-80 Mod I, III, 4, 4p	*	N/A	*	N/A	N/A
Direct commands	*	N/A	N/A	*	*
Maximum scientific digits of accuracy (COS, SIN, ATN, LOG, EXP etc.)	6 to 54 selectable by the user	11 Binary BCD N/A	16	16	6
Device Independent Graphics (same CMDs all graphic modes and computers)	*	N/A	N/A	N/A	N/A
SAME File commands all computers?	*	N/A	N/A	N/A	N/A
STRUCTURED Labels, Functions, LONG IF etc.	*	*	N/A	*	N/A
Same editor commands all versions/computers	*	*	N/A	N/A	N/A
Sieve benchmark (Byte January 1983, 10 iter's)	137 sec.	141 sec.	14.9 sec.	261 sec.	2190 sec.
Shell-Metzner SORT (Sydex-BASIC for Scientist's and Eng. 2,000 5 char. strings)	19 sec.	28 sec.	71 sec.	194 sec.	2700 sec.
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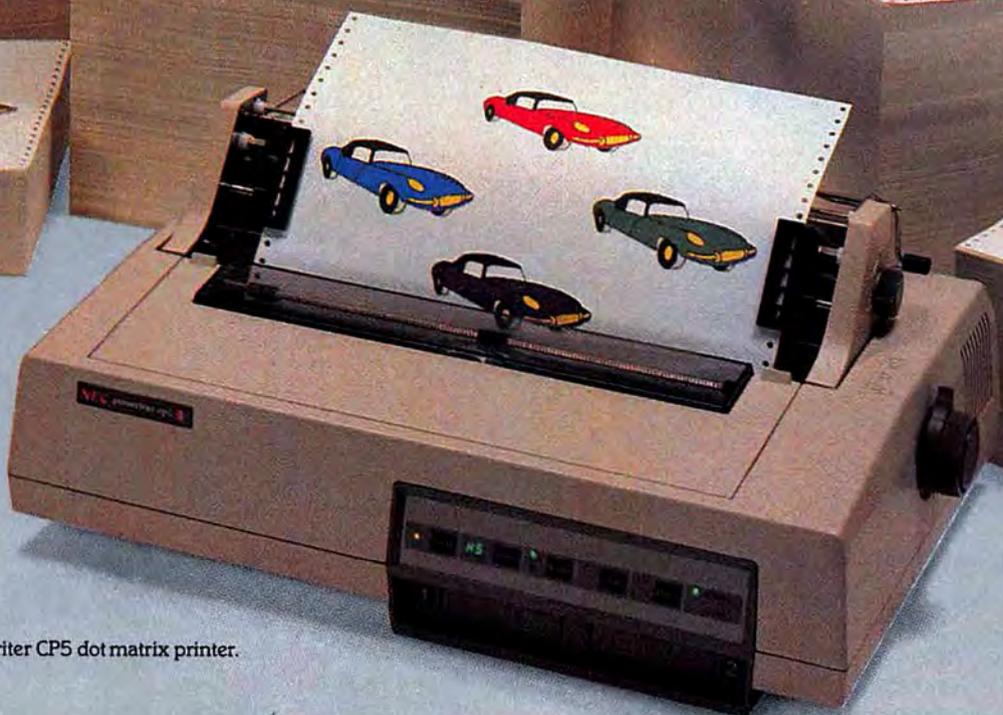
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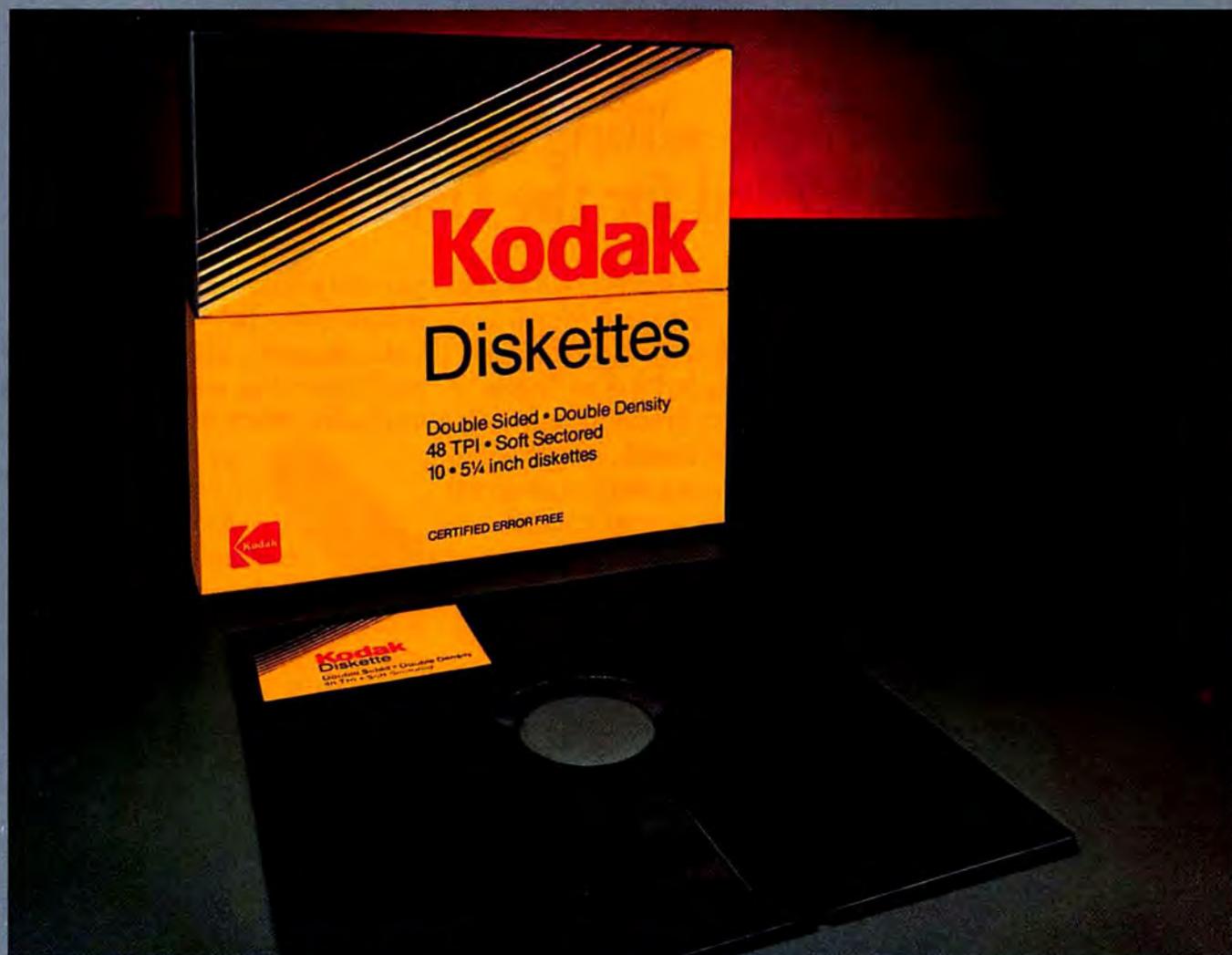
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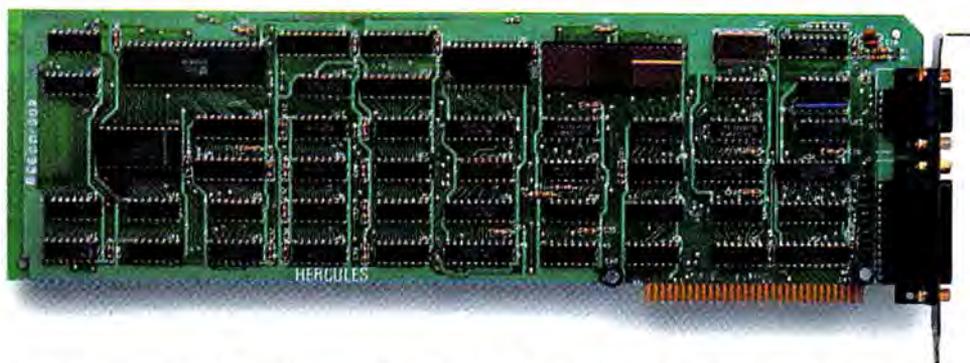
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Letters

Reactions and responses from the PC World community

Smile When You Say That
PC World, you're slipping. Why are John Dvorak's views so important? He's the travel agent of the data processing industry and doesn't belong in a personal computer publication. His specialties are parties, rumors, and travelogues. He may be hot on the West Coast, but he's got no standing here in Texas.

And please—enough pictures of Bill Gates ["The DOS Drivers," *PCW*, July 1985]. Isn't there anybody else who can tell us something about the industry—or is the entire business wrapped up in this one person? Gates must be making a fortune.

Dave Unclebach
Houston, Texas

Window Warriors

I enjoyed Alan Cooper's comments in "Window Viper" [*REMark*, *PCW*, August 1985] until he said, "Even Apple... has quietly dropped almost all windowing activities from the Macintosh." A bit later he asserted that "anyone with real work to do on the Mac switches to one of the... command-oriented operating system interfaces."

As a software developer for IBM and Apple, I'm amazed by these comments. Anyone involved in the Macintosh user community would find them laughable.

To my knowledge, FastFinder is the only general command-driven Mac operating system interface currently available (other than UNIX-like software development systems)—and only software developers use it. The best editor for software development on the Mac is the one Apple supplies, and it allows up to four windows (that is,

four separate files) to be open at once. This feature is extremely useful, as any user will testify. Additionally, such companies as Microsoft and Lotus are marketing packages, like *Jazz* and *Excel*, that make extensive use of windows.

Most Macintosh users tend to know very little about operating systems but still manage to get plenty of work done. Some never even get around to reading the manuals. That truly makes the Mac a computer interface "for the rest of us."

Eric C. Anderson
Deerfield Beach, Florida

I appreciate Mr. Anderson's provocative letter very much. Too little informed dialogue takes place between software authors, to the detriment of the user community.

As far as I can tell, there are no windows in MacPaint, the software product that Apple used to sell its prodigal computer to a new generation of believers (as well as to a few of us in the older generation). MacPaint allows some tiling and has pop-up menus and message boxes, but no windows.

Apple's use of windows appears to be pretty much restricted to the absurdly limited and slow presentation of disk directories. However, unlike on PARC's original Alto, Xerox's derivative Star, and Apple's own Macintosh progenitor, Lisa, each application initiated on the Mac takes over the entire screen, having dropped windowing completely.

Both FastFinder and UNIX were exactly what I had in mind when I discussed switching to a

(continues)



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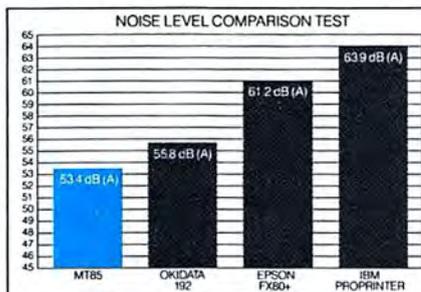
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"command-oriented" interface. It is my strong belief that the Mac's gospel of icon windows, although useful for overcoming a first-time user's technophobia, is like a car's first gear—not much good after leaving the curb.

Ironically, as commercial software authors, Mr. Anderson and I belong to one of the few small groups that windows actually benefit. Although I'd try to avoid putting an application program in a window, I wouldn't hesitate to add extensive windowing capability to a compiler, a debugger, an editor, a linker, or any other

program targeted solely at software pros. Mr. Anderson's observation regarding Apple's windowing editor for developers suggests that we are in agreement. —Alan Cooper

COBOL Controversy

Marilyn Z. Smith's review of mbp COBOL in "COBOL Comeback" [PCW, July 1985] was good in its consideration of compiler efficiency and screen and error handling, and in its inclusion of utilities.

Ms. Smith is wrong, however, in saying that "mbp perversely fails to allow the creation of numeric fields with dollar signs." We have

no idea why Ms. Smith was unable to verify this feature.

She also incorrectly reports that mbp COBOL cannot compile a 2000-line program. We know of application software vendors who use the product and have created programs exceeding 10,000 lines. The I/O error Ms. Smith encountered was probably due to a 'Disk Full' condition. In any case, a call to mbp technical support would have quickly led to diagnosis of the difficulty and an explanation of how to increase the work file size to meet her requirements.

(continues)

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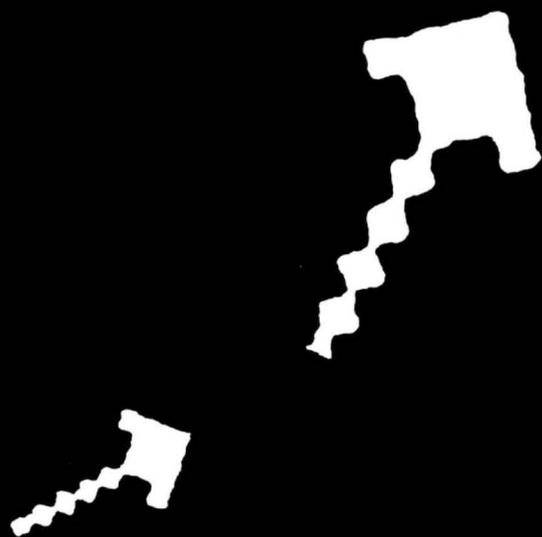
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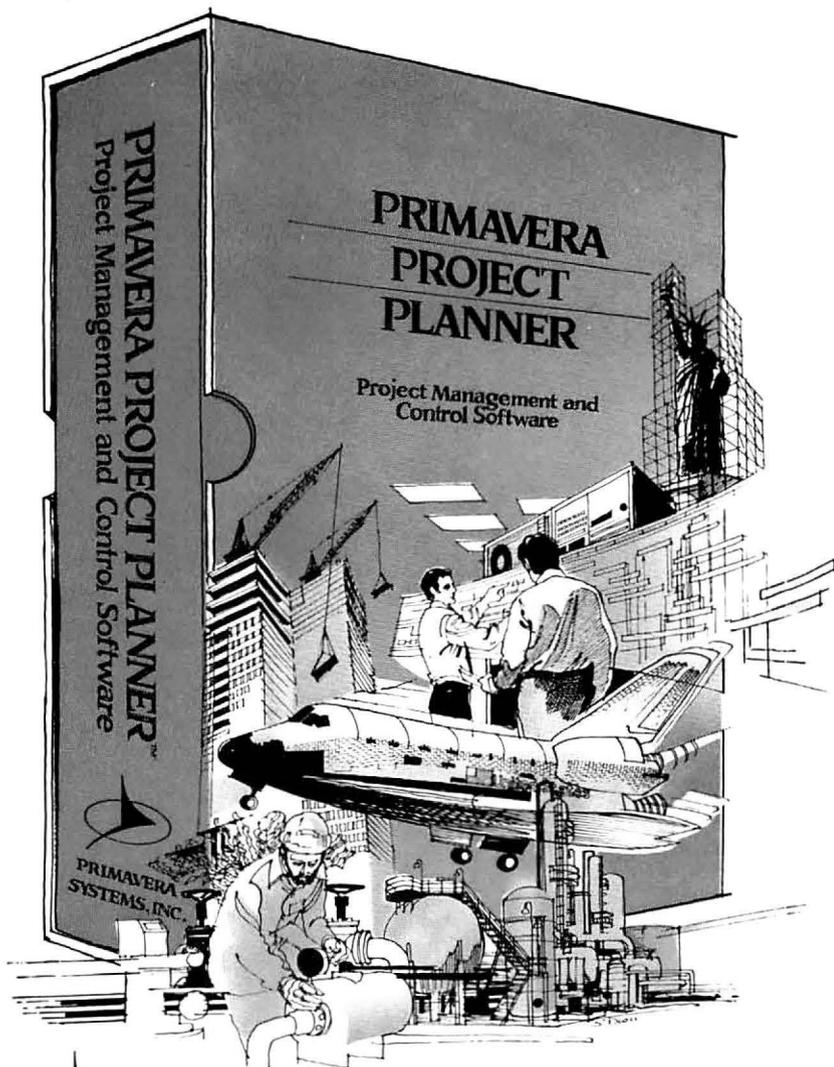
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Before saying that mbp COBOL lacks "clear and useful examples," Ms. Smith should have noted that each mbp compiler includes a disk chock-full of sample programs that demonstrate its advanced features.

Gerald E. Weltner, Jr.
mbp Software and Systems
Technology, Inc.
Oakland, California

When I mentioned that mbp COBOL does not allow dollar signs in displayed material, I was referring to the SMS screen management system and not the DISPLAY verb as illustrated in the compiler's sample program. As the reference manual points out, SMS limits numeric editing to decimal point and sign.

When I encountered the internal I/O error, I chose not to consult technical support. I have since discovered, however, that mbp Software's support is extremely helpful. As Mr. Weltner points out, the solution is to increase the work file size beyond the 512K default, an operation not required with the new 9.0 release. (mbp COBOL, version 9.0, was available only as a beta test release; PC World policy is not to evaluate beta versions.)

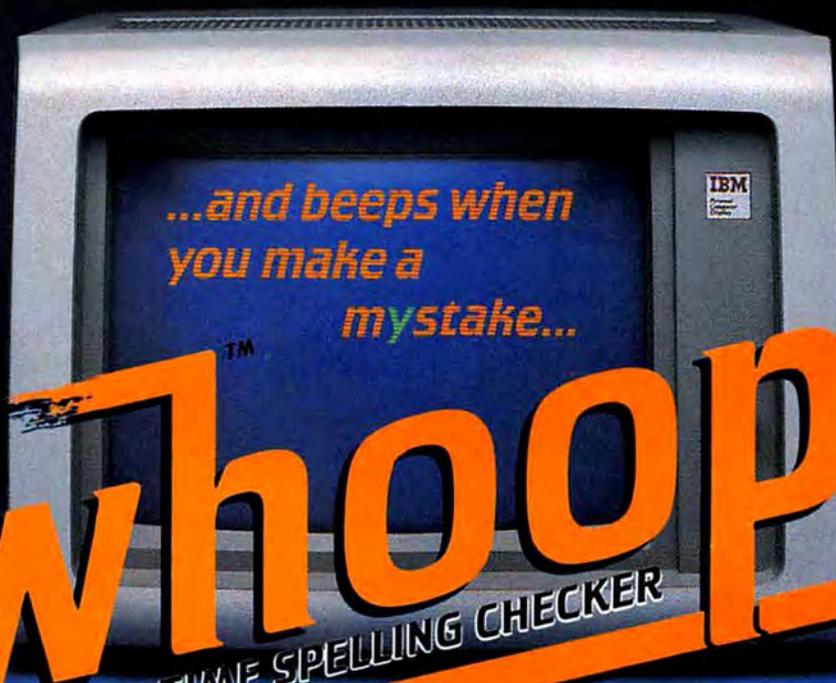
I did examine the sample programs included with the compiler and found them to be useful. It's always a boon to have complete examples rather than snippets of verbs and phrases. I would prefer that the examples be indexed in the manual, just as a reminder that they exist. It's difficult to rummage through a floppy disk looking for them. —Marilyn Z. Smith

(continues)

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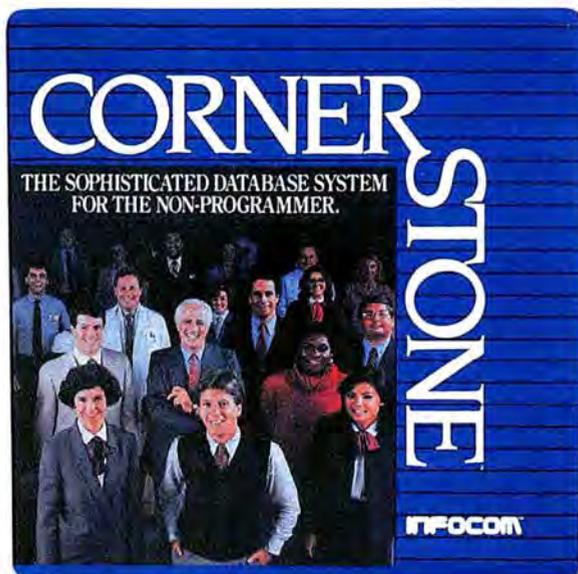
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*The New York Times quote from the May 5, 1985 issue.

Circle 949 on reader service card

Don't Sell the 8088 Short

Testing my PC knowledge with "The PC World Advanced Users Quiz" [PCW, July 1985] was fun. I must, however, disagree with your answer to question 11, concerning the amount of RAM the PC's 8088 CPU can address directly.

Although it's true that the 8088 lacks a 20-bit address register, to say that it can "directly address only one 64K segment of RAM at a time" is certainly incorrect. Remember that there are four segment registers. Depending on the setting of these four registers, one can "directly" access up to 256K of RAM.

With this in mind, answer B, "64K," can be eliminated. Answer

D, "3 gigabytes," is definitely wrong. Answer A, "640K," is wrong when one considers the RAM used for a screen buffer in addition to the maximum available 640K of RAM. The only answer left is C, "1MB." If one bends the definition of "random access" to mean being able to read and write memory, "1MB" is the most plausible response. (The 8088 can write to the 64K ROM even though it won't change the contents.)

*Hank Wan
Millbrae, California*

We assumed that the segment registers had not been manipulated and held their normal value—zero. Thus, by our reckoning, the 8088 directly addresses only 64K. —Karl Koessel, Technical Editor

DOS Does It

The answer to question 50 in the "Advanced Users Quiz" is correct, but your explanation regarding the reloading of COMMAND.COM reveals a misunderstanding of the process.

You state that "some programs ... look to drive A: ... when they exit to DOS." I maintain that

(continues)

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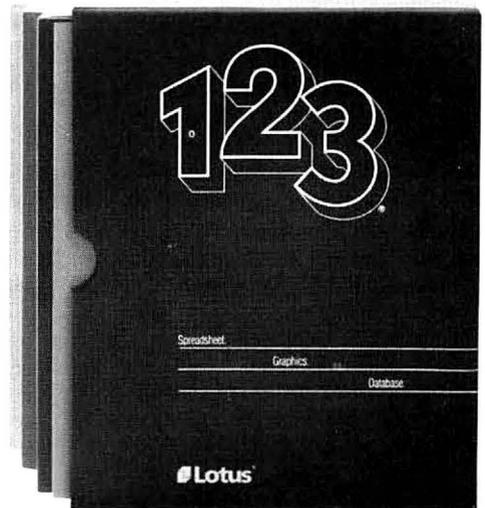
If you're a registered 1-2-3 user and want to upgrade to new 1-2-3, you'll find all the details in a mailing from Lotus. If you haven't registered yet, complete and send in your Warranty Registration Card or call 1-800-TRADEUP* so we can send you the mailing.

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John Doe	1000	Personnel	100	A	15,000	H	12/31/85
Jane Smith	2000	Marketing	200	B	20,000	H	12/31/85
Bob Johnson	3000	Finance	300	C	25,000	H	12/31/85
Carol White	4000	Operations	400	D	30,000	H	12/31/85
David Brown	5000	Personnel	500	E	35,000	H	12/31/85
Evelyn Green	6000	Marketing	600	F	40,000	H	12/31/85
Frank Miller	7000	Finance	700	G	45,000	H	12/31/85
Grace Wilson	8000	Operations	800	H	50,000	H	12/31/85
Henry Moore	9000	Personnel	900	I	55,000	H	12/31/85
Irene Taylor	10000	Marketing	1000	J	60,000	H	12/31/85
Jack Anderson	11000	Finance	1100	K	65,000	H	12/31/85
Jill Roberts	12000	Operations	1200	L	70,000	H	12/31/85
John King	13000	Personnel	1300	M	75,000	H	12/31/85
Jane Scott	14000	Marketing	1400	N	80,000	H	12/31/85
James Adams	15000	Finance	1500	O	85,000	H	12/31/85
Jessica Baker	16000	Operations	1600	P	90,000	H	12/31/85
John Hall	17000	Personnel	1700	Q	95,000	H	12/31/85
Jane Young	18000	Marketing	1800	R	100,000	H	12/31/85
James Lee	19000	Finance	1900	S	105,000	H	12/31/85
Jessica King	20000	Operations	2000	T	110,000	H	12/31/85
John Wright	21000	Personnel	2100	U	115,000	H	12/31/85
Jane Lopez	22000	Marketing	2200	V	120,000	H	12/31/85
James Hill	23000	Finance	2300	W	125,000	H	12/31/85
Jessica Green	24000	Operations	2400	X	130,000	H	12/31/85
John Adams	25000	Personnel	2500	Y	135,000	H	12/31/85
Jane Baker	26000	Marketing	2600	Z	140,000	H	12/31/85
James Clark	27000	Finance	2700	AA	145,000	H	12/31/85
Jessica Evans	28000	Operations	2800	AB	150,000	H	12/31/85
John Hill	29000	Personnel	2900	AC	155,000	H	12/31/85
Jane King	30000	Marketing	3000	AD	160,000	H	12/31/85
James Lee	31000	Finance	3100	AE	165,000	H	12/31/85
Jessica Scott	32000	Operations	3200	AF	170,000	H	12/31/85
John Taylor	33000	Personnel	3300	AG	175,000	H	12/31/85
Jane White	34000	Marketing	3400	AH	180,000	H	12/31/85
James Brown	35000	Finance	3500	AI	185,000	H	12/31/85
Jessica Green	36000	Operations	3600	AJ	190,000	H	12/31/85
John Miller	37000	Personnel	3700	AK	195,000	H	12/31/85
Jane Wilson	38000	Marketing	3800	AL	200,000	H	12/31/85
James Moore	39000	Finance	3900	AM	205,000	H	12/31/85
Jessica Taylor	40000	Operations	4000	AN	210,000	H	12/31/85
John Anderson	41000	Personnel	4100	AO	215,000	H	12/31/85
Jane Baker	42000	Marketing	4200	AP	220,000	H	12/31/85
James Clark	43000	Finance	4300	AQ	225,000	H	12/31/85
Jessica Evans	44000	Operations	4400	AR	230,000	H	12/31/85
John Hill	45000	Personnel	4500	AS	235,000	H	12/31/85
Jane King	46000	Marketing	4600	AT	240,000	H	12/31/85
James Lee	47000	Finance	4700	AU	245,000	H	12/31/85
Jessica Scott	48000	Operations	4800	AV	250,000	H	12/31/85
John Taylor	49000	Personnel	4900	AW	255,000	H	12/31/85
Jane White	50000	Marketing	5000	AX	260,000	H	12/31/85
James Brown	51000	Finance	5100	AY	265,000	H	12/31/85
Jessica Green	52000	Operations	5200	AZ	270,000	H	12/31/85
John Miller	53000	Personnel	5300	BA	275,000	H	12/31/85
Jane Wilson	54000	Marketing	5400	BB	280,000	H	12/31/85
James Moore	55000	Finance	5500	BC	285,000	H	12/31/85
Jessica Taylor	56000	Operations	5600	BD	290,000	H	12/31/85
John Anderson	57000	Personnel	5700	BE	295,000	H	12/31/85
Jane Baker	58000	Marketing	5800	BF	300,000	H	12/31/85
James Clark	59000	Finance	5900	BG	305,000	H	12/31/85
Jessica Evans	60000	Operations	6000	BH	310,000	H	12/31/85
John Hill	61000	Personnel	6100	BI	315,000	H	12/31/85
Jane King	62000	Marketing	6200	BJ	320,000	H	12/31/85
James Lee	63000	Finance	6300	BK	325,000	H	12/31/85
Jessica Scott	64000	Operations	6400	BL	330,000	H	12/31/85
John Taylor	65000	Personnel	6500	BM	335,000	H	12/31/85
Jane White	66000	Marketing	6600	BN	340,000	H	12/31/85
James Brown	67000	Finance	6700	BO	345,000	H	12/31/85
Jessica Green	68000	Operations	6800	BP	350,000	H	12/31/85
John Miller	69000	Personnel	6900	BQ	355,000	H	12/31/85
Jane Wilson	70000	Marketing	7000	BR	360,000	H	12/31/85
James Moore	71000	Finance	7100	BS	365,000	H	12/31/85
Jessica Taylor	72000	Operations	7200	BT	370,000	H	12/31/85
John Anderson	73000	Personnel	7300	BU	375,000	H	12/31/85
Jane Baker	74000	Marketing	7400	BV	380,000	H	12/31/85
James Clark	75000	Finance	7500	BW	385,000	H	12/31/85
Jessica Evans	76000	Operations	7600	BX	390,000	H	12/31/85
John Hill	77000	Personnel	7700	BY	395,000	H	12/31/85
Jane King	78000	Marketing	7800	BZ	400,000	H	12/31/85
James Lee	79000	Finance	7900	CA	405,000	H	12/31/85
Jessica Scott	80000	Operations	8000	CB	410,000	H	12/31/85
John Taylor	81000	Personnel	8100	CC	415,000	H	12/31/85
Jane White	82000	Marketing	8200	CD	420,000	H	12/31/85
James Brown	83000	Finance	8300	CE	425,000	H	12/31/85
Jessica Green	84000	Operations	8400	CF	430,000	H	12/31/85
John Miller	85000	Personnel	8500	CG	435,000	H	12/31/85
Jane Wilson	86000	Marketing	8600	CH	440,000	H	12/31/85
James Moore	87000	Finance	8700	CI	445,000	H	12/31/85
Jessica Taylor	88000	Operations	8800	CJ	450,000	H	12/31/85
John Anderson	89000	Personnel	8900	CK	455,000	H	12/31/85
Jane Baker	90000	Marketing	9000	CL	460,000	H	12/31/85
James Clark	91000	Finance	9100	CM	465,000	H	12/31/85
Jessica Evans	92000	Operations	9200	CN	470,000	H	12/31/85
John Hill	93000	Personnel	9300	CO	475,000	H	12/31/85
Jane King	94000	Marketing	9400	CP	480,000	H	12/31/85
James Lee	95000	Finance	9500	CQ	485,000	H	12/31/85
Jessica Scott	96000	Operations	9600	CR	490,000	H	12/31/85
John Taylor	97000	Personnel	9700	CS	495,000	H	12/31/85
Jane White	98000	Marketing	9800	CT	500,000	H	12/31/85
James Brown	99000	Finance	9900	CU	505,000	H	12/31/85
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03/30/85	Net 30	005		\$206.00	\$602.70
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05/30/85 181

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Circle 617 on reader service card



DOS, not the program, looks to drive A: after the program has exited to DOS. More precisely, the program exits to the resident portion of COMMAND.COM (in low memory). There, DOS performs a checksum to see if the transient portion (in high memory) is intact. If not, the resident portion of DOS then reloads the transient portion of COMMAND.COM (from disk to high memory). Control then passes to that code to await the next command.

Many BASIC programs provoke this action because they tell DOS to load part of themselves (specifically the stack and string variable space) into high memory. This overwrites COMMAND.COM.

John W. Atwood
San Antonio, Texas

An Unholy Alliance?

After all the time I've spent using computers of various makes, models, and operating systems, I've failed. I really considered myself to be an advanced user, but your "Advanced Users Quiz" has taught me humility.

I suppose it had to happen eventually. I can race through a session with *XyWrite II Plus*. I can crank out proposals with *ThinkTank* and can take a portion of a *Smart System* spreadsheet, make a graph, and embed it in a document written with the *Smart System* word processor. But *WordStar*? I've never had the opportunity to work with anyone old enough to know *WordStar*. And how was I to know that I would someday disgrace myself because I refused to

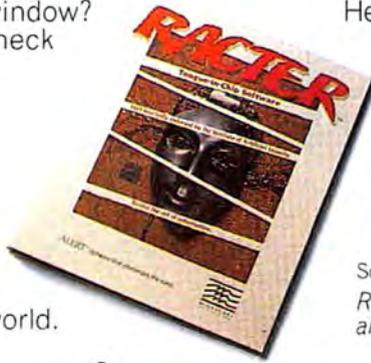
(continues)

How much is that doggie in the window?
Did Noah own an umbrella? Is that check
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work with antiquated software like 1-2-3 and dBASE II?

I never realized that an "advanced user" couldn't exist without full awareness of the Holy Trio—WordStar, 1-2-3, and dBASE. What if my company finds out? I'll lose my job, my company car, and my access to the office coffeepot.

In the future I hope you'll admit to your readers that it really isn't necessary to limit one's knowledge to the Holy Trio.

Pete White

Holliston, Massachusetts

The Price of Failure

Until I decided to wade into your "Advanced Users Quiz," I had been happily tapping away at my PC, regularly running a word processing program, a spreadsheet, a Dow Jones package, and a few other business programs. Yipes! I got only 15 right. I raced to the scoring breakdown and found that for grades as low as mine, you suggest purchasing back issues of *PC World*. Trouble is, I have all of those already. What should I do now, pack up my PC and put it in cold storage?

Oh, what a world, what a world.

Carolyn Susmann

Palo Alto, California

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STEPHEN KING

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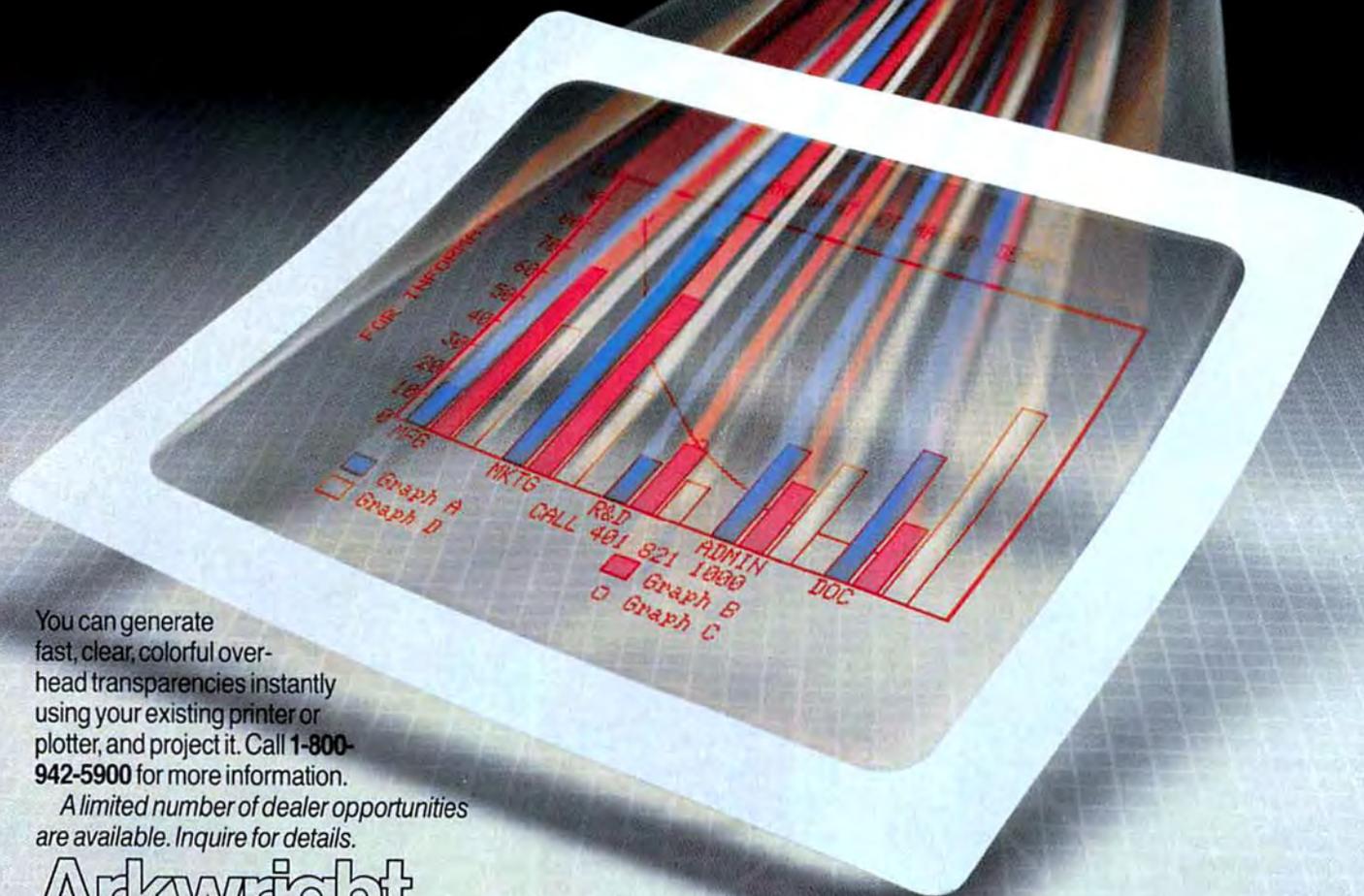


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As you've learned to expect from Persoft, the industry leader in software terminal emulation, SmarTerm 220 continues the tradition of offering "smart" software solutions where IBM PC hardware limitations prevent exact duplication of DEC terminal features. For example, we give you horizontal scrolling for 132-column text display, and also support popular 132-column

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SmarTerm 220 is a powerful communications package as well, allowing text and binary file transfer at speeds up to 19,200 baud. In addition to the



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After SmarTerm, what do you do with your obsolete terminal?

IDEA CREDIT: Ann Garner Riddle of Winston-Salem, N.C.

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HENRY FORD TO CREATE A FOUR



Although we're told that saddlemakers were all for the idea, and submitted some rather startlingly innovative ideas, breeding the perfect family horse just didn't seem right to Mr. Ford. His mind took a different tack, a new line of thought. A line of assembly. A whole new approach to providing people with a way to get from where they were... to where they wanted to go.

A whole new approach. That seemed like an excellent starting point for a relational database. We did not want to simply rewrite an arcane programming language or rework an old mainframe database.

Our goal was to create a relational database that would, for the first time, really combine power and ease-of-use. And we wanted to bring you that combination no matter what your application requirements or computer sophistication.

The goal has been achieved. If power and ease-

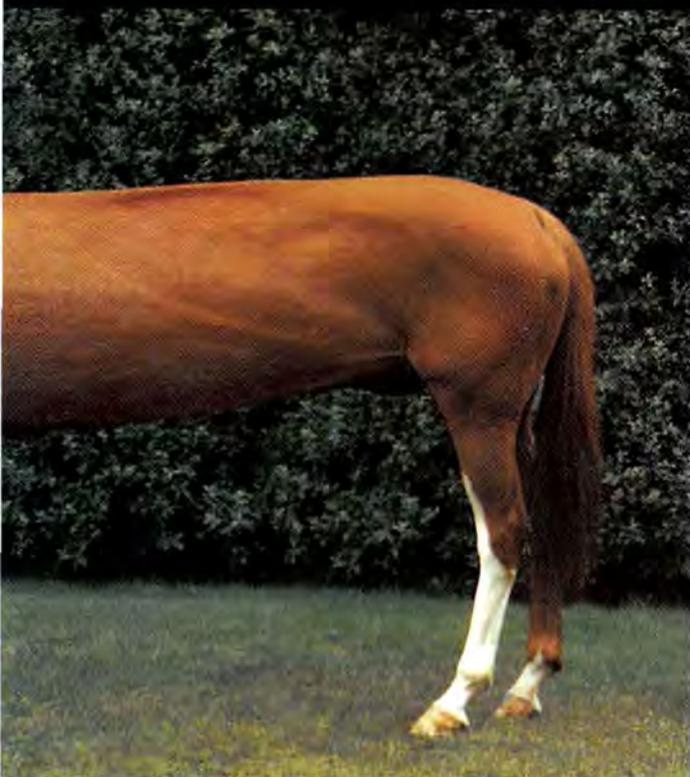
of-use seem to be a paradox you've heard before but never seen, you should know our name is Paradox.™

Paradox brings what used to be the contradiction of power and ease-of-use together in several concepts.

First, Paradox brings an easy-to-use Lotus-like standard menu together with a powerful way to interact with the information in your database. With Paradox you simply type in an example of the information you seek, rather than having to write a line-by-line program to do things like join different tables or do calculations.

Second, Paradox brings a rather revolutionary new concept to personal computer technology. Known in artificial intelligence circles as "machine reasoning," Paradox uses this feature to evaluate your request and, *on its own*, writes a program for you that seeks the answer in the fastest possible way. Paradox then exe-

DIDN'T SET OUT PASSENGER HORSE.



...cutes this program and produces the answer. You don't need to know how the information is organized, how to best approach the problem or how to write a program.

The advantages of these features, aside from being rather fascinating we think, are incredible speed, an easy-going experience and a real opportunity to do more with a database than ever before.

If all of that sounds terrific but you're concerned about "driver's education," don't worry. The familiar Lotus-like menu is only one of many ways we've made Paradox easy to use. You'll hum right along.

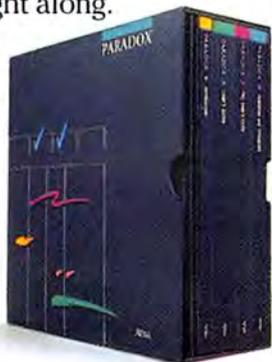
There's a lot more we'd like to tell you about Paradox (which explains the very last paragraph), but you've really got to see it. All of this may give you that "easier said than done" feeling, when in

truth, it's now "easier done... than said." We hope you'll visit your computer retailer and see it all for yourself.

You'll see a lot more than just an improved breed. You'll see a whole new way to handle data on the IBM® PC line, the Compaq® line and other 100% compatibles. A new way to get where you want to go with power and ease. We started from a clean base and now, it seems, we've left the others in the proverbial dust. Paradox. The Base of Departure.™

*Part of the "lot-more" we'd like to tell you:
Easy importing and exporting of data from Lotus 1-2-3™, Symphony™, dBASE II®, dBASE III™, PFS:FILE®, VisiCalc® and ASCII / Complete report generator / Scripting (macros) with Paradox memorizing key strokes and commands as you go / Our own full-featured application programming language / Forms that you can design / Unlimited number of tables, each up to 260 million characters.*

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Relational Database



THE BASE OF DEPARTURE.™

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PC WORLD

Big Blue's News

IBM's agenda for PC software has a great deal to do with mainframes.

For independent software companies, the good news is that IBM isn't concentrating on PC software per se. The bad news is that IBM's PC software is being written to embrace the IBM hardware spectrum—and will thus likely become de rigueur for Big Blue's mainframe customers.

That's a thumbnail sketch of impressions and insights gleaned from a recent visit with John Steuri, IBM vice president and general manager of the company's Information Services (IS) in Milford, Connecticut.

PC World View reports new developments in computer technology, items of interest to computer enthusiasts, and the most significant and enticing insights about industry trends and personalities. We've reserved the "Grapevine" section of this column for industry reports that are still at the speculative stage.

—Ken Greenberg

Steuri presides over an operation that exemplifies the current edict around IBM to place everything PC-related under one roof. In creating IS, IBM has brought all software development and acquisition into a single business unit. IS writes software not only for the PC line but for the entire range of IBM products, from PCjr (honest) to the System 370 and beyond. In addition to its Milford operations, IS does business in Silicon Valley, North Carolina, Georgia, Maryland, Texas, and Florida.

One overwhelming impression after visiting IS is that software for the PC is not nearly as important as IBM would have PC users believe. Indeed, the company seems to have returned to its big-system roots. "PC software is only 10 percent of our revenue," Steuri explained. "Software in the retail channel is a second-class citizen—and we don't understand the retail market all that well. We're interested in retail to the extent that dealers are willing to train their people.

"We couldn't produce all the software for the PC anyway—we couldn't hire enough programmers. But with something like 21,000 programs for the PC out there, some order, some standard, must be imposed."



John Steuri, overseer of software development for IBM: "Our users are asking for accessible, generic integrated software."

With or without retail, IBM is determined to trumpet that standard across the software marketplace from micro to mainframe. The core strategy involves developing programs that will run on most or all of its hardware lines. A *Business Management Series* or a *DisplayWrite* will work not only on the XT and the AT but on the System 36, 38, 4300, and 370.

View

News and notes for the computing community

"Half of the PCs in business are connected to a [mini or mainframe] host or a local area network," Steuri noted. "Our users are asking us for accessible, generic, integrated software that can span the distance from PC to mainframe. Try hooking up three different third-party programs, sharing data, and then moving that data to a mainframe. It's pretty hard.

"We're hearing from our customers that 1-2-3 was good for them—but now they want to be able to roll from a spreadsheet to a word processor to a mainframe data base."

Part of the challenge—some would say the difficulty—of writing software that bears the IBM logo is the alphabet soup of standards to which all programmers must adhere: PC-DOS, *TopView*, IMS (mainframe DBMS), VM/CMS (mainframe operating system), API, and ISPF. In spite of the consolidation that IS represents, IBM will continue to rely on selected third parties for software—so long as they remain faithful to that litany of standards.

For Steuri and IS, education is a priority—educating dealers and, especially, educating those users apt to buy IBM's more-or-less vertical software, such as *BMS* and the *Personal Decision Series*. IBM has turned backflips to ensure

BMS's certification by Price Waterhouse; Big Blue will be training thousands of CPAs this year in the hope that its accounting series will become the system of choice.

Finally, IBM is counting on its omnipresence to keep software distribution channels full. "We're still considering on-line networks, where prospective buyers can view an on-line catalog, run a demo on

line, enter a credit card number, and either dump the program to disk or trigger an order from a distribution center," Steuri said. Better still, according to Steuri, is the chance to provide support and product updates on line. "This is something dealers can't do—and we can." —Robert Lubn

Fighting Words

Detroit may have invented downsizing (and coined that unfortunate term to describe it), but Silicon Valley has perfected it—and even taken the "less is more" idea a step further. A move to both strip down *and* expand existing products is catching fire among word processing vendors, beginning with the leader.

With the release of *Easy*, its new low-end word processor, MicroPro International has staked out perhaps the last untrampled turf in the fiercely competitive word processing market. But that territory surely won't remain pristine for long.

MicroPro's move signals the company's desire to fill out—and invigorate—its product line in the

(continues)





Fighting Words
(continued)

wake of the company's first money-losing year. *Easy*, one of a growing number of no-frills word processors from familiar publishers, strives to live up to its name as both simple to use and gentle on the wallet. MicroPro is catering to first-time users with a product that looks nothing like the arcane, cryptic, and fabulously popular *WordStar*.

Exercising utmost care not to cannibalize their existing packages, other word processing firms are also venturing where MicroPro is now eager to tread, preferring products shorn of such accoutrements as mail merge, spelling checkers, footnoting, indexing, communications features, DBMS-like capabilities, and macro routines. Multimate recently introduced *JustWrite* for the first-time user segment, and Microsoft acknowledged the low end with *Microsoft Write*, dispensed as part of its *Windows* environment.

For these products and others, the pivotal price point seems to be \$150, although *JustWrite* lists for \$250. This kind of "unbundling"—distilling products to their essences—may mean that some companies have seen the light of Borland International's economic gospel, as demonstrated by *Turbo Pascal* and *SideKick* (the lower the tariff, the more you sell).

When Select Information Systems shot out of the starting gate more than a year ago with *Select Write*, a svelte \$99 version of *Select: The Word Processor*, initial

jockeying for market share took place at the high end, and those maneuvers continue still. Companies have been inspired to beef up their products to grab sales from text data management systems and integrated software. Samna introduced *Samna Plus*, Multimate unveiled *MultiMate Advantage*, and MicroPro launched *WordStar 2000*. WordMarc begat the low-end *WordMarc Author* and the high-end *WordMarc Composer* in addition to its vanilla *WordMarc*. Lifetree

Grapevine

Chips Ahoy

Is the Intel 80286 a loser? Is the microprocessor around which a new generation of PCs is even now being built a mere shadow of its potential self? Few would deny the 286's speed, oodles of addressing capability, and memory management moxie. Still, molding an operating system to the chip's prodigious talents continues to confound the industry. Now we hear that some folks at Intel itself have virtually admitted the 80286 is a bust, compatibilitywise—and that there may not be *any* DOS capable of running in both the chip's memory-protected mode and its PC-compatible mode. Wake me when it's over.

See-You-in-Court Redux

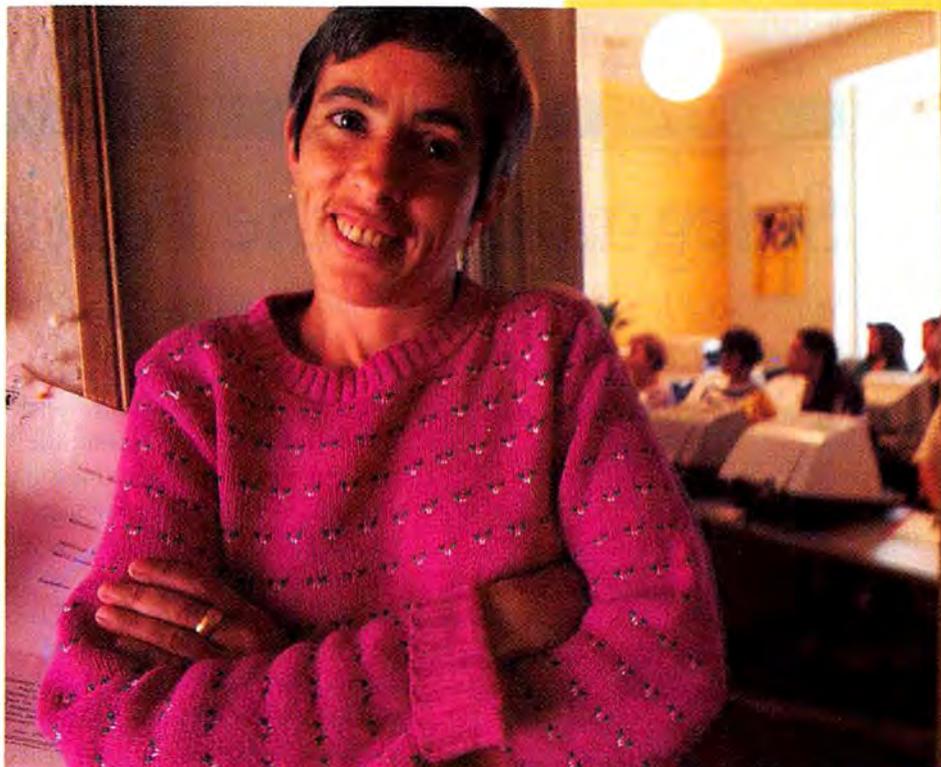
The European Commission, which rattled sabres and then chose not to press a long-threatened antitrust suit against IBM a year ago, is reportedly going back to the files it spent 10 years amassing. The commission is irked that IBM hasn't held up its end of last year's deal and hasn't sufficiently altered what the Europeans regard as the company's distinctly anti-competitive position. Ready, aim, unsheath ...

supplemented *Volkswriter* with *Volkswriter Deluxe* and *Volkswriter Scientific*. And IBM discontinued its low-end *DisplayWrite 1* upon introducing its top-of-the-line *DisplayWrite 3*.

Most of the new packages don't radically depart from their predecessors. But in virtually every case, publishers have continued to sell the older products and have often slashed prices, the better to spread their rosy fingers a little further over the word processing horizon.

The jury is out on whether the entire word processing industry will now streak for the low ground. Asked about the impetus for developing *JustWrite*, a source at Multimate suggested that, after careful scrutiny, "you might think *JustWrite* was a product for the [PC]jr"—an indication that that offering may have been keyed more to last year's hopes for a booming home market than to current realities.

When it previewed *Easy*, MicroPro cited statistics showing sales for low-end word processors neck and neck with those for traditional, feature-laden office offerings. Until now, the low end has been relatively unpopulated; the market currently belongs to Software Publishing's *pfs:write* and IBM's *Writing Assistant*—which is, of course, simply *pfs:write* by another name. That other word processing publishers will pass up a piece of so tasty a pie seems unlikely. —Darcy DiNucci



For Terry Greenblatt of the Women's Computer Literacy Project, computer education can underwrite success on the job.

Our Computers, Ourselves

The gender gap exists not only in paychecks, voting patterns, and local softball teams, but in deciphering bits and bytes as well. For every female in a computer course, from grade school on up, there are two males.

That's the word from Terry Greenblatt of the Women's Computer Literacy Project in San Francisco. As the Project views it, bridging the gap is good economic sense as well as just common sense. According to Greenblatt, the costs of women remaining PC illiterate could well be exorbitant; as offices increasingly turn to automation, women will need computer savvy to sustain recent gains in the job market.

For the professional typist intimidated by a word processor,

(continues)

Safeguarding the Fortress

Some say it's lonely at the top. Lotus Development and Ashton-Tate would like to keep it that way.

The two titans of software are spearheading integrated software's second coming with fresh versions of 1-2-3, *Symphony*, and *Framework*. These new releases boast something for everyone—power users, application developers, even

novices. For both companies, the new editions could not have hit the market at a more opportune time. 1-2-3, established lord of the spreadsheet realm, is feeling the heat from innovative products like Analytica's *Reflex*, Javelin Software's *Javelin*, Microsoft's *Excel*, and inexpensive alternatives such as Paperback Software's *VP-Planner*. The market dominance of Ashton-Tate's *dBASE* family has suddenly become tenuous, thanks in part to overhauled products like Microrim's *R:base 5000* and dynamic upstarts like Ansa's *Paradox* and Symantec's *Q&A*.

Spurred by the realization that corporate empires cannot be guarded by single-product marketing—or by a fad, even one as attractive as integrated software—both companies have solidified their market-leading positions through acquisitions (Software Arts and Dataspeed for Lotus, Multimate and Forefront for Ashton-Tate). This commitment to growth has gone hand in glove with the upgrading of current products and the assurance that new offerings have hooks into existing members of the product line.

Significantly, both Ashton-Tate and Lotus have heeded criticism of their mainstay products for somewhat sloppy use of memory. The spreadsheet components of *Framework II*, *1-2-3 Release 2*, and *Symphony 1.1* all rely on a so-called sparse matrix implementation, which allocates memory for only those worksheet cells that actually contain data. Previous editions apportioned RAM even for cells that were empty.

Even though they manage memory better, these revised packages need not fret about slamming into the 640K barrier. All have been sculpted for the new wave of expanded memory boards. *1-2-3 Release 2*, and *Symphony 1.1* support the Lotus/Intel/Microsoft extended memory specs and Intel's

Our Computers, Ourselves (continued)

the accountant awed by a 1-2-3 macro, or the advertising executive who needs to navigate a data base almost instinctively, computer familiarity can mean the opposite of contempt—and the difference between a quality job and just scraping by.

The Project, a three-year-old venture, was founded to offer introductory training in PC hardware and software, and currently holds classes in New York, California, and—via traveling workshops—locations throughout the

country. Tuition ranges from \$175 to \$365 and is tax deductible as a career-oriented expense. The curriculum includes two-day seminars in hardware and software concepts, computer languages and programming, operating systems, data management, and word processing. Some 4500 women have completed the program, Greenblatt notes. Classes are taught by women and are intended primarily, but not exclusively, for women.

Participants enroll for a variety of reasons; Greenblatt recalls one recent student, a therapist by trade. "Her clients were using computer terms to describe their emotions," she says. "She needed to take the course so she could understand them." —Marina Hirsch

AboveBoard, Maynard Systems' Accent, STB's Bank-A-Byte, and Talltree Systems' JRAM 3. *Framework II* works with AboveBoard as well as RamPage! from AST.

Lotus is in the enviable position of building on 1-2-3's massive installed base. Not surprisingly, all three of these updates are able to import files from that legendary spreadsheet. Naturally, *1-2-3 Release 2* and *Symphony 1.1* maintain seamless file compatibility.

Although *Framework II* can read 1-2-3 files, Ashton-Tate technical public relations manager Scott Brown cautions that the upgrade "is a direct response to improvements on *Framework* suggested by our users rather than a reaction to anything Lotus has done."

A macro library manager in *Symphony 1.1* permits macros, numbers, labels, and named ranges to be stored outside a worksheet and recalled by another worksheet. In addition, the new 1-2-3 contains a Learn mode for building macros. Both Lotus products are also potentially speedier, thanks to their support of the 8087 and 80287 math coprocessors.

In its second go-round, 1-2-3 has become the spreadsheet equivalent of *Symphony*, boasting string

arithmetic, 40 new macro commands, 39 new numeric and logical functions, and, in its graphics module, exploded pie charts. The revised product can hide cells and columns, list addresses of circular references, suppress visual evidence of macro execution, read and write to disk within a macro, and provide a worksheet status report.

With Release 2, Lotus includes support for up to eight local area network devices, drops the needed key disk for a hard disk system, and, by preserving compatibility with Release 1A applications and macros, continues to endorse de-

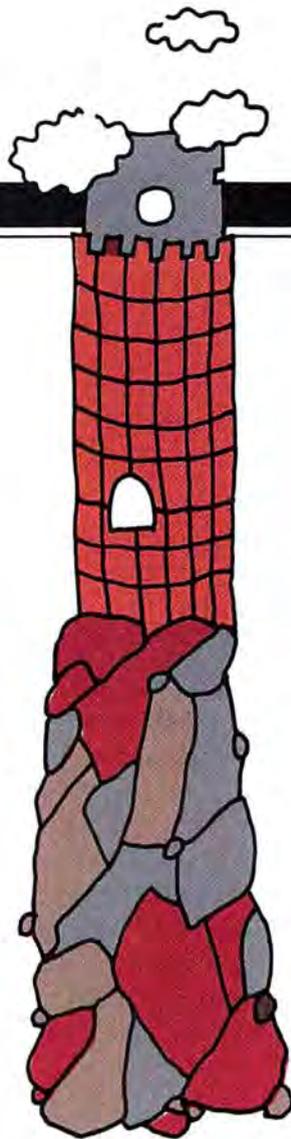
velopment of 1-2-3 templates. Lotus is also marketing its first companion product, *1-2-3 Report Writer*, priced at \$150.

In an effort to woo neophytes, Lotus has completely rewritten the documentation and tutorial for both programs, and each features an enhanced, easier-to-use install program.

Not to be outdone, *Framework II* features the ability to import and export files to and from *WordStar*, *MultiMate*, and IBM's *DisplayWrite* and can import *dBASE III* files. The *Framework* word processor is replete with an 80,000-word spelling checker.

Mite, the communications component of the original *Framework*, is gone. In its place is a fully integrated communications program that will capture information in the background while other *Framework II* functions are in use. Commands have also been added to the procedural language, FRED, to make *Framework II* easier to tie to other applications.

Might this be tinkering with success? Lotus and Ashton-Tate clearly don't think so, and both seem convinced that their new offerings play to their respective strengths. But if you ask Coca-Cola that question ... —Wes Nihei



South China Seize

Absolutely 100 percent IBM PC-compatible personal computers go for about \$700 in Hong Kong. The price covers dual 5¼-inch floppy disk drives, an "American" keyboard, a full-color Japanese-made monitor, a near letter quality Epson LX-80 dot matrix printer, and an asynchronous communications adapter. All components are manufactured legally except the PC's pirated BIOS in ROM, which makes the system virtually an IBM stand-in, albeit a contraband one.

Contrary to expectations, the Hong Kong visitor seeking such discounted wares is not led blindfolded to a dark alley and does not need to brandish a wad of small, unmarked bills. At cut-rate outlets, which proliferate under the neon of popular Hong Kong shopping complexes, U.S.-dollar traveler's checks are accepted at the best bank exchange rates. The entire transaction seems almost legitimate.

The best-known center for buying these purloined PCs, as several Hong Kong guide books can tell you, is the Golden Shopping Arcade at the Sham Shui Po station of the MTR, Hong Kong's bright new subway system. Just a 10-minute subway ride from



Technology melds with tradition in Hong Kong, where knocking out PC knockoffs is big business.

Kowloon's Tsim Sha Tsui district, where most Hong Kong visitors stay and shop, the Golden Shopping Arcade's first floor is dedicated exclusively to gaudy electronics shops with names like Easy

and Nice. Shop windows feature unmarked disk drives with handwritten signs proclaiming "Apple IIe compatible" or "IBM PC compatible." Printers, monitors and floppy disks all bear manufacturer's labels.

Secret Agents

"In a gold rush, the people who make money are those who sell eggs for \$10 each." With these words, murmured a scant two years ago, a taciturn New York literary agent named John Brockman formulated a new occupational species: software agent. At the time, some of the nation's largest book publishers were poised to buy their way into the sizzling software industry.

Looking to middlemen like Brockman to help make connections, the moguls jabbered about "windows of opportunity," described seven-figure advances as "statements," and promised to

turn reclusive assembly language programmers into "household names."

Now, with the shifting winds of the market, agents—those who can still be found, that is—are counting their change and wondering aloud if the industry hasn't been completely vanquished. "Basically, agenting is a dead horse right now," says Charles King, who spearheaded the software efforts of the giant talent agency International Creative Management (ICM). "Book publishers who jumped in lost their shirts."

Inside these shops (and elsewhere in Hong Kong), enthusiastic groups of local computer mavens stand ready to pull together almost any permutation of hardware and software. These are young men and women who have learned computers "on the job"—assembling compatibles and peripherals, copying and testing software. Their expertise is a source of pride; they have an uncanny knack of procuring the latest products on the market, dissecting them, and, in short order, replicating them for a song. Collectively, they represent a mountain of expertise developing, legally and illegally, in the Far East.

IBM World Trade Asia has thus far shrugged off the bite that bootlegging, pervasive as it is, may be

taking out of its market. IBM officials say they are directing their energies at wholesalers and exporters. Nevertheless, police regularly raid one Golden Arcade shop or another, confiscating merchandise and shutting the operation. Invariably, the same crew, armed with new inventory, surfaces under a different name within a few days.

But some computer buffs in the Far East see a consequence of piracy more insidious than the erosion of IBM's market share: the virtual elimination of any system to compete with Big Blue's. The popularity of the PC (whether genuine or in knock-off form), combined with the ease of counterfeiting, has reportedly brought local R&D to a grinding halt. Better, cheaper mousetraps simply can't be built.

Even these black market machines carry "warranties" that run anywhere from 1 to 24 months. In Hong Kong, at least, service and training are happily provided, so long as you haul the computer back to the Golden Shopping Arcade and can find the same people who sold you the goods. For many people in Hong Kong, particularly students and journalists on local assignment, such risks are well worth the savings. An authentic IBM PC sells for about 25 percent more than it does in the States.

—Sally Adamson Taylor

Next month: the Far East's bootleg software—and the battle to eradicate it.

But middlemen are a resourceful lot. Although their glory days are history, yesterday's agents have become today's consultants to both programmers and publishers. King, for example, has left ICM to found Pleiades Consulting Group and now offers technical and marketing assistance in launching new products. Similarly, Sandra Elkin of Electronic Media Associates notes that her agency has been retained by software developers to help in such diverse areas as venture capital and distribution.

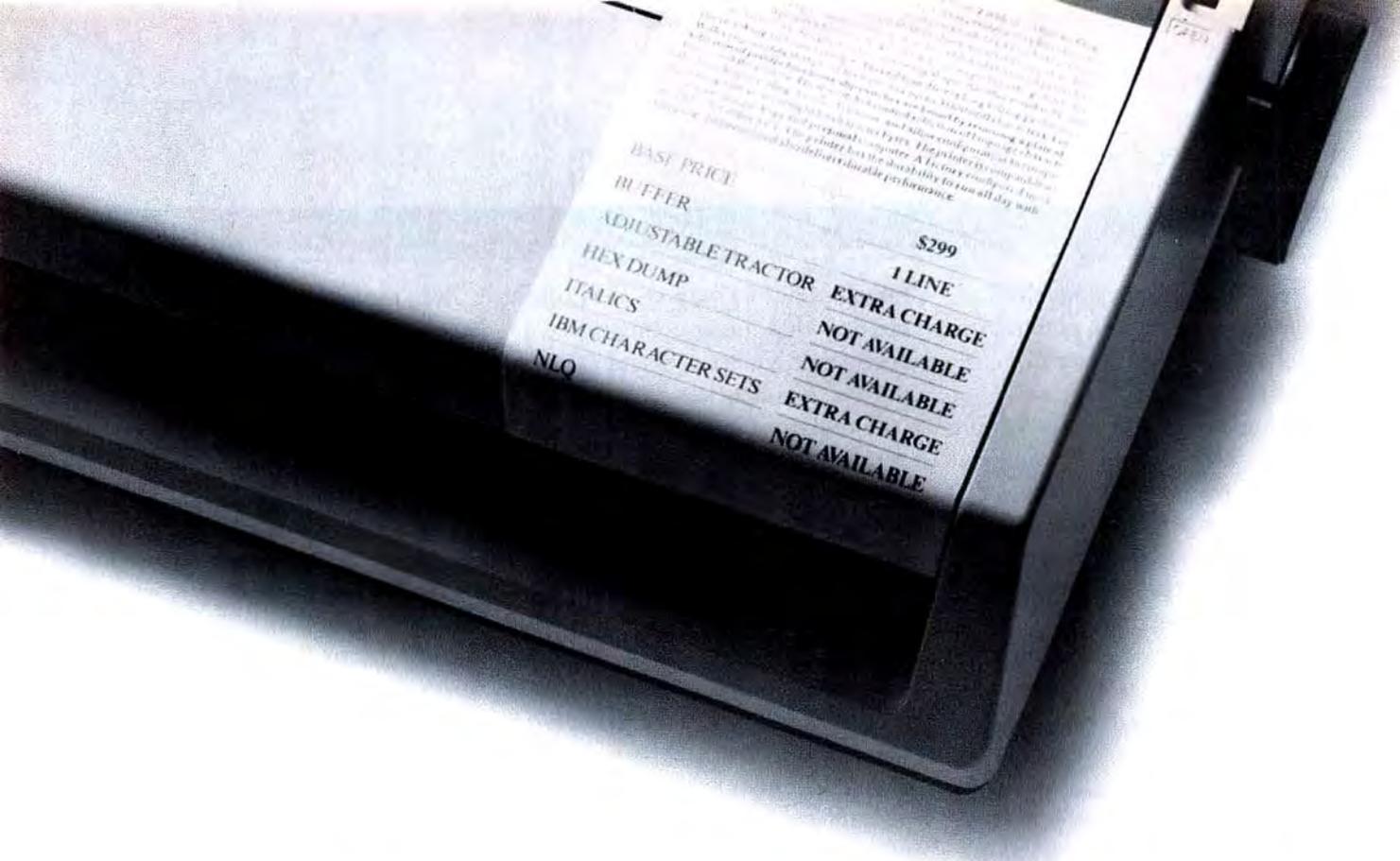
Having closed his West Coast office and watched his client list shrink to "a core group of eight,"

John Brockman notes that although software continues to sell, the number of active developers has diminished.

Still, despite the shortage of buyers for gilded eggs, thoughts of hard times fade as the master dealmaker dips into his apparently bottomless well of enthusiasm: "The future of software agents? I think there's a great future. The industry has been going through a slump, but agents flourish in a rational market. When things settle down, we'll still be around. But," he adds wryly, "I'm in a good mood today." —Ted Nace

Marina Hirsch, a freelance writer in Berkeley, California, is a frequent contributor to PC World. Sally Adamson Taylor is a freelance journalist based in Hong Kong.

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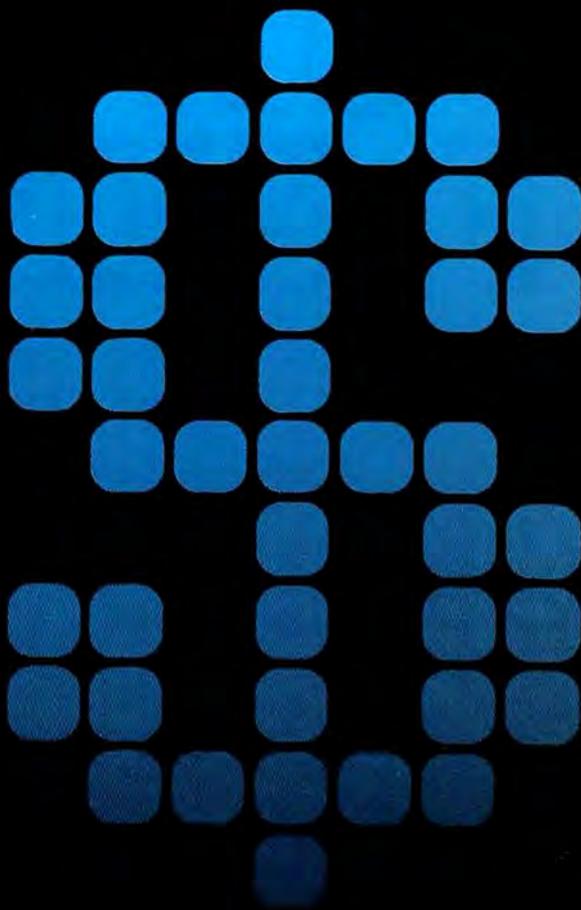
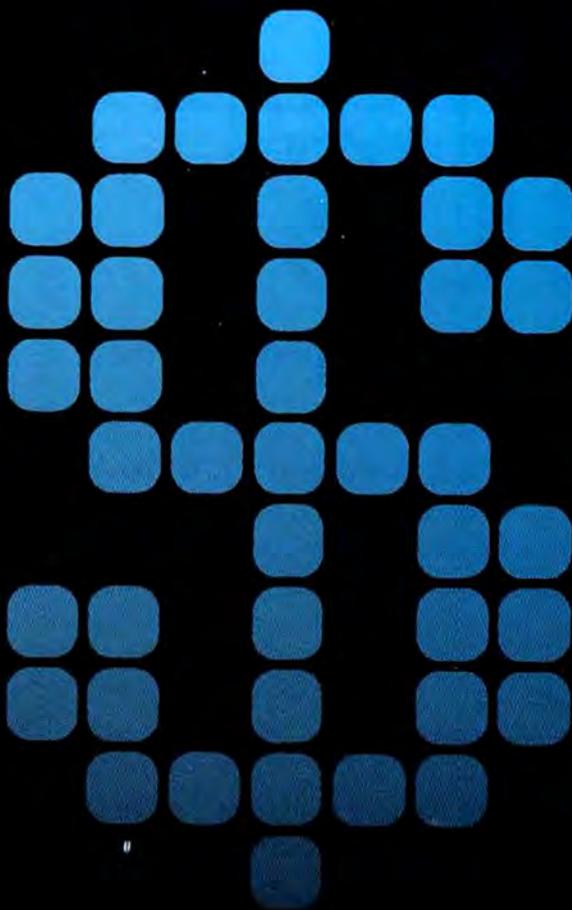
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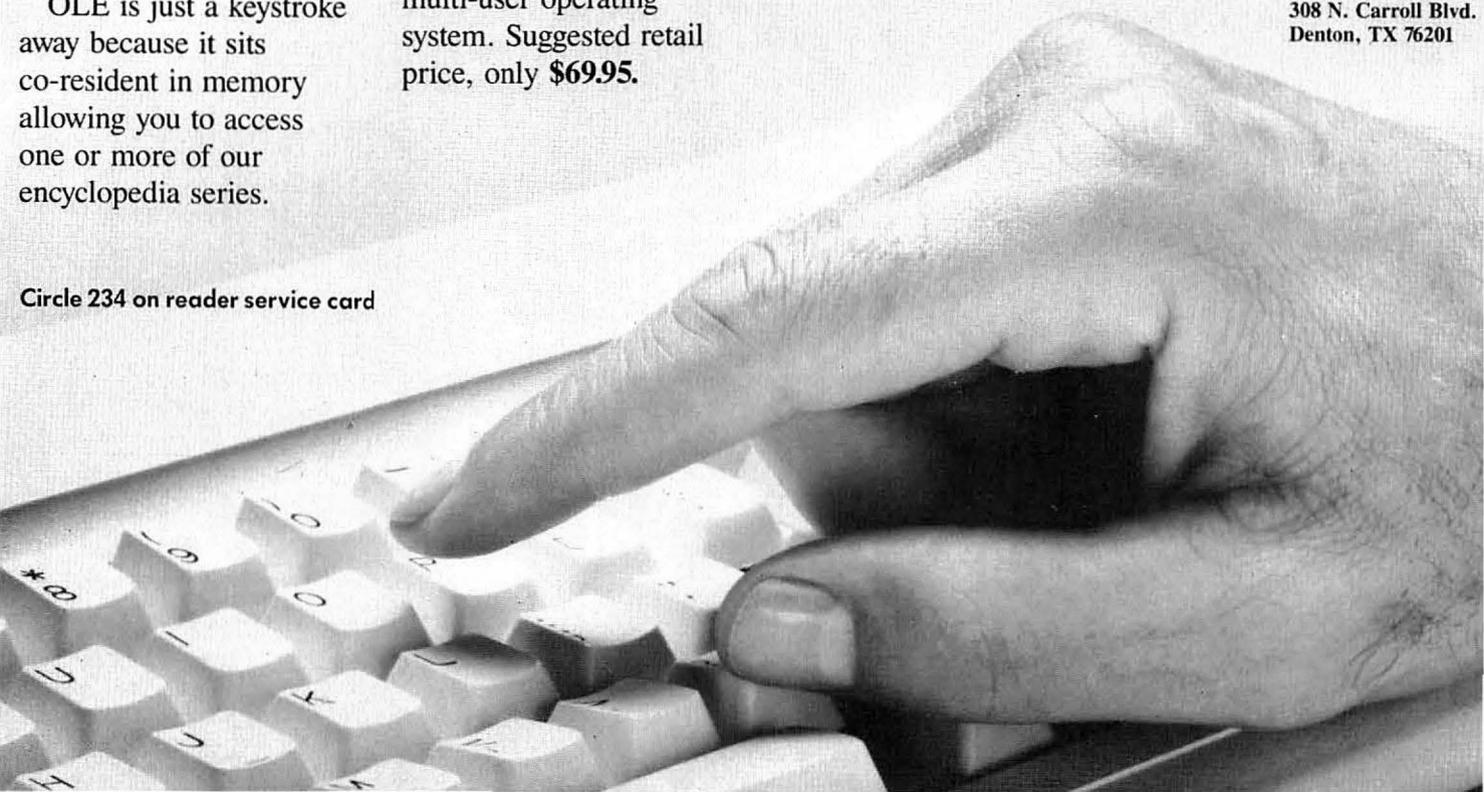
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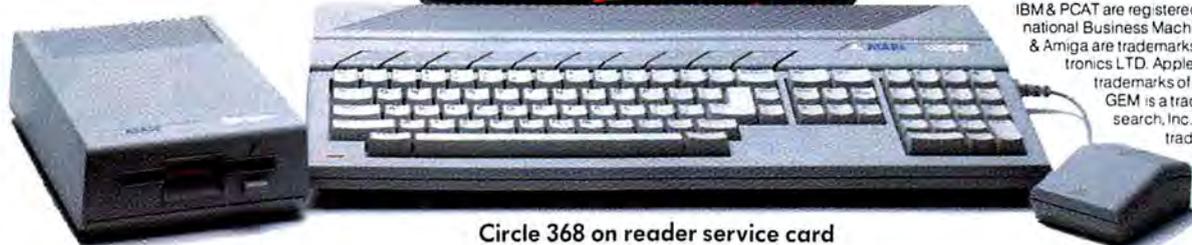


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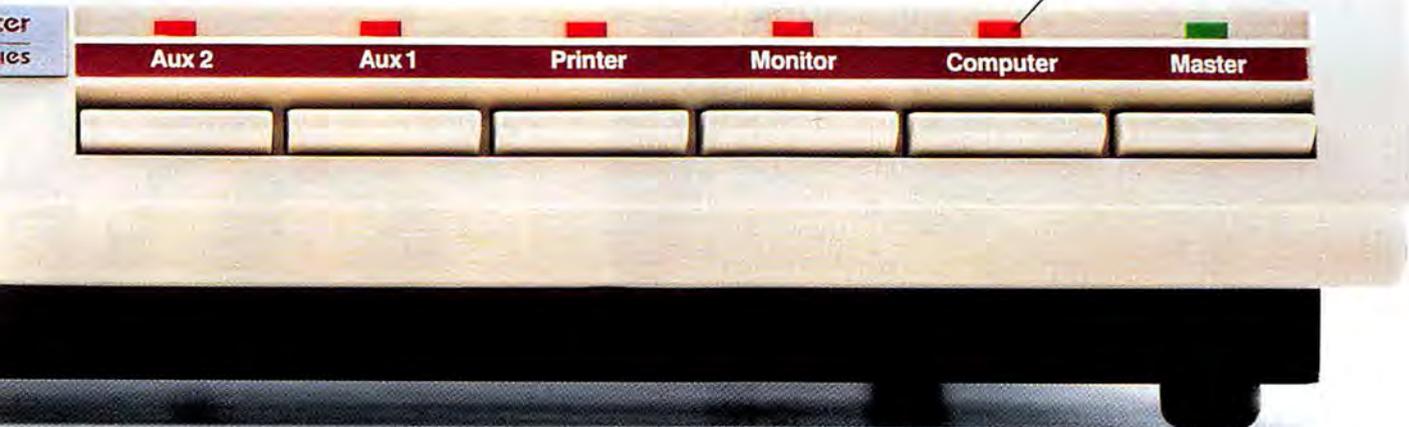
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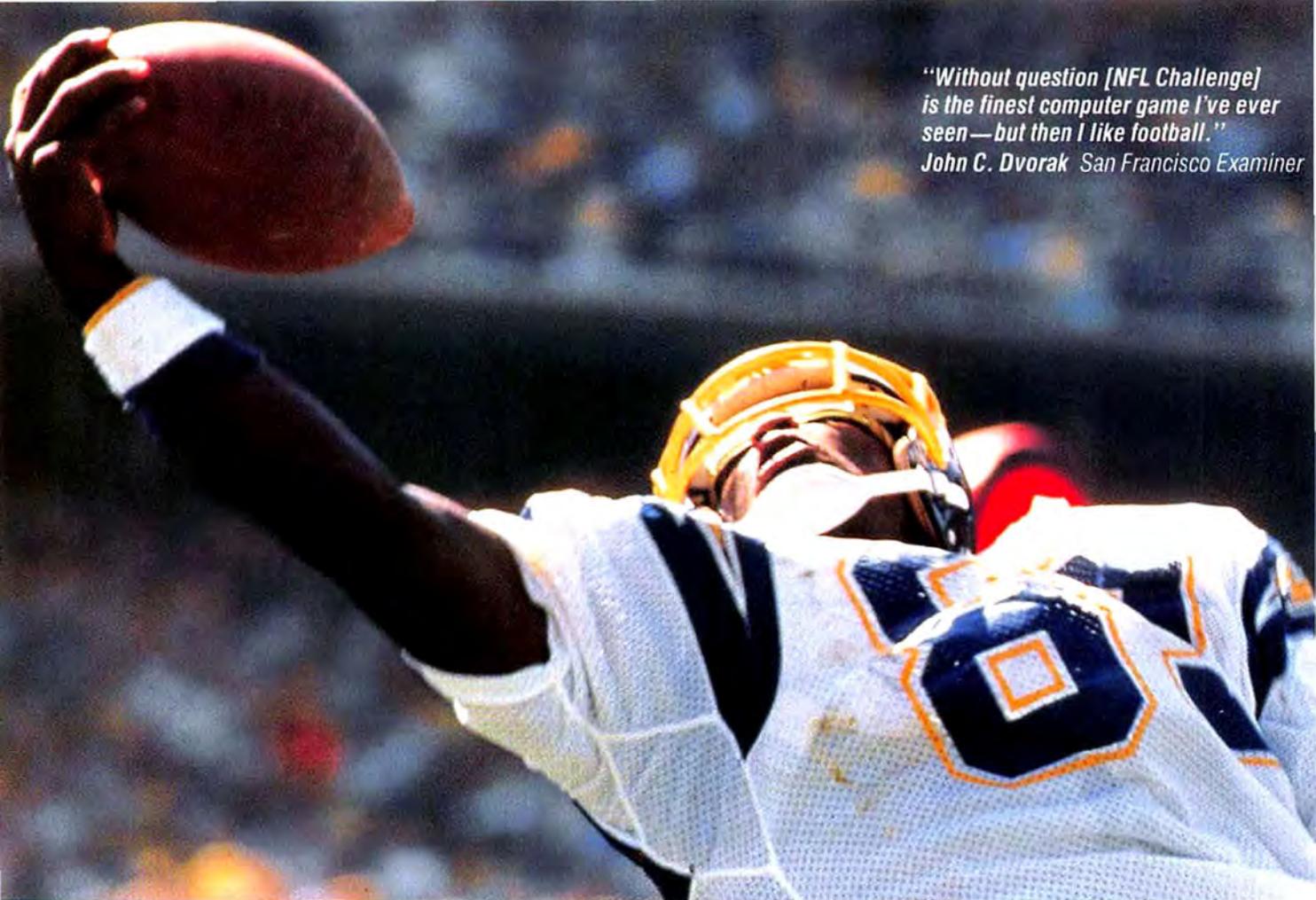
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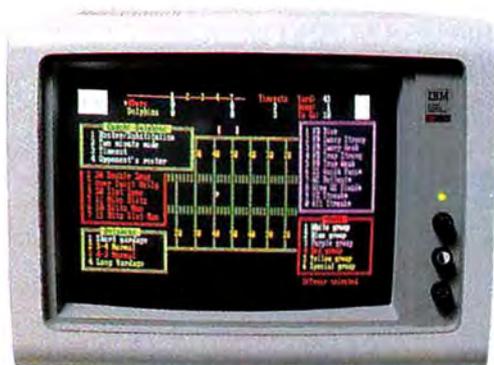
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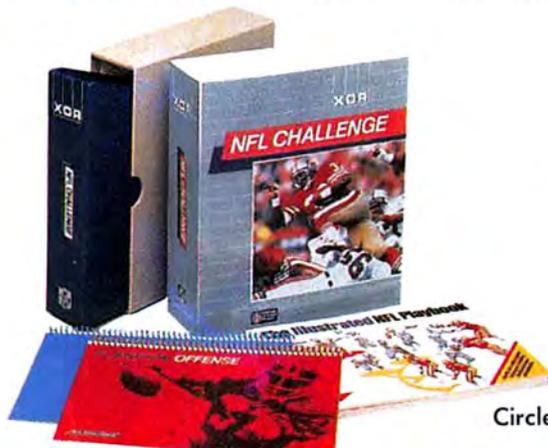
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The Help Screen

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This month: switching between two parallel printers, underlining in WordStar and WordPerfect, getting Microsoft Word to print bidirectionally, and more

Karl Koessel

Artful Screen Dumps

Q. My PC is equipped with a Color/Graphics Adapter and is hooked up to an IBM Graphics Printer. There are times when I'd like to obtain hard copy of the graphics images displayed by some of the programs I use. I find, however, that although the <Shift>-<PrtSc> combination prints text screens just fine, attempts to dump graphics screens yield garbage. What's confounding me is that I've seen printed graphics. Is it possible to obtain graphics screen dumps with <Shift>-<PrtSc>, or can they be generated only with graphics software?

*Malvina Schwartz
Poughkeepsie, New York*

A. The routine that <Shift>-<PrtSc> invokes was written for text screens only. DOS 2.00 and later versions, however, contain a utility called GRAPHICS.COM that augments the original screen dump routine. Simply insert a copy of GRAPHICS.COM in drive A: and, at the DOS prompt, type **GRAPHICS** and press <Enter>. <Shift>-<PrtSc> will now dump graphics screens to your graphics printer.

Switching Between Parallel Printers

Q. My PC drives two parallel printers, one a dot matrix and the other a letter quality printer. Using MODE, I can command DOS to reroute parallel printer output to either serial port, but there is no provision for switching among the three parallel ports LPT1, LPT2, and LPT3.

I've been told that because I lack a reportedly simple program, I must disconnect the cable of one

printer from parallel port LPT1 and then connect the second printer's cable to that port in order to switch between the two printers. I also understand that LPT1 and the two parallel printers can be connected to a switch box, which is then used to choose the active printer. Because my PC already has two parallel ports, however, I'd prefer not to buy a switch box and a third printer cable but use this alleged program instead. Can you help locate the program?

*John W. Douglass
Baltimore, Maryland*

A. SWAPLPTS.BAS is a BASIC program that swaps LPT1 and LPT2. Load BASIC and enter the following listing:

```
10 DEF SEG = &H40
20 A = PEEK(8) : B = PEEK(9)
30 POKE 8,PEEK(10) : POKE 9,PEEK(11)
40 POKE 10,A : POKE 11,B
50 SYSTEM
```

Now type **SAVE "SWAPLPTS"** and press <Enter>. Type **SYSTEM** <Enter> to return to DOS. Whenever you want to switch printers, run this program from DOS with the command **BASIC SWAPLPTS**.

Each parallel port installed in a PC is configured with a unique port address value. When you start the computer it checks its slots for parallel port addresses and builds a table in a specific portion of low RAM, listing the port addresses for LPT1, LPT2, and LPT3. An application's request to DOS to send output to LPT1, for example, requires that DOS read the first entry in the parallel port address table and direct output to that port.

(continues)

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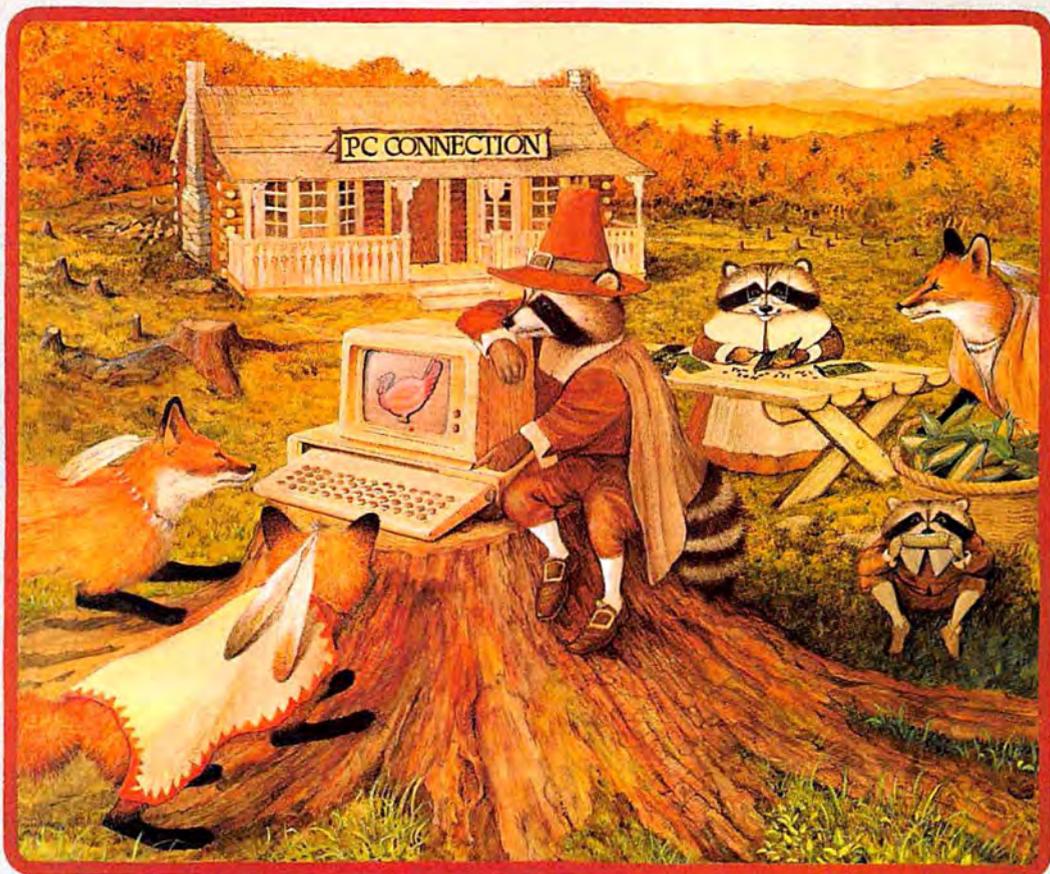
✓Alphabet Zoo (ages 3 to 8)..... 20.

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	7.
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Flight Simulator 2.12 (now works with Hercules Mono Card)	32.
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150WJ

SWAPLPTS.BAS exchanges the values of the first and second entries in the port address table, thereby changing the port address used for LPT1 output. Thus, output is directed to the other printer.

Running SWAPLPTS.BAS, of course, requires that the BASIC language interpreter, BASIC.COM, be available. With a floppy-based system, you need to keep both BASIC.COM and SWAPLPTS.BAS on the same disk—most likely the disk that contains your word processing program and related utilities. Even

though SWAPLPTS.BAS is easy to write and understand, keeping BASIC.COM on the disk with that program means giving up a great deal of space for the minor task of swapping two pairs of bytes.

Aside from that, it's slow. A small machine language program is quicker and more economical.

Using DEBUG.COM (from the DOS Supplemental Programs disk) you can fairly easily assemble 8088 mnemonics into a machine language .COM file that can be run directly from DOS. Place a copy of DEBUG.COM in drive B: and the disk to contain the .COM file in drive A:. At the A> prompt type the following bold characters, pressing <Enter> at the end of

each line. (The other characters are displayed by DEBUG; xxxx represents a 4-digit hexadecimal number that varies with each machine.)

```
A>B:DEBUG
-A
xxxx:0100 MOV AX,40
xxxx:0103 MOV DS,AX
xxxx:0105 MOV BX,[8]
xxxx:0109 MOV CX,[A]
xxxx:010D MOV [8],CX
xxxx:0111 MOV [A],BX
xxxx:0115 INT 20
xxxx:0117
```

(continues)

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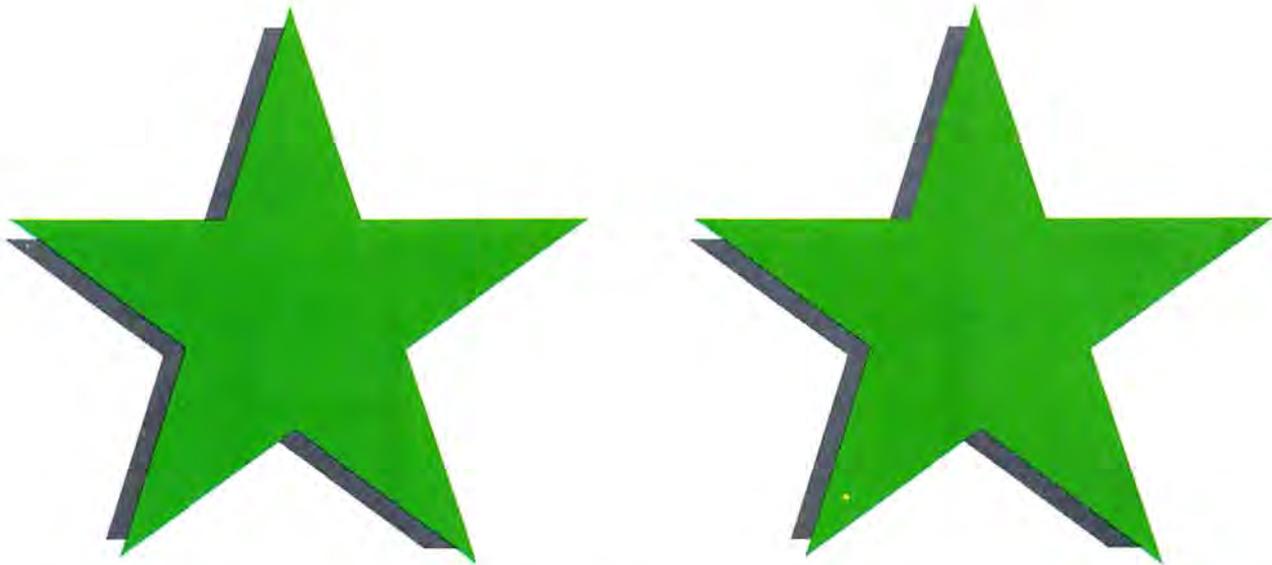


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****	8.3	Chart-Master	Pre.6.1	■	■	■	■	192K	\$375	✓	✓	✓	26
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**	6.0		1.02	■	■	■	■	128K	\$295	✓	✓	✓	24
*	5.5		3.27	■	■	■	■	128K	\$450	✓	✓	✓	38
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	4.9		1.0	■	■	■	■	256K	\$200	✓	✓	✓	40
	4.5		2.2	■	■	■	■	320K	\$795	✓	✓	✓	34
	3.4		2.00	■	■	■	■	128K	\$295	✓	✓	✓	30

Ratings Key

(On a scale of 0 to 10. For methodology, see Page 68.)

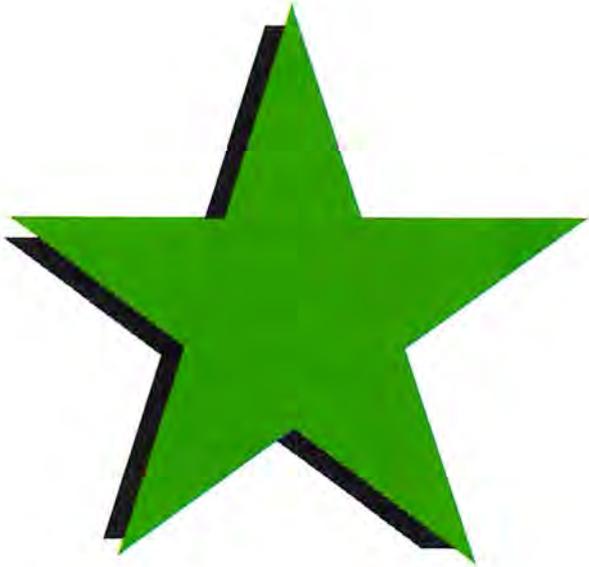
OVERALL EVALUATION

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- * 6.0-6.9
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Circle 209 on reader service card



-R CX

CX 0000

:17

-N A:SWAPLPTS.COM

-W

Writing 17 bytes

-Q

SWAPLPTS.COM accomplishes the same task as SWAPLPTS.BAS but does so without BASIC. The first two lines set DS, the 16-bit data segment register, to 40 hexadecimal. (A register is a storage area, functionally equivalent to RAM, within the 8088; the value of the segment register is used to calculate a "base address" for 8088 instructions, which access RAM only within 64K from the base address. To access the parallel port table, the base address must be lower than the table's beginning address.) The next line sets BX, another 16-bit register, equal to the values in the 8th and 9th bytes of the data segment. The following line acts in the same way, setting CX to the values of the 10th and 11th bytes (Ath and Bth in hexadecimal, respectively). The 16-bit value in the CX register is copied to the 10th and 11th bytes, and the value in the BX register is copied to the 8th and 9th bytes. Once the values of the 8th and 9th bytes have been exchanged with the values in the 10th and 11th bytes, the last line ends the program and returns control to DOS.

(continues)



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The Help Screen



WordStar Scored and Underscored

Q. Perhaps you can offer a solution to a very trying project of mine. I have been using WordStar version 3.3 for about seven months now and have enjoyed the quality of the finished output it generates. When text must be continuously underlined, however, WordStar's inability to underline spaces hinders the job. I've repeatedly tried going into Winstall, only to find no difference between word underline and continuous underline.

Is there a way to fix this problem, or is WordStar incapable of being mended in this way?

*Edward LaVine
Marietta, Georgia*

A. Although there is no patch to WordStar for this "problem," you can obtain a continuous underline by typing <Shift> and the underline character (found on the key adjacent to the close parenthesis) instead of a space.

Underlining in WordPerfect

Q. I've been an extremely satisfied user of WordPerfect version 4.0 and very pleased with the performance of my Paradise Modular

(continues)

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Graphics Card in conjunction with my IBM Monochrome Display—until I put the hardware and the software together, that is. I've found that I can no longer display underlines on the screen. WordPerfect's setup menu would seem to handle this situation with its single-color monitor option, but that fails to do the trick. When normal underline is selected, the result is a dimmed character. The folks at Satellite Software International, publishers of WordPerfect, say I have to settle for inverse video. I'm certain that a simple patch could alleviate this problem but developing the patch is beyond my expertise. Know of any means of correcting this problem?

P. J. Kohler
San Diego, California

A. Your predicament stems from your hardware, not your software, so there's no patch to remedy the situation. A program produces an underlined character on the IBM Monochrome Display driven by the IBM Monochrome Display Adapter when that character's foreground attribute has a value of 1. On a color monitor a foreground attribute value of 1 produces a blue character. When you installed the Paradise Modular Graphics Card, you gave your Monochrome Display color graphics capability (substituting shades of green for colors), but lost the traits of the Monochrome Display Adapter—in particular, its ability

(continues)

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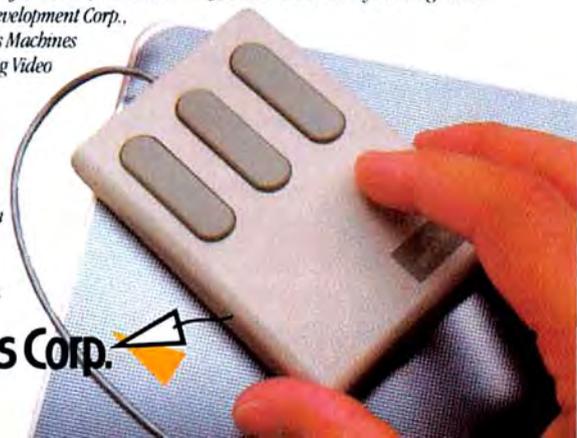
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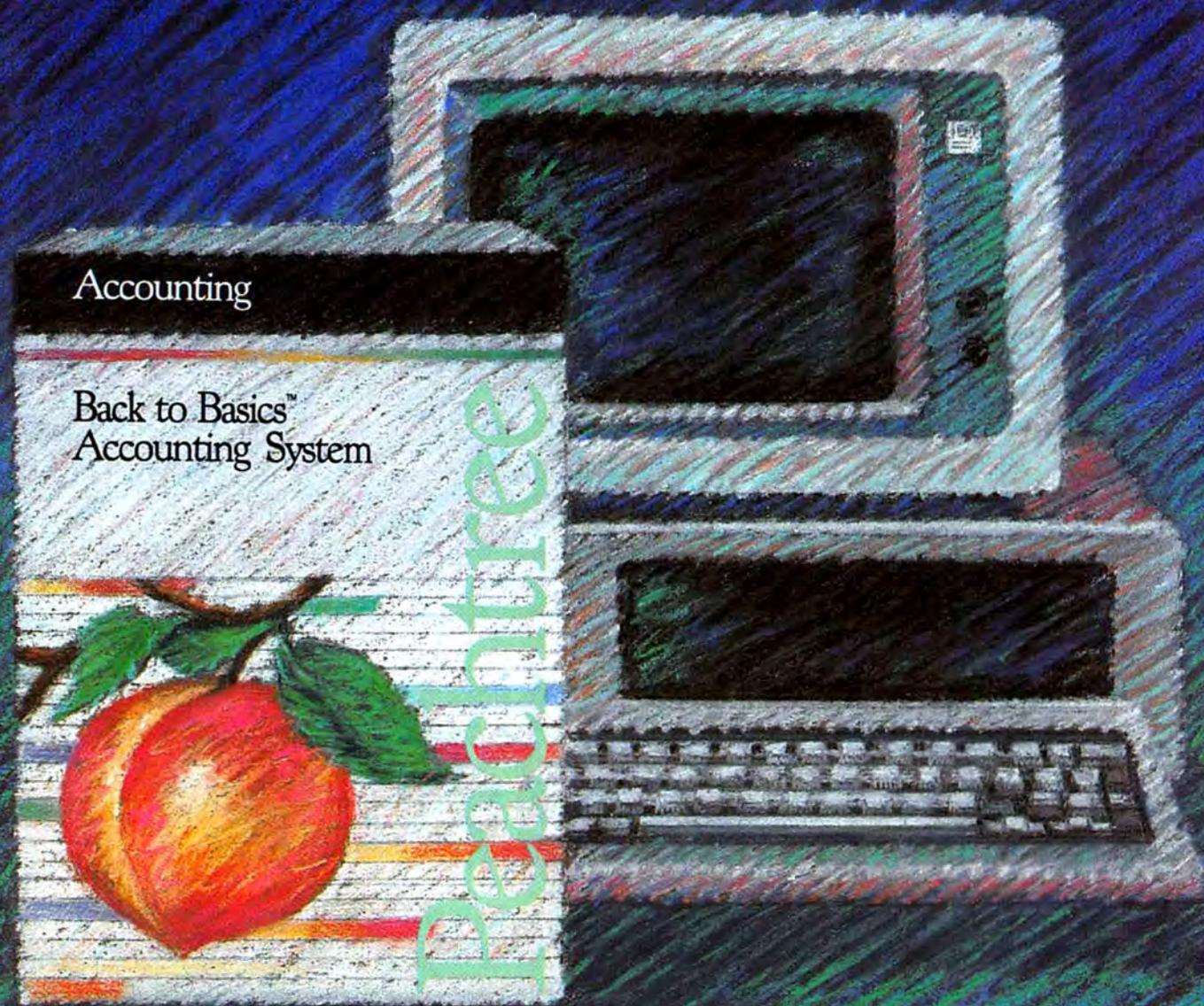
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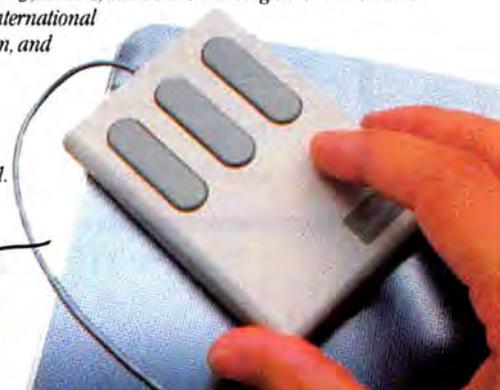
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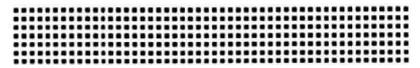
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to display underlined characters. That's why characters that were once displayed with underlining now appear dimmed—the Paradise Modular Graphics Card's equivalent of blue.

Unfortunately, most graphics boards for the IBM Monochrome Display (yours included) mimic the performance of color graphics boards, even in text mode, and thus cannot display underlined characters. (I'm aware of only a few exceptions: The Chauffeur from STB Systems and the Spectrum from Genoa Systems. Both of these Monochrome Display graphics boards, when in text mode, emulate the IBM Monochrome Display Adapter.) You can, however, put your IBM Monochrome Display Adapter back in the PC alongside the Paradise board. (But take note: You must adjust the PC motherboard's switch settings to reflect the presence of the Monochrome Display. Failure to do so may result in damage to your system.)

When you want to see underlined characters, connect the IBM Monochrome Display to the IBM Monochrome Display Adapter; when you want color/graphics capabilities, connect the monitor to the Paradise Modular Graphics Card. This configuration also returns to your system the IBM Monochrome Display Adapter's parallel port.

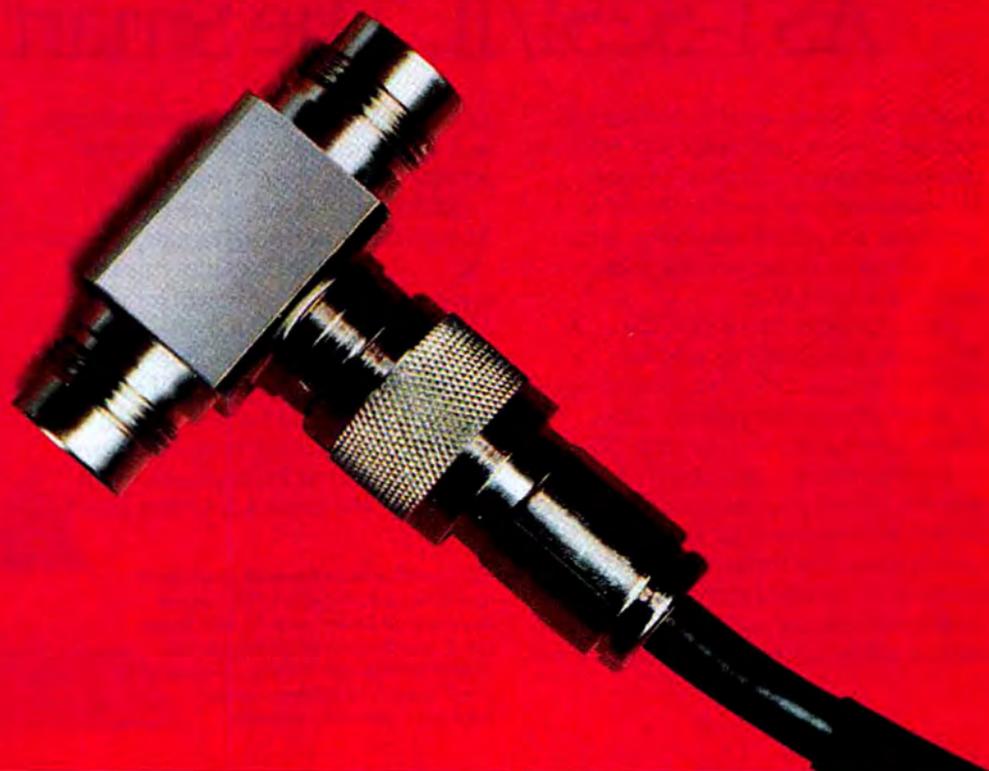
Incidentally, in last month's *, *, reader Mark Kramer offered a fix that enables *WordPerfect* to display, on a color monitor (or graphics-board-driven IBM

(continues)

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12

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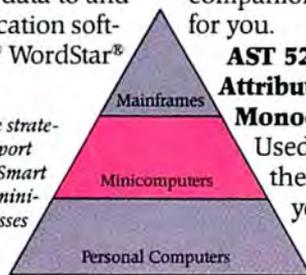
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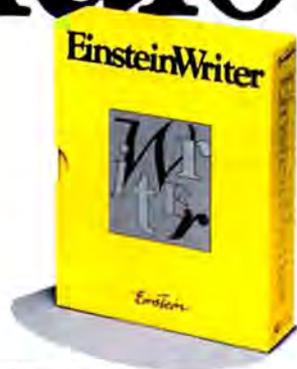
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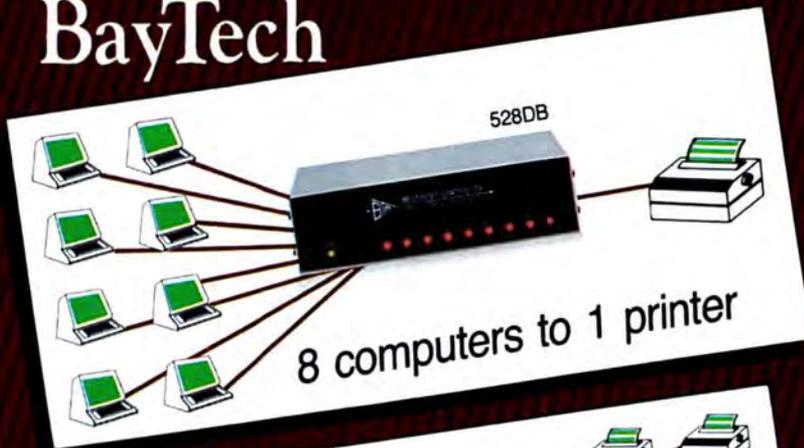
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Circle 654 on reader service card

The Help Screen

Monochrome Display), underlined blanks that, when printed, are continuous rather than dashed (see "Perfect Underlining," *, *, PCW, October 1985).

Bidirectional Printing With Word Q. I use Microsoft Word at work and have access to two letter quality printers: a Diablo 630 and a C. Itoh Starwriter FP-1500-45P. While I find Word an excellent word processor, I am perplexed about why the program does not print bidirectionally on either letter quality printer (as it does on my dot matrix printer). Furthermore, other word processors we use do print bidirectionally on both letter quality printers. Do you have any idea why this is?

*Sid Herman
Philadelphia, Pennsylvania*

A. Both the Diablo 630 and the C. Itoh Starwriter FP-1500-45P are capable of microjustified printing. When you use *Word* with either printer (selected by the SETUP routine or by Print Options), the program looks to a printer definition file to determine how to use the printer in question. The printer definition files for both printers tell *Word* to print with microjustification, a mode in which those printers do not perform bidirectionally.

You can patch the printer definition files for your printers to disable microjustification, enabling them to revert to bidirectional printing. Printer definition files are found on *Word's* Utilities disk and

(continues)

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Built-in Format Sheets For Easy Documents		✓		✓
"Undo" To Easily Restore Text		✓	✓	✓
Built-in Telecommunications				✓
Spelling Corrector	✓	✓	✓	✓
Mail List Manager				✓
Windows Onscreen		✓		✓
Four Function Math Built-in			✓	✓
Alphabetic And Numeric Sorting Within Document				✓
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Experience With Over 1.3 Million Owners				✓

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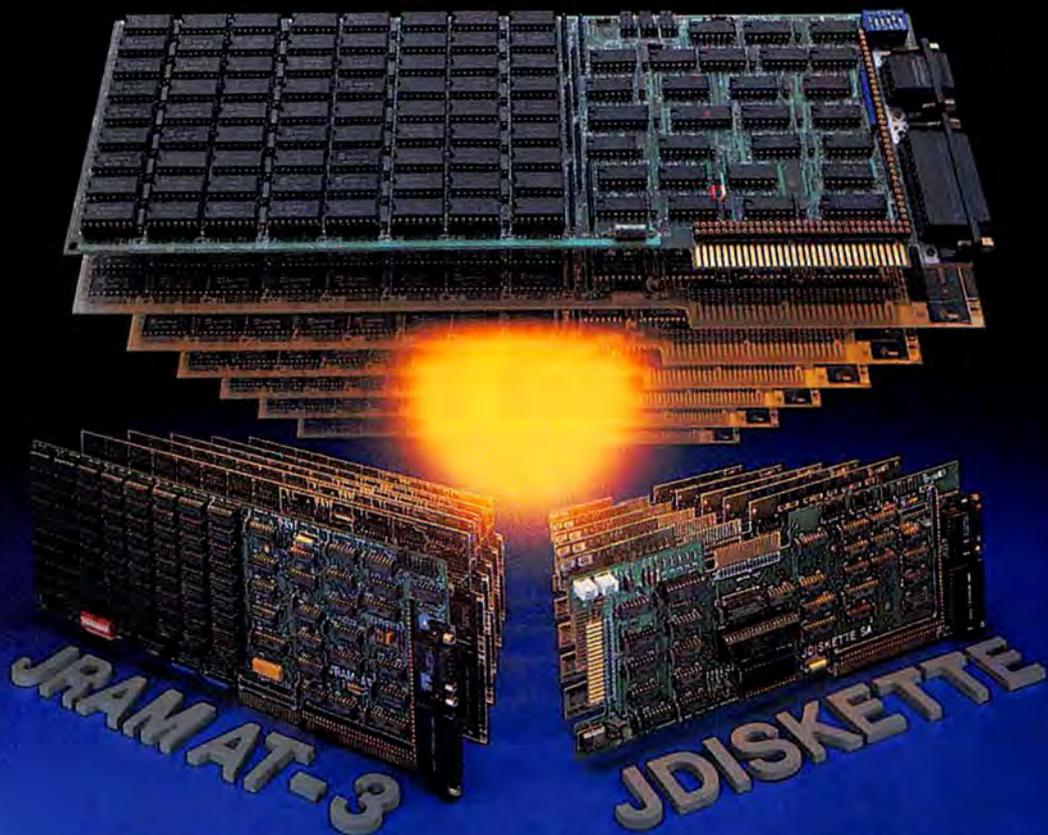
MicroPro®

This updates and corrects comparisons with MultiMate which appeared previously.
For a complete comparison chart, write: MicroPro, Dept. 2000, 33 San Pablo Ave., San Rafael, CA 94903. Specifications are for the latest released versions of all products effective July 1985. MultiMate is a trademark of MultiMate Corp.; Microsoft is a registered trademark of Microsoft Corp.; WordStar and MicroPro are trademarks of MicroPro International.

Circle 382 on reader service card

THE FAMILY TREE

JRAM-3



BRANCHING OUT

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Determined to maintain our reputation as the price leader in memory expansion, Tall Tree Systems offers JRAM-3 fully populated with two megabytes for an amazing \$699. A JETDRIVE/JSPOOL combo disk is included free of charge. This is the same highly acclaimed JRAM software that has helped make Tall Tree Systems the pioneer in the industry

for bank switched memory and RAM disk technology. The new combo disk features JPAGER which allows any expanded memory application program to utilize multi-megabyte memory.

The family tree wouldn't be complete without an AT version. Look to us in September for the new JRAM AT-3, our third generation 16 bit board providing support for expanded spreadsheets. JRAM AT-3 will be available with two megabytes at \$799.

Don't forget the rest of the JRAM family either. We'll continue producing our popular JRAM-2 and our present JRAM AT board, along with our full range of "slim daughter board" modules. The JRAM-2 and JRAM-3 can co-exist in the same computer, but only the JRAM-3 can be used for expanded memory applications. Use JRAM-2 for DOS, multi-tasking, print spooling, and electronic disk.

To complete the family line-up we feature JDISKETTE. This controller card lets you put 1.2 megabyte diskette drive(s) in your PC or XT. You can read, write, and format the AT high density diskettes and communicate easily between a PC or XT and an AT. You won't lose a single slot, since JDISKETTE replaces your old controller and handles up to four internal floppy drives. Free of charge with JDISKETTE, you will receive the popular JFORMAT software, a DOS compatible device driver that gives your computer the ability to handle expanded disk formats.

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— *Computers and Electronics*

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MicroPro.

have an extension of .PRD. Originally the value of the 202nd byte in each of your printers' .PRD files is even, and microjustification is enabled. Incrementing the value of that byte by 1 (resulting in an odd value) disables microjustification.

Place a copy of D630.PRD and ITOHSTAR.PRD in drive B:, a copy of DEBUG.COM (from the DOS Supplemental Programs disk) in drive A:. Type the following bold characters, pressing <Enter> at the end of each line.

```
A>B:DEBUG D630.PRD
-EICA
xxxx:01CA 06.7
-W
Writing 06F3 bytes
-Q
```

Follow the same steps for ITOHSTAR.PRD except that the 202nd byte will be displayed as '04.' instead of '06.' and should be changed to 05. Then copy the patched .PRD files back to their respective Word disks.

The Chauffeur
STB Systems, Inc.
601 N. Glenville #125
Richardson, TX 75081
214/234-8750
List price: \$395

Microsoft Word, version 2.0
Microsoft Corp.
10700 Northup Way
Bellevue, WA 98009
206/828-8080
List price: \$375
Requirements: 256K, two disk drives

Paradise Modular Graphics Card
Paradise
150 North Hill Dr.
Brisbane, CA 94005
800/527-7977, 800/822-2020
California, 415/588-6000
List price: \$395

(continues)

Computer Professionals for Social Responsibility

Computers are changing our world. Computers can bring us great benefits, making life easier, more efficient and safer. But computers also have the potential to do great harm. If they are used recklessly, without regard to their limitations, they could bring us 1984 — or start a nuclear war.

Computer Professionals for Social Responsibility is an organization of some 800 computer professionals in the United States and overseas. We feel it is the obligation of people in the computer field to help educate society about the potential abuses of computer technology. We try to bring to the public's attention issues relating to computer reliability, what computers should not be used for, and how computers contribute to the arms race. We are a non-partisan, educational, tax-exempt, non-profit organization.

We write and do research and public education on such topics as the computer system of the "Star Wars" plan; the Strategic Computing Initiative; the militarization of computer science in the United States; computers and privacy; computers and the First Amendment; and computers in the workplace. We want to engage the profession in a dialogue with

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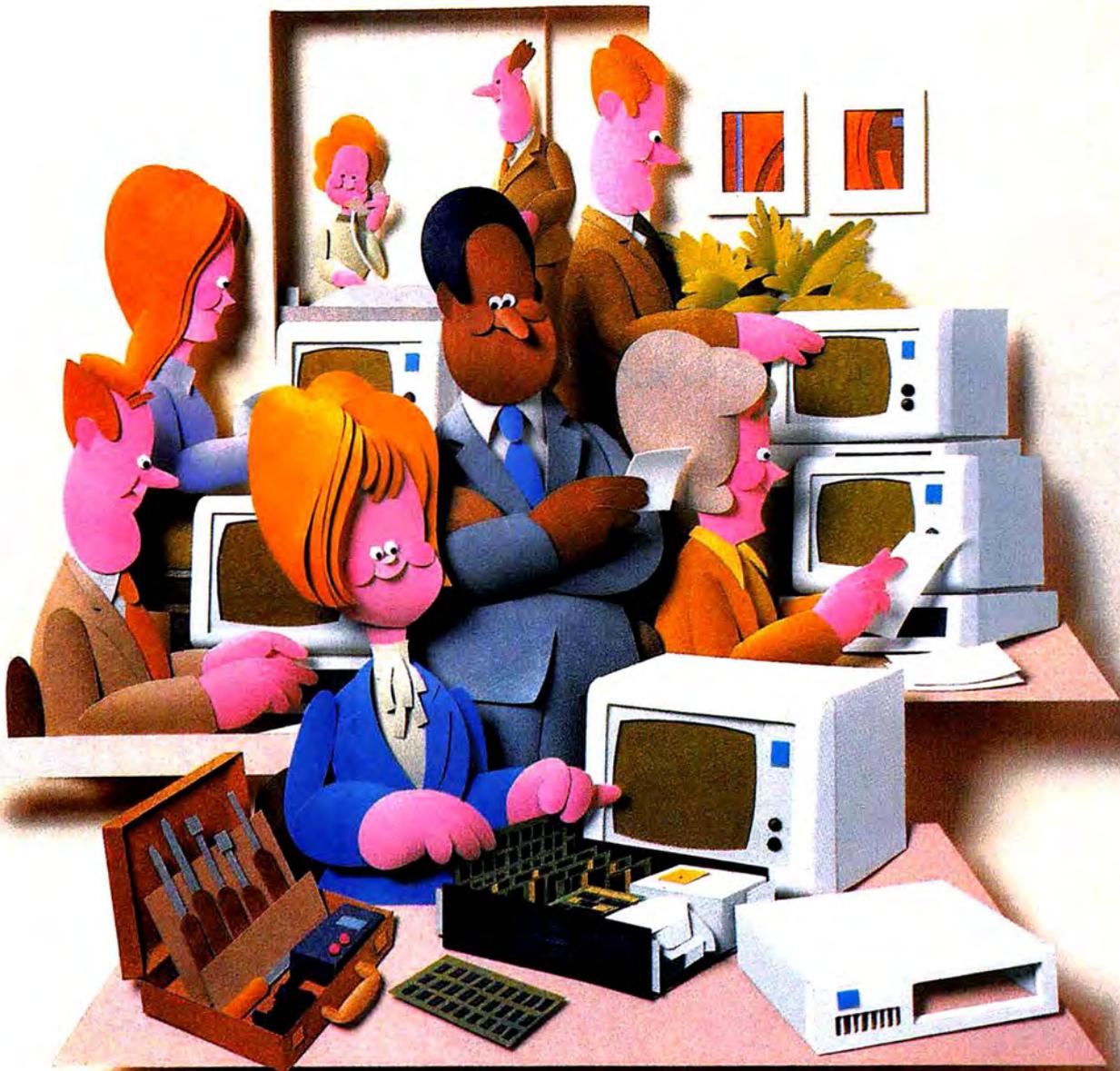
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Amazing what's
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And each program is enhanced by Macintosh's many beloved features: window sizing, the menu bar, clipboard, calculator and notepad. All controlled, of course, by the infinitely convenient mouse.

But MacCharlie also provides several other unexpected pleasures. Like the ability to link Macintosh to IBM serial networks and mainframes. And the flexibility of file transfer between the two popular PC's, which means offices using both computers can kiss double entries goodbye.

MacCharlie also makes Macintosh compatible with almost any IBM peripheral, including printers, modems and even hard disk drives.

In brief, MacCharlie makes it a cinch to justify adding the powerful, easy-to-use Macintosh to your software-laden family of IBM PC's.

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*For a copy of the Lifetime Warranty, write BASF Systems Corporation, 19 Crosby Drive, Bedford, MA 01730.

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Please send me the free cassette(s) indicated at right, and enter me in the BASF Computer Sweepstakes. My order represents a total of one two three Offer Requests, and I am enclosing for each request the special offer sticker(s) and bar code(s) from the BASF FlexyDisk pack(s) I have purchased, together with \$1.00 postage & handling (2 requests = \$2, requests = \$3).

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Circle 207 on reader service card

The Help Screen



Spectrum
Genoa Systems Corp.
73 E. Trimble Rd.
San Jose, CA 95131
408/945-9720
List price: \$459

WordPerfect, version 4.0
Satellite Software International
323 N. State St.
Orem, UT 84057
801/227-4020
List price: \$495
Requirements: 192K, two disk drives

WordStar, version 3.3
MicroPro International
33 San Pablo Ave.
San Rafael, CA 94903
415/499-1200
List price: \$495
Requirements: 64K, one disk drive

Do you have any questions concerning the IBM PC or compatibles? Send them to The Help Screen, PC World, 555 De Haro St., San Francisco, CA 94107, or electronically to CompuServe 74055,412 or The Source STE908. ☉



Dear Reader:

We're proud that Xanaro Technologies chose PC WORLD for its historic distribution of an ABILITY demonstration. ABILITY is a powerful new business productivity tool, and Xanaro has created a special way for you to experience it here.

In 1983, Microsoft provided a sample of their word processing program to PC WORLD subscribers. Approximately 100,000 disks were bound into subscriber magazines.

Now in November 1985, Xanaro is distributing over 600,000 disks to PC WORLD readers! Two disks are included within each subscriber version, and a free, postage-paid request form is in every newsstand copy.

The trial sample of ABILITY uses new demonstration technology. It

contains an actual, working overview of the product's many business functions—word processing, spreadsheet, database, graphics, and more. No one has ever before attempted this level of direct, public trial for software.

As you might imagine, a project of this magnitude requires enormous mutual planning. The PC WORLD staff has worked closely with Xanaro in coordinating the distribution of this unprecedented number of demonstration disks. Foremost in our minds was the need to insure their safe arrival, both to subscribers and to readers who request them.

Xanaro has undertaken this significant trouble and expense because the company considers its product good enough to warrant it. Its creators believe that once you get a taste of their product, you will want the entire banquet. In selecting

PC WORLD, they know they are reaching an important and influential audience—*you*.

I urge every subscriber to try the sample disks enclosed. (Be sure to note the instructions for memory requirements.) Every newsstand reader is invited to send for the two free disks as well.

We are delighted to have our readers be part of another step forward in the fast-evolving history of bringing people and technology together.

Sincerely,

David Bunnell
Publisher
PC WORLD

FREE DEMO DISKS INSIDE.



READ ME FIRST!

Open tab to remove disks

This envelope contains two floppy diskettes, labeled ABILITY DEMO DISK 1 and ABILITY DEMO DISK 2. These two disks will allow you to observe a demonstration of ABILITY's power and ease of use, and also to experience some of ABILITY's features yourself, just as you would with the actual product.

Instructions for Dual Floppy Disk Drives

1. Insert your DOS disk and reboot your PC. (Simultaneously press the Ctrl key, the Alt key, and the Del key.)
2. Remove the DOS disk from drive A:
3. Insert the ABILITY DEMO DISK 1 in drive A:
4. Insert the ABILITY DEMO DISK 2 in drive B:
5. Type:
demo (to see the 20-30 minute 'filmed' demonstration)
• **STRONGLY RECOMMENDED** •
SEE THIS DEMONSTRATION FIRST!
or type
teach (for 10-minute orientation prior to actual hands-on experience of ABILITY.)
or type
ability (to explore the product itself, after viewing the demo)
6. Press RETURN

Instructions for Hard Disk Drive

1. Insert the ABILITY DEMO DISK 2 in drive A:
2. Type:
a:setup
3. Press RETURN
4. Follow instructions on the screen.

NOTE: The installation procedure automatically leads you directly to the demo.

TECHNICAL NOTES ABOUT THIS DEMONSTRATION

This demonstration requires an IBM PC, PC XT, PC AT, or 100% compatible running PC-DOS 2.0 or later, or MS-DOS 2.0 or later.

ABOUT MEMORY: the demonstration technology used on these disks actually requires more memory than ABILITY itself (320K).

- For DOS 3.0 or later, you need at least 384K of memory.
- For earlier DOS versions, you need at least 320K of memory.
- Some compatibles will require 384K of memory regardless of DOS version.
- It is likely that more memory will be required if your machine has any custom device drivers, print spoolers, RAM disks, keyboard handlers or other memory resident programs.

The demonstration requires either two floppy disk-drives, or a single floppy drive and a hard-disk.

This demo runs on IBM monochrome or color systems. Hercules Graphics Cards are treated as IBM monochrome displays by the demonstration. The IBM enhanced graphics adapter is supported with the exception of screen colors (the screen will remain white.)

Some keyboard handling programs will interfere with the demonstration. If you have any problems please try the demonstration again, after booting your machine from your original DOS diskette (this should remove any special memory resident programs that you normally use).

If you experience difficulty running this demonstration, try booting your machine from the original DOS diskette *before* running the demo. This should bypass anything in your normal boot procedures that might interfere with the unique technology in the demo disks.

**FOR THE U.S. DEALER
NEAREST YOU,
CALL 1-800-556-2283**

About this demo.

The special demonstration disks in the envelope facing this page will allow you to observe some of the features that make ABILITY a powerful yet easy-to-use business tool... AND try it out for yourself.

However, this unique demonstration actually requires more memory than will ABILITY itself. Please note

that to view the demonstration you will need an IBM PC, PC XT, PC AT, or 100% compatible running PC-DOS 2.0 or later, or MS-DOS 2.0 or later. For DOS 3.0 or later you need at least 384K of memory; earlier DOS versions require at least 320K of memory.

These demo disks provide you

with an actual limited copy of ABILITY itself. Therefore, if the demo disks work successfully on your machine, so will ABILITY.

Read the instructions on the envelope carefully *before* tearing tab to remove disks.

To learn how to get ABILITY, call: 1-800-556-2283.

Xanaro would like to thank...

The following companies helped create the enclosed software gift for you. We are grateful for their

help and participation in giving you, the PC WORLD reader, the best possible "sample" of ABILITY.

Disk.



Control Data Canada, Ltd., Scarborough, Ontario, Canada; and Xidex Magnetics, Mountain View, California

Xanaro chose CDC and Xidex to supply diskettes for this ABILITY preview. Extensive testing convinced us of the extreme quality of the disks that would house our program for you. Both companies impressed us with their concern for producing consistently optimum storage capacity, electrical performance, and media durability. We felt strongly that ABILITY—and you, the PC WORLD reader—deserve that kind of quality in disk workmanship and resulting performance.

Duplication.

Reprosoft, Inc., Scarborough, Ontario, Canada; Best Impressions Corporation, Cincinnati, Ohio; and Xemag Corporation, Menlo Park, California

Because of the extraordinary quantity of disks needed at once—two bound into every November issue of PC WORLD magazine—Xanaro needed to choose several companies to duplicate our demo program on disk. What we cared most about was providing PC WORLD readers with a 100% error-free, bit-by-bit replica of our specially designed demo program for ABILITY.

The three companies we selected are known for their extreme conscientiousness and quality. Reprosoft is a wholly owned subsidiary of Baton Broadcasting Inc. based in Scarborough, Ontario, Canada. Best Impressions is a disk duplication, printing, and software packaging firm with additional emphasis on design. And Xemag offers protection, duplication, testing, blank disks, packaging materials, assembly, and shipping.

Our thanks to these three fine suppliers for their outstanding work performing to consistently rigorous standards.

Demonstration.



The Software Recording Corporation of America, San Rafael, California

Using traditional technology, Xanaro would have needed many months of programmer time to create the demonstration you find in this issue. With SRCA's technology, however, we were able not only to save time, but also to create a better demonstration for you. SRCA's software works with existing, "live" products like ABILITY to create instructional tools on diskette in days instead of months. Writers and communicators can work directly on software instruction rather than needing programmer intervention. We were glad for the opportunity to work with SRCA to create unusual ABILITY sample disks—allowing you, right now, to both observe a demonstration *and* explore for yourself.



Some years ago, we systematically interviewed management professionals in 400 corporations. We asked them very simply: what kinds of things do they do every day? What would most help them work better?

The answers were consistent. For gathering information, for organizing data, and for displaying the results...everyone felt that the power of the computer is a major opportunity for better business productivity.

So many people believe, however, that computers are too difficult for most of management to use. Xanaro set out expressly to address that concern, beginning with the IBM PC.

Before we knew how our product would look and feel, even before we knew we would call it ABILITY—we knew what we wanted to create:

Software to let "non-tech" professionals be much more productive with a computer.

While we're proud of ABILITY's power, we're also very proud of how easy it is to use. To those enthusiastic people who already have the ABILITY, our thanks. To the rest of you, come on in.

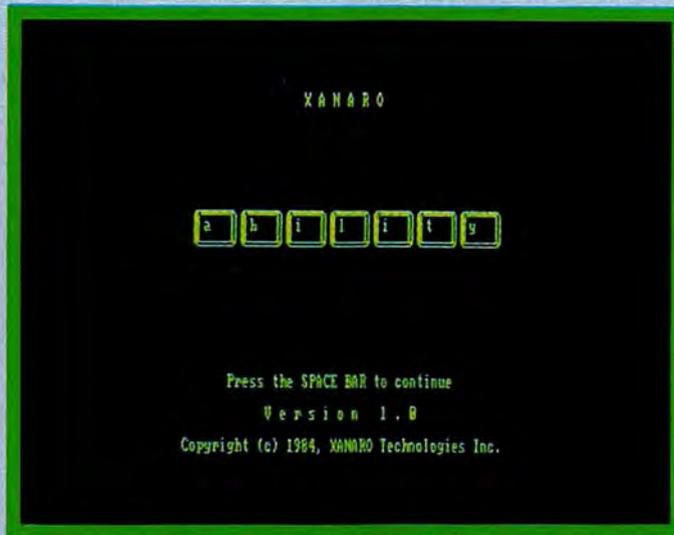
A handwritten signature in cursive script that reads "Robert Hryniak".

Robert G. Hryniak
President
Xanaro Technologies Inc.

In developing ABILITY, we've included special features to help you, day-to-day. Print a document sideways, for example, whenever you want—no need to purchase a separate program to do it. (That's an especially important benefit for spreadsheet users).

Another innovative feature: "flipping". We incorporated the concept after considering and rejecting the "windows" treatment of other products.

Windows seem to offer more promise than punch. Sure, people want to do more than one thing at a time. But it simply takes



too long to learn complex commands and keystrokes just to move window around or change its size.

"Flipping", like windows, lets you work on two separate tasks at the same time.

Is it easier? Yes. Press a single

key to immediately "flip" your screen from one task to the other. Is it powerful? Yes. Work simultaneously with two spreadsheets, a spreadsheet and a graph, a document and a telecommunications session—whatever combination you need to get your work done faster and easier.

In the following pages, take a closer look at specific features of ABILITY. We believe you'll see ample evidence of the care that went into creating it.

When you use the product itself, you will see even more.

ABILITY OVERVIEW

Hardware Requirements

- Requires IBM PC™, PC/XT™, PC/AT™, Portable PC, or 100 percent compatible
- Dual floppy disk system or Hard drive
- Minimum 256Kb RAM (384Kb recommended)
- Supports 8087 math coprocessor
- Color or monochrome monitor
- Wide variety of printers and plotters

General Information

- Six applications: Word Processing, Spreadsheet, Database, Graphics, Telecommunications, Presentation! (Slide show builder)
- ABILITY's 4 disks are not copy protected to make it even easier for you
- Up to 30 user-defined macros in each directory
- Fully integrated without windows
- No complex commands to memorize

Printing and Plotting

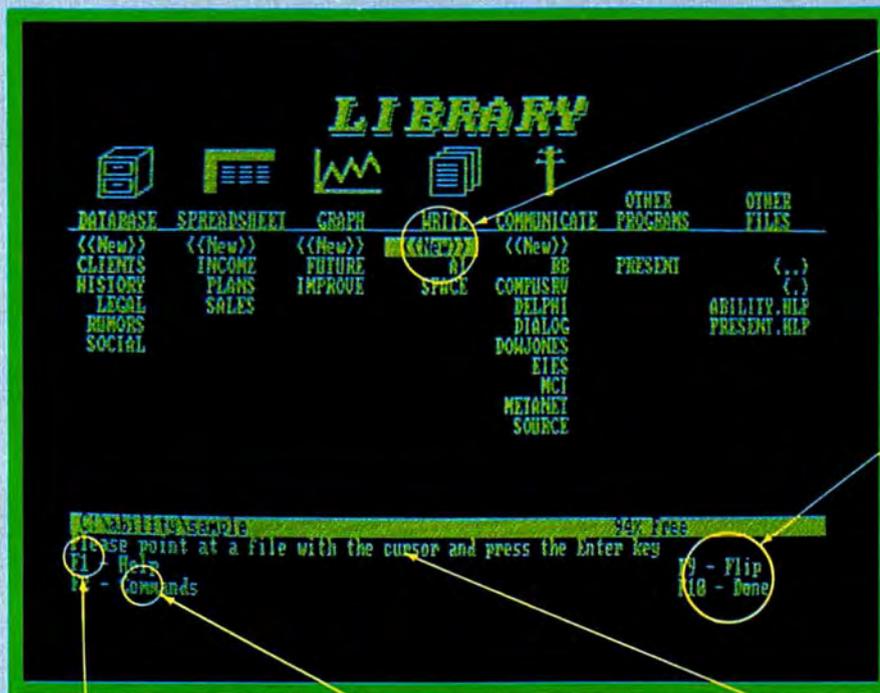
- What you see on the screen is what you get
- Print draft or final quality on dot-matrix printers without using special printer codes
- Print graphics on many daisy wheel printers
- Print in pica, elite, or condensed type sizes without using special printer codes
- Without changing paper position, print sideways to fit more on a page

Documentation and On-Screen Help

- Extensive step-by-step tutorial for new users
- Complete and concise reference to all features
- Helpful error messages for common formula errors
- Extensive on-line help messages, context-sensitive and topically organized

The Ability Library.

The Library screen is a unique Ability feature. Use it to select the files you work with. Or create new ones. It will keep them all organized. (You'll find it a real pleasure.)



Use the cursor to select any file you want to work with—like a document, spreadsheet, or graph—or create a new one.

Ability uses all 10 function keys on the PC keyboard. At the bottom of the screen, you'll always see which keys to use.

No matter where you are in Ability, F1 is always the Help key—press it whenever you want more information on what to do next.

F2 is always the Commands Key. Use it to gain access to additional commands when you need them.

Ability always displays a reminder line.

Now you know the essentials. These simple and easy-to-use principles are consistent in all of Ability.

It makes life easier.

Goodbye

SOURCE	XCO	901	1-10-85	12:02a
SOURCE	XTM	815	1-10-85	12:02a
CLIENTS	XDB	204	2-06-85	6:16p
CLIENTS	XPF	5743	2-06-85	6:16p
SALES	XSS	1389	1-31-85	9:40a
IMPROVE	XGR	788	2-05-85	5:03p
PRESENT	EXE	4096	1-10-85	12:04a

The Library adds convenience features to the Disk Operating System (DOS) of your personal computer. That's why you won't be needing this haphazard, old-

style listing of your files.

Instead, with Ability, you'll find your files in alphabetical order. They're efficiently grouped by category—text files, spread

sheet, database, etc.

Whether you're experienced or new to a personal computer, you'll appreciate the organization and ease of Ability's Library.

So long

```
copy a:file1234.txt b:file5678.txt
```

The Library lets you avoid routine commands, yet you're able in a flash to get to DOS whenever you like.

Instead of remembering the syntax to copy a file, for example, just use the cursor to select whatever you're copying.

Then:



Press the F2 Key for Commands

Hello

```
Put-away Active-drive Directory Erase Rename Copy File-stats Other
Copy the current file F1 - Help; Esc - Continue
```

Choose "Copy" from the command line. Decide on your new file name.

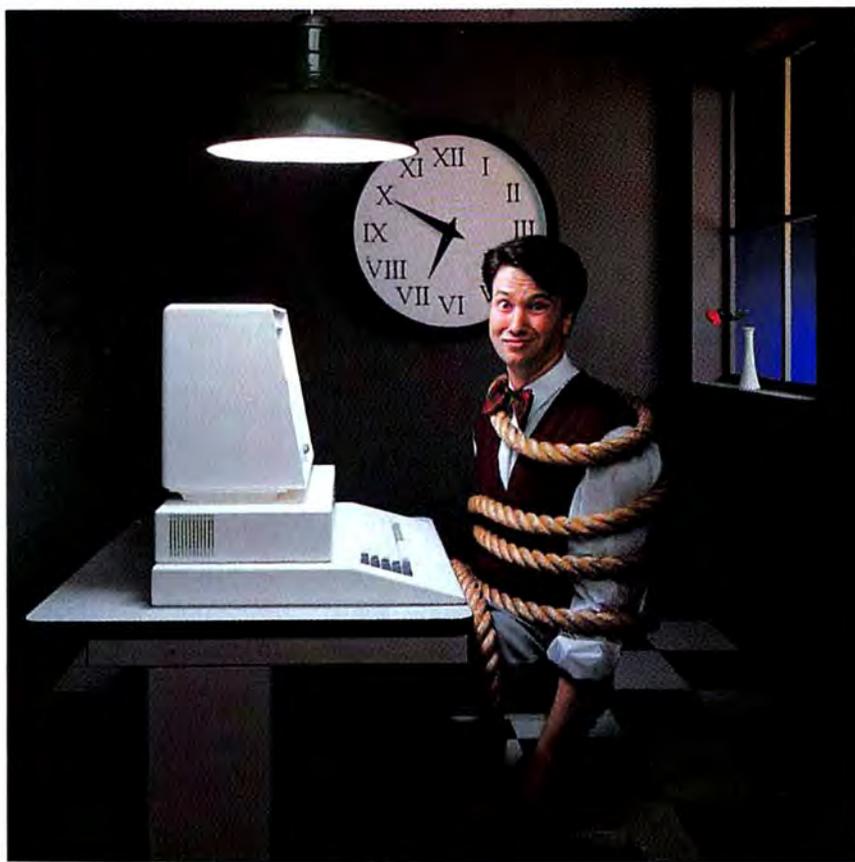
That's it. The simple Point and Select process is exactly how you use Ability—all the time.

SOFTWARE SHOULDN'T TIE YOU UP IN KNOTS.

The Ability to write.

It shouldn't be a big deal to use powerful and effective word processing. Why should you have to struggle to make a document look the way you want it to?

Success, all the while saving you time and energy, is the real purpose of Ability, and of the word processing features shown on the right.



Full featured Ability.

Of course, with Ability you can type new text and easily edit, move, or copy it as you wish. Of course, you can **bold face**, *italicize*, and underline. (You'll see each type style right on your computer screen, so you won't have to settle for merely a "symbol" of what you're creating.)

Those are basics, and Ability makes them easy. But what about other features?

You can certainly put spreadsheet numbers or graphs into Ability documents. But with a new level of ease we think you'll find remarkable. Any data you include can be updated automatically—again with ease.

Here's one more example of the power Ability offers. Establish a "field" in the middle of your Ability document—like, "You will probably be impressed

WRITE OVERVIEW

- Document size limited only by available memory
- Maximum width of text is 25 inches (635 mm)
- Formatting on screen is same as on printout
- Insert and typeover modes
- Search by page number or text string
- Cut and paste, copy, move, delete
- Search and replace—global and selective, with or without wildcards (*and ?)
- Left justify, left and right justify, and center
- Boldface, italics, and underlining on-screen
- Headers and footers appear on screen
 - Left- or right-justified, or centered
 - Automatic dates and page numbers
 - Can suppress on first page of document
- Auto indent for paragraphs or bulleted lists
- Include spreadsheet in a document with a single command; changes to the spreadsheet can be automatically reflected in document
- Include graph in a document with a single command; changes to the graph can be automatically reflected in document

by 87 superior features of Ability"

Now, suppose you "link" that number to the data file in which you had counted those 87 features. What if you find one more, and change the data to 88? If you like, the sentence can also change automatically, noting 88 features as well. The convenience is extraordinary.

You will see for yourself.

WHAT YOU SEE IS WHAT YOU GET.

Sound familiar? With Ability, it's really true.

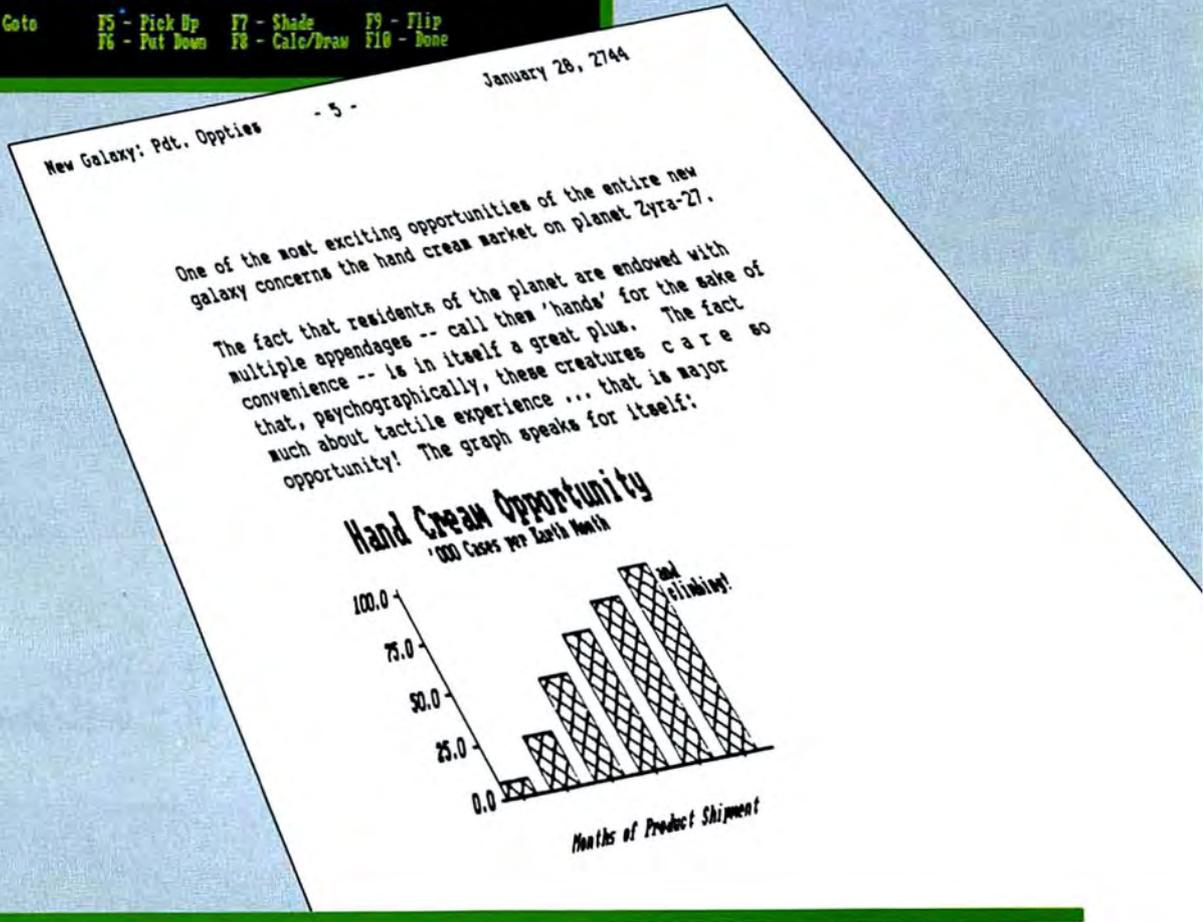
If you're tired of being tied to tedious rules that waste time—just to know where your page break will be, or just to get a header where you want it in your document—you'll appreciate this feature of Ability.

Look at this copy of an actual Ability screen. Then look at the printout it produces.

With Ability you see—really see—your page breaks, headers, footers right on the screen. No more guesswork. No more laborious

commands. Just results, obtained with ease. Just the way you want them.

Ability. The right way to WRITE.



If you know about spreadsheets.

For the experienced spreadsheet user, ABILITY offers impressive power and speed. Fast recalculation of changes, data that can remain "live" and linked to graphs or text, con-

veniences and innovations that make building and customizing a spreadsheet simple, consistent, and powerfully effective.

You'll find much that you'll appreciate in ABILITY. The fol-

lowing specifications help to indicate the product's power.

But...experiencing it for yourself is the best proof of all.

SPREADSHEET OVERVIEW

- Spreadsheet size 702 columns by 9,999 rows
- IEEE format numbers, accurate to 15 digits
- Numbers range between 10^{-308} and 10^{308}
- Name cells; ranges of adjacent cells; lists of constants, non-adjacent cells, ranges, & other lists
- Insert and delete rows and columns
- Copy, move, replace, delete cell contents
- Copy values and formulas between spreadsheets
- Left and right justification, and centering
- Variable column widths from 1 to 75 characters
- Long labels run over column boundaries if adjacent cell is empty
- Freeze row or column titles
- Data-fill range of cells
- Transpose range of cells
- Numeric display formats: Fixed, Variable, Scientific, Percent, Money, Date (four date formats)
- Optional commas
- Minus sign or parentheses for negative numbers
- Math operators: +, -, ×, ÷, ^, %
- Relational operators: =, <, >, <=, >=, <>
- Logical operators: AND, OR, NOT
- Search spreadsheet (with or without wildcards)
- Date arithmetic
- Lock cells to prevent changing important values
- Display and print values or formulas
- Sort by rows or columns (entire spreadsheet or selected portion)
- Add, subtract, multiply, and divide entire spreadsheets
- Formulas can refer to and result in labels
- Can have multiple spreadsheets in memory
- One-way and two-way linking
- Built-in functions: ABS, ACOS, ASIN, ATAN, ATAN2, AVG, COMB, COMPOUND, COS, COUNT, DATE, DAY, EXP, FACT, FIND, FV, IF, INDEX, INT, IRR, ISERR, LN, LOG, LOOKUP, MAX, MIN, MOD, MONTH, NPV, PERM, PI, PMT, PV, RAND, ROUND, SIN, SQRT, STD, SUM, TAN, TODAY, TOTAL, VAR, WAVG, WEEKDAY, YEAR
- Range intersection
- Check for error in cell, range of cells, or entire spreadsheet
- Recalculation:
 - Natural order
 - Automatic or manual
 - Iterate fixed number of times
 - Iterate until specified cell equals zero
- Include all or part of spreadsheet in a document and use full SPREADSHEET capabilities within the document; changes made to the spreadsheet in the document affect the actual spreadsheet and vice versa
- Copy all or part of spreadsheet to document without linking
- Link spreadsheet to a graph; changes to the spreadsheet automatically change the graph
- Copy values from spreadsheet to graph without linking
- Link spreadsheet values to "fields" in a document
- Copy all or part of spreadsheet into a database
- Copy all or part of database into a spreadsheet
- Print sideways to fit more on a page

SOFTWARE SHOULDN'T MAKE YOU FEEL FOOLISH.



The Ability to use Database.

Power to spare

Unlike some integrated products, the ABILITY Database is a full-featured way to store, organize and retrieve information.

Lots of information.

This is a "record!"

Suppose you had a long list of records like this one to work with.

Name: Sir Jasper ("Feathers")
Freelance, III
Hobby: Canine Hypnosis & Therapy (Regional Champion)

Wine Preference: Chateau-Grafitte '48
Most Recent Book Read: Eclectic Gourmet of the Streets
Most Recent Movie: Mindtwist!
Banquet Seating: Table 2 (likely Donors), Seat 6

Mystery Partner for Drawing: Lady Muffinchaps
Most Recent Contribution to Publishers Fund: \$1,000, 2/2/82 (Push for donation!)

NOW.

If you were using an IBM PC with 384Kb of internal memory and a 10 Megabyte Hard disk

with DOS 2.0, and if you could receive just one dime for every such record you could store...

WITH

LOTUS 1-2-3

SYMPHONY

FRAMEWORK

ABILITY

YOU COULD BUY:

a few dozen long-stemmed roses (\$97.60)

a bit of music—three Compact Disks on sale (\$34.30)

a sweet little picture frame right from your corner dime store (\$13.80)

a dandy BMW 635-I, with about three thousand dollars left over for some fine chocolate (\$45,248.87)

That's how much power ABILITY gives you to handle large quantities of data.

And if you don't have a hard-disk drive? Even with one 360Kb floppy disk, ABILITY can still store more data than Lotus™ 1-2-3 and Symphony™ and Framework™ combined.

If you're new to Database.

```

RAPUNZEL ESTATE
BENEFICIARY #: 343
LAST NAME: Custo           MIDDLE INITIAL: Z.
FIRST NAME: Sensanario    NICKNAME: "Snips"
RELATIONSHIP TO DECEASED: Hairdresser, Confidante
GOODS AND PROPERTY BEQUEATHED:
    $10,000 U.S., Silver Alpha Romeo ('88),
    Sterling Silver Hairbrush
WIDOW RAPUNZEL'S MESSAGE TO BENEFICIARY:
    Well, Snips - this is it! I've loved it all.
    Don't use so much conditioner!! Ta', Lady R.

```

```
DB: And/ browse      Form 1      91% free
Enter key: 946
F1 - Help           F3 - Goto           F5 - Pick Up       F9 - Flip
F2 - Commands      F4 - Edit Field    F6 - Put Down      F8 - Calc/Draw    F10 - Done

```

ABILITY gives you flexibility, so your database can look the way you'd like it to. Learning to use its capability—and enjoying yourself—becomes natural. Once you see the way any one part of ABILITY works, you're already familiar with the ground rules for the rest. If you've never used a database before, now's your chance.

If you know about Database.

ABILITY offers a full-featured relational database that can link with grace and ease to all its other

functions. You don't need to suffer through learning a programming language to enjoy a

“real” database with very powerful business features.

DATABASE OVERVIEW

- Forms-based, relational database
- Maximum database size is 65 thousand records; each record can include up to 32 thousand fields (or 65 thousand characters)
- Each field can contain up to 75 characters
- Recover records after accidental deletion
- Backup feature to prevent losing data
- Use all SPREADSHEET functions in calculated fields
- Use all numeric display formats available in SPREADSHEET
- Modify form after storing data in a database
- Browse through records in original or sorted order
- Search by record number or with search criteria
- Search operators:
 - Relational operator: <, >, <=, >=, <>
 - Logical operators: AND, OR, NOT
 - Wildcard characters: * and ?
- Create “subset” of records that match search criteria; browse subset or save as separate database
- Sort records in ascending or descending order; any number of sort keys can be specified
- Join two files that contain different information
- Form reports show records as they appear on the form
- Summary reports organize information into columns
- Mail merge combines database information with a standard document
- Consolidate records to produce summary information for records that contain the same data in a particular field
- Output reports to screen, printer, or disk file
- Merge some or all of the information in a database into a document you create with WRITE
- Move all or part of a spreadsheet into a database
- Copy records from a database into a spreadsheet for quick modeling
- Link database field to a spreadsheet field for computation or display

The power of a graph.

Dear Mom and Dad,

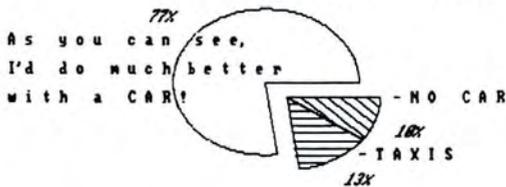
I'm very glad to have my own computer here at school. It will make a very big difference to my future, as of course you realize. Thank you!

You know, though, I've been thinking -- given the amount of time I waste getting from one part of campus to another -- having a CAR would make a substantial difference, too!

With all the time I'd save, I'll be able to achieve a much higher level of excellence. Below is a graph of my best estimates for hitting Dean's List:

- with a car (by far the best chances!)
- without a car.
- with more money for taxis.

Chances of Dean's List
effect of having my own car on campus



Now, Mom and Dad, let's talk about just what kind of car would help me obtain the very finest grades!

Bar charts, pie charts, line charts—they help you show trends and relationships more vividly.

You'll be impressed at the effortless way you can add the power of a graph to anything you communicate. Make a graph in just a minute? You bet.

You'll be pampered by the con-

venience of having a graph in your document remain "live" all the time. If you've created it from a spreadsheet, make a change in the original numbers and, WHAM, the graph is automatically updated.

That's the power of an ABILITY graph.

GRAPH OVERVIEW

- Graph Types:
 - Bar (clustered or stacked)
 - Line (with or without point marks)
 - Pie (with or without exploded wedges)
 - Combination Line/Bar
- Bar and Line graphs may be vertical or horizontal
- Single graph may represent 7 series of values, each series including 18 data points
- Graph updated immediately when data is entered or changed; optionally disable automatic redraw
- Data and graph appear simultaneously
- Graph title, subtitle, x-axis title, y-axis title
- Manual or automatic y-scale increments
- Ten fill patterns for column and bar graphs
- Eight different point marks for line graphs
- Include graph in a document; changes to graph automatically reflected in document
- Link graph to spreadsheet; changes to spreadsheet automatically reflected in graph
- Specify plotter colours for outlines, fill patterns axes, titles, x-labels, y-labels, pie wedges
- Plot graph in 4 page positions or full page

The Ability to communicate.

```
STEVE AND ABILITY™ Conference 85 7888 STEVE GIBSON, organizer, (answers 28)  
FRI, 03/08 11:39 (1682 characters)
```

```
-- Steve Gibson here!!! --  
-- HI Y'ALL !! --
```

```
Yesterday morning Federal Express delivered a final production copy of ABILITY  
to my doorstep.
```

```
This morning I have read a good portion of the manual and have been using the  
system for a day.
```

```
I am really, truly, and deeply, impressed.
```

```
There are WONDERFUL, subtle things about ABILITY which are not easy to  
communicate - Software has been SO WRONG for SO LONG, that it's actually a bit  
hard to accept that Ability is as RIGHT as it is. I find, in myself, a  
resistance to BELIEVING that this is a real experience I'm having.
```

```
Ability is so laced with correctness, clarity, and obvious ease of use  
features that I've decided it's been misnamed ... it really should be called  
MODESTY.™
```

```
Communicate SOURCE BB: Free FLIP
```

```
F1 - Help  
F2 - Commands
```

```
F9 - Flip  
F10 - Done
```

Courtesy Steven M. Gibson, President, Gibson Laboratories and developer of the Gibson Light Pen. Mr. Gibson was an early user of ABILITY and was so

impressed he started an electronic teleconference, "Steve and Ability" for readers of Participate™ on The Source™

Communications is the future.

It's a well established fact that computer communications is rapidly becoming one of the most significant uses of computing technology.

Computers facilitate all kinds of data exchange—within a company, between companies, or using commercial services like Dow Jones/News Retrieval® and DIALOG®.

Electronic communication now lets you problem-solve, learn from, and interact with people with similar interests. Exchange

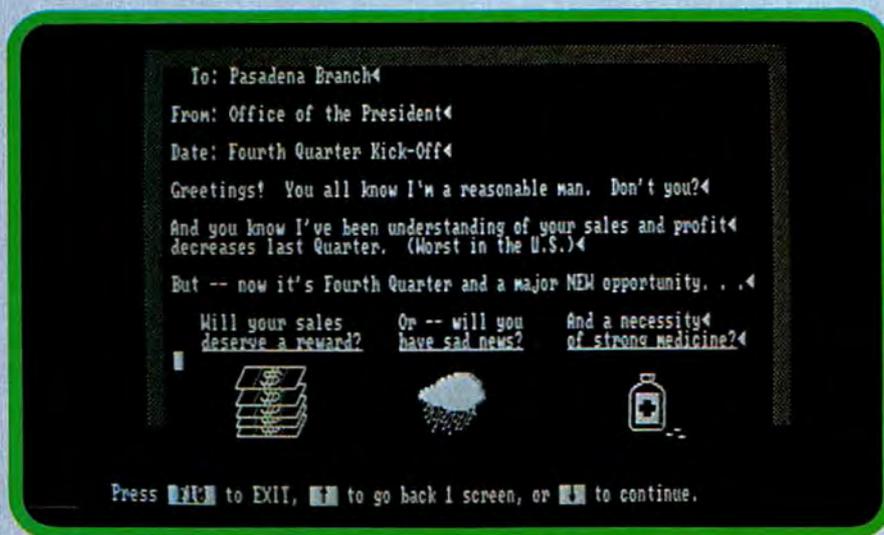
views in private or public discussions, with MCI MailSM, Compuserve®, THE SOURCESM and many others. Conduct teleconferencing "meetings" on some public systems, or perhaps your own internal company network.

ABILITY will help you take advantage of the many exciting communications resources available. The COMMUNICATE function is versatile, convenient, and a pleasure to use. Which is just what you'd expect.

COMMUNICATE OVERVIEW

- Asynchronous serial communications
- Uses Hayes Smartmodem 1200™, Smartmodem 1200B™ and 100 percent compatibles
- Emulates VT100™, VT52™ and dumb terminals
- Transparency for diagnosing bad communications
- Optional reverse video
- Baud rates from 110 to 9600
- Parity: None, Odd, Even, Space, Mark
- Full and Half Duplex
- Word size: 7-8, Stop bits: 1 or 2
- EIA and Xon/Xoff flow control
- Capture and upload
- Transparent, error-checking file transfer between ABILITY users with optional password protection
- Read and edit capture files in WRITE
- Upload documents created in WRITE
- Transfer spreadsheets, databases, graphs, documents, and presentations to other ABILITY users

Presentation!



ABILITY was designed for professionals who care about excellence but don't want to become "techie" to attain it.

When the product's many features were being created—integrated to make them unusually easy to use with one another—we saw an opportunity to include one additional option... an extra to help you build more creativity and quality into your communications. More choice in how you communicate means more effectiveness at your disposal.

It's called "Presentation!" Use

it to make a slide show of any screens you create with ABILITY.

A slide show with built-in timing to run itself. Just give another ABILITY user the disk you've created—and let your audience sit back and view a vivid communication, just as you planned it. (Or allow your viewer to control each change from one "slide" to another.)

But why stop there? ABILITY lets you communicate your slide show presentations over the telephone too. Send the instant

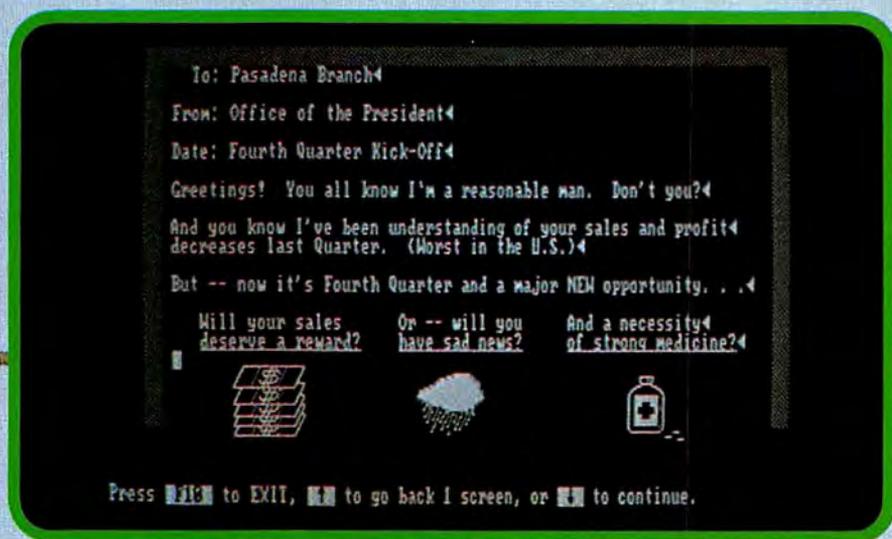
impact of your presentation right across the country.

Can you put spreadsheet numbers into the "snapshot library" used to create a presentation? Sure.

Can you send graphs to make your points more evident? Of course.

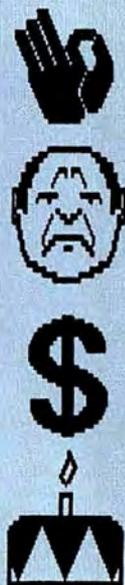
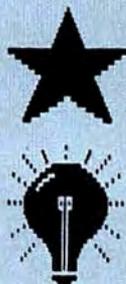
And you can even add musical "punctuation" for extra emphasis. (We've got some dandy little tunes for a sales increase, and a choice of sombre dirges when you're faced with presenting bad news.)

Do it with Ability.



As an extra touch included for whenever you want to enjoy them, you've even got optional symbols to add wherever you want.

Send a conscientious employee an electronic note of praise on a disk. Get someone's attention with a new idea for efficiency.



Send an electronic message when you think an idea's really OK. (Or--let 'em know when it's not.)

You may find "Presentation!" is a little communications extra to help you make money.

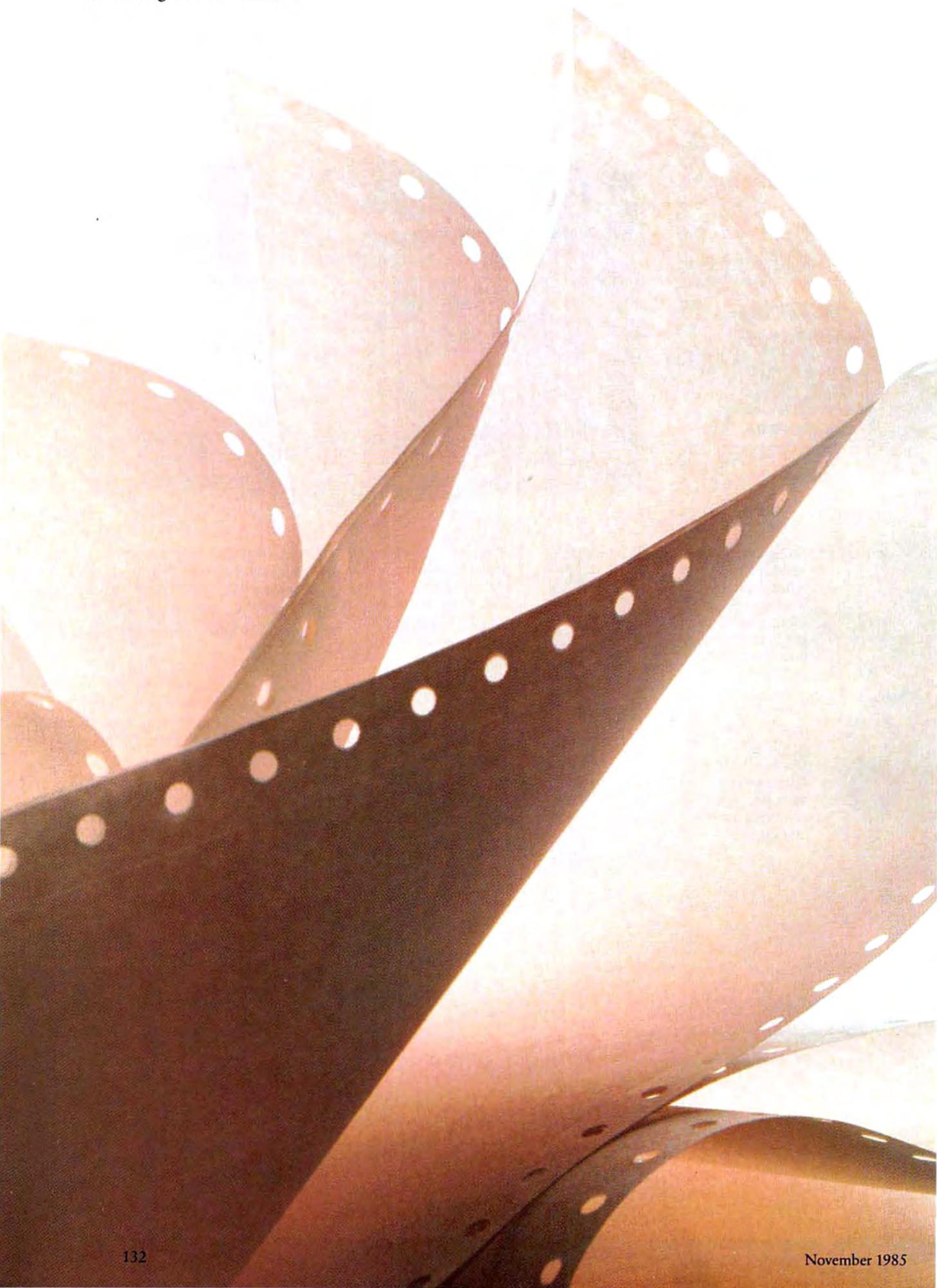
Or--you might just enjoy wishing someone Happy Birthday along with your presentation on next year's profit margins.

"Presentation!" is another example of what we've aimed for throughout ABILITY: technology is meant to be used and enjoyed. Computers should help us achieve our aspirations.

Excellence--in everything you do--should not have to feel like drudgery. Not in building a spreadsheet, not in storing and analyzing data, and not in the way you communicate, either.

"Presentation!" is an extra innovation we're very happy to make available.

NOW YOU HAVE THE ABILITY.





A Printer Shopping List

Picking the best printer from among the hundreds available might seem a herculean task. But never fear, knowledge conquers all. Read on to find out everything you always wanted to know about printers—but were too embarrassed to ask.

Don Conkey and Sharyn Conkey

▄▄▄▄ Choosing the right printer for your business is akin to hiring the right employee—you need one that works diligently, is available every day, and won't quit in the foreseeable future. These virtues are not merely desirable—their absence can cost you time and money. When a printer doesn't do its job, your business is disrupted—while your expensive investment depreciates.

With the multitude of printers available for the PC, the choices are overwhelming. To select the right printer for your particular application, it helps to know what differentiates the various types: dot matrix, letter quality, laser, and ink jet. Once informed,

you should be able to confidently march up to any printer salesperson and ask the important questions about quality, speed, reliability, noise, cost, and features.

■ Dot Matrix: Flexible and Fast

Although dot matrix printers produce lower-quality print than either letter quality or laser printers, they are the most popular for several reasons: their versatility in printing both text and graphics, their speed, and their affordability.

Dot matrix printers in draft mode can be ten times faster than comparably priced letter quality printers, but you must settle for connect-the-dots quality. Characters, often riddled with white spaces, tend to look blurry.

Dot matrix printers with a near letter quality (NLQ) mode produce, at a slower speed, more solid-looking characters, which may be suitable for correspondence. Most printers support the important word processing features: subscripts and superscripts, condensed print, and italics.

Many NLQ printers offer a third mode, called enhanced, that lies somewhere between draft and NLQ modes in both speed and print quality. In general, print speed slows by half as you move from draft to enhanced mode, and is halved again in NLQ mode.

Not all dot matrix printers have graphics capabilities; of those that do, some produce only monochrome graphics, while others produce color. An important point to verify is whether your favorite graphics program supports the printer you choose. In any case, dot matrix graphics quality is uneven at best and thus not recommended for presentations.

A dot matrix printer forms characters by striking different configurations of pins against a ribbon. (Because the printhead is an impact device, you can use carbons to make multiple copies.) The print quality depends on two major factors: the number of pins or wires in the printhead and the number of passes the printhead makes to print a character. The more

The IBM Selectric typewriter is a good standard for print quality.

Letter quality printers produce high quality print, comparable to that of the IBM Selectric.

Laser printers are doubly versatile: almost indistinguishable from letter quality and in some cases approaching near typeset quality.

Dot matrix near letter quality mode is slow, but the output may be suitable for correspondence.

Dot matrix draft mode produces poor quality but at high speed

Color ink jet printers are primarily designed for graphics and generally produce poor quality text at relatively slow speed.

Figure 1: Comparison of text from an IBM Selectric typewriter and letter quality, laser, dot matrix, and ink jet printers

pins and passes, the denser the characters. Older dot matrix printers like the Epson FX-80 rely on 9 pins; newer printers with 24 pins make NLQ printing a reality (see "Dot Matrix Triple Play" in this issue).

In NLQ mode the printer makes two passes; on the second, the printhead makes a slight vertical shift

An important point to verify is whether your favorite graphics program supports the printer you choose.

to fill in the white space between dots. For boldface characters, the printhead makes a third and fourth pass, "doublestriking" the existing dots or repeating the line after shifting slightly sideways. Although multiple passes improve quality, they decrease printer speed.

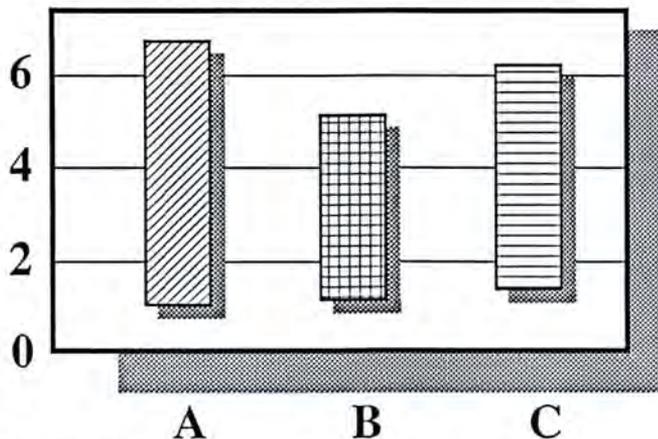
Letter Quality: Looking Good

Letter quality printers produce sharp, solid characters of the highest quality, making them the best choice for business correspondence that must look first-rate. Characters are created by cast images on a daisy wheel striking against a ribbon and are practically indistinguishable from those pounded out on an IBM Selectric typewriter (see Figure 1). A daisy wheel produces clear carbon copies, and although not as durable as a dot matrix printhead, it is replaced as easily and cheaply as a Selectric typewriter element. Most letter quality printers create boldface and underlined text, support subscripts and superscripts and proportional spacing, and accommodate several type pitches—but it's a good idea to double-check.

Alas, you pay the price for producing snappy-looking documents by waiting nearly a minute for an average one-page letter to be printed. To all intents and purposes, you also forgo the ability to produce graphics such as pie and bar charts.

HP LASERJET PLUS PRINTER: As a companion to the LaserJet Printer, this product is designed for those of you who:

- * would like higher-resolution, full-page graphics;
- * would like merged text with high resolution graphics, such as the following:



- * would like electronic forms capability;
- * need the ability to download fonts (up to 30 point).

Figure 2: Merging sharp looking graphics and near typeset quality text on the same page is a special talent of laser printers such as the HP LaserJet Plus.

■ Laser: Top of the Line

Laser printers may redefine our expectations of print quality, speed, and quiet operation. With some laser printers, you can produce text that approaches near typeset quality. Most laser printers make it easy to create superior black-and-white graphics suitable for reports, presentations, and certain unusual printing tasks. For example, you can simultaneously create and fill in a 1040 tax form.

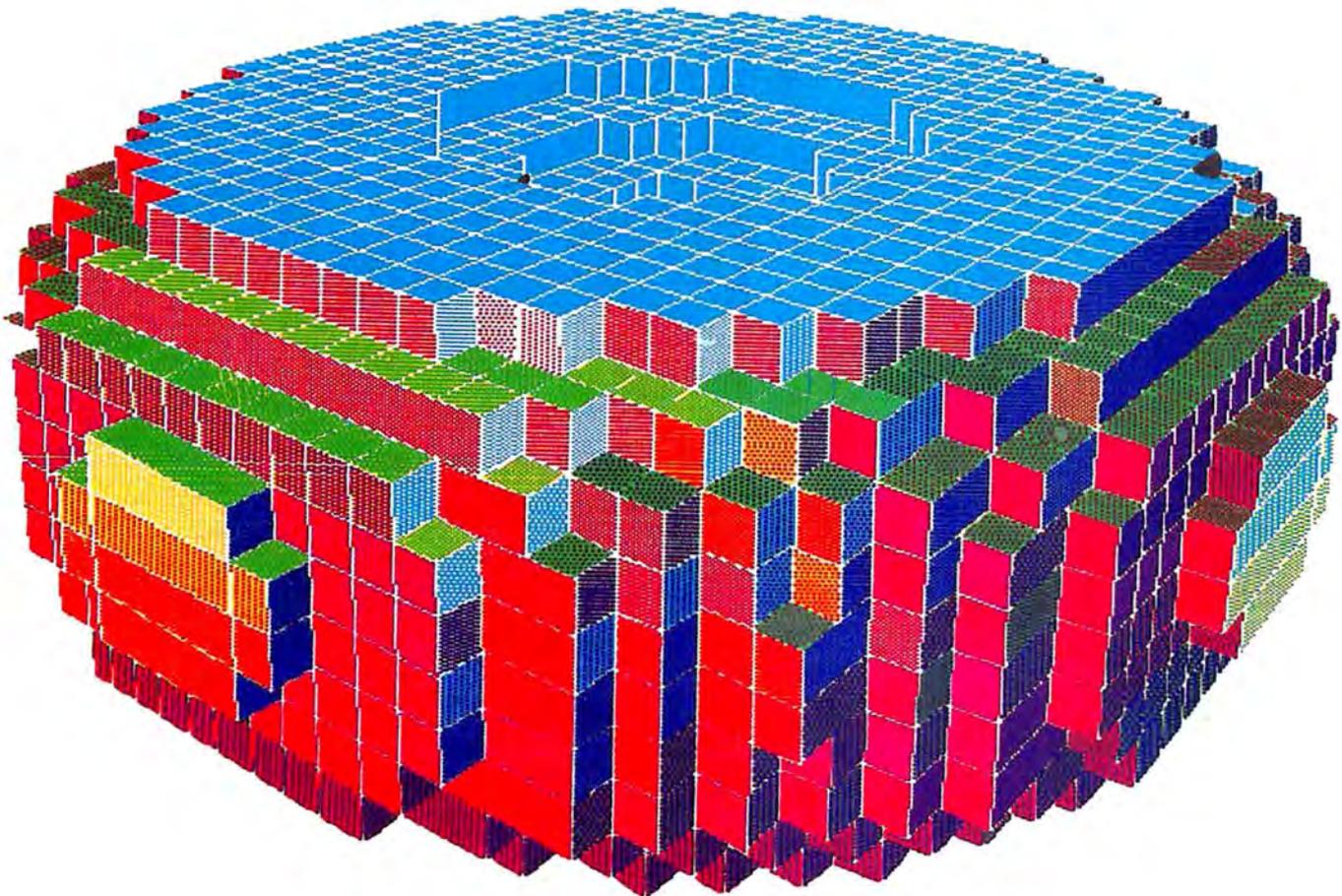
As the technology stands now, laser printers' major drawbacks are price (currently starting at \$3000), lack of color, and somewhat cumbersome form feeding that requires switching paper trays or hand feeding odd-size paper and envelopes. (Some third-party companies have created add-on paper-feeding mechanisms that resolve this problem.)

Based on the xerographic technology that brought us photocopiers, laser printers produce consistently dense characters and graphics. Resolution of laser-generated output is typically 300 dots per inch

(dpi). (In comparison, the type on this page has a resolution of 950 dpi.) For a final, "polished" product, you can combine letter quality text and graphics on the same page (see Figure 2) and even incorporate digitized images (see "Personal Publishing," *PCW*, June 1985).

Laser printers may redefine our expectations of print quality, speed, and quiet operation.

Laser printers vary in their approaches to generating graphics. The Corona LP-300 Laser Printer, for example, can act like an Epson printer and thus take advantage of the multitude of Epson-compatible graphics programs. In addition, the printer has a proprietary set of commands that are more complicated to use than a graphics program but provide greater flexibility and better images.



A laser printer is usually four to six times faster than the fastest letter quality printer; speed is measured in pages per minute (ppm). Although printing text, mixing fonts, and changing character sizes don't affect performance, printing graphics slows a laser printer by 25 to 50 percent, depending on the size of the image.

Color Ink Jet: Rainbow of Hues

If you want to create eye-catching graphics displaying a vivid array of colors, consider a color ink jet printer (see Figure 3). The color range, consistency, and density usually surpass the output from color dot matrix printers. Unfortunately, a color ink jet produces dot matrix quality text at letter quality printing speeds.

On the other hand, monochrome ink jet printers offer higher-quality text at faster speeds. Although color and monochrome ink jet printers are not as popular as impact and laser devices, the improving technology and decreasing prices may make them a good alternative to dot matrix printers.

Ink jet printers spray ink through tiny nozzles to create dots that form images on paper. Color ink jet printers may utilize several color cartridges. Because only a few cartridges can be loaded simultaneously, the number of colors and combinations that can be produced at one time is limited—so be prepared to experiment. Also, be forewarned that ink cartridges clog with some regularity; some ink jet printers are messier than others to operate. Try before you buy.

Major Considerations

You have met the family of printers; now it's time to get better acquainted. You must not only examine print quality but also consider four other important factors: speed, reliability, noise, and cost.

Speed Manufacturers' speed claims for any type of printer are often—intentionally or unknowingly—inflated. They are based on the theoretical capabilities of a printer under ideal conditions, and can omit key factors such as the time it takes for the printhead to make a carriage return or for paper to advance one line. A rule of thumb is that the actual speed for dot

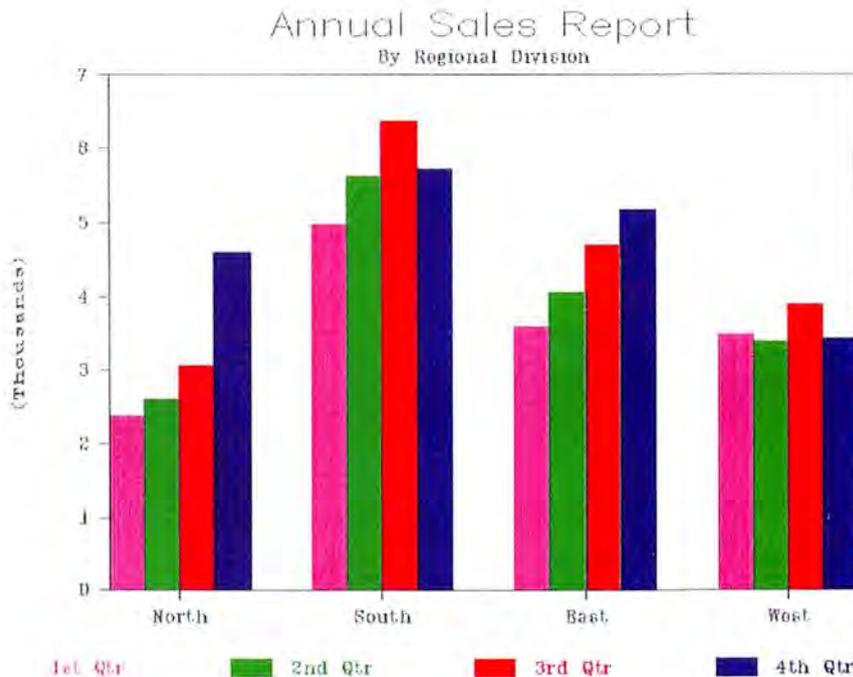


Figure 3: At the leading edge of color ink jet printing, the TC1040 Color Ink Jet Printer from PrintaColor Corporation produces stunning color graphics for a top-of-the-line price of \$5995. Toward the lower end of the price spectrum at \$745, the IBM Color Jetprinter also creates a vivid display for business presentations.

matrix and ink jet printers is 55 to 75 percent of the quoted speed, for letter-quality printers 70 to 90 percent, and for laser printers 75 to 90 percent.

Consider, too, the idiosyncrasies of individual programs (*WordStar*, for example, prints documents more slowly than *WordPerfect*), PC-to-printer communications requirements (parallel connections usually operate faster than serial), and the kind of documents you are printing (letters print faster than engineering reports that contain sub- and superscripts, and engineering reports in turn outstrip graphics every time).

Printer speed is specified in characters per second (cps), except for laser printer speed, which is measured in ppm. Most cps ratings assume 5-character words plus a space, 60-character lines, and pica type (10 monospaced characters per inch). Multiply the cps by 10 to convert cps to words per minute. For example, a printer that operates at 30 cps is printing 300 words—the length of an average business letter—per minute.

Reliability Was your printer made on a Monday morning? There's no sure way to tell. As with all things PC, word-of-mouth and personal recommendations are your best bet for predicting long-term reliability.

Table 1: Dot matrix printers—typical characteristics

Price range	Speed (cps)	Carriage (inches)	Graphics resolution (dpi)	Printhead wires
\$250–\$450	80–130	8–10	Varies greatly; trade-off between higher resolution and speed	9
\$450–\$1000	150–200	10–16	Varies greatly; trade-off between higher resolution and speed	9, 18 (rare)
Near letter quality				
\$500–\$1000	150/35*	8–11	< 144 by 144	9
\$1000–\$2000	200/40*	10–15	144 by 144	9, 18, 24
\$2000–\$5000	400/100*	13–15	72 by 72–240 by 480	9, 18
\$5000–\$8000	1320/165*	15–16	100 by 100	Data not available

*Draft/NLQ modes

Table 2: Letter quality printers—typical characteristics

Price range	Speed (cps)	Carriage (inches)	Graphics resolution (dpi)	Bidirectional tractor price	Cut-sheet feeder price
\$500–\$1000	12–30	13–17	< 120 by 48	\$150–\$200	\$250–\$700
\$1000–\$2000	40–50	15–17	> 120 by 48	\$200–\$300	\$300–\$1600
\$2000–\$3500	55–80	15–17	> 120 by 48	\$300–\$400	\$600–\$2000

But you, the prospective buyer, can take some initiative. First, check the printer shell for durability. Next, lift the printer's hood to examine the print-head, pulleys, gears, and other parts that are most prone to failure. Although not a clear-cut indicator, an abundance of plastic and moving parts could spell trouble.

Technical specifications about long-term reliability can be revealing—when you can get them. *Mean time between failure* (MTBF) indicates in hours the operating time between hardware failures and is calculated by using average failure rates for the printer's various components. *Duty cycle* is the percentage of time per day that the printer is in use. The two factors are interrelated: Generally, the higher the MTBF and the higher the duty cycle, the longer a printer will last. A high-rated duty cycle also means the printer is designed to withstand the rigors of constant use. Printers suitable for business applications are usually rated over 2000 hours MTBF with a 25 percent duty cycle.

The print elements for letter quality and dot matrix printers—daisy wheels and printheads—typically last for 10 to 200 million impressions (daisy wheels are at the low end of the spectrum, printheads at the high end). The result is minimal allocated costs per page—usually less than half a cent. You should determine print element replacement cost, especially for printheads.

Noise Noise does not, to quote a famous writer, “knit up the raveled sleeve of care.” It can, in fact, drive you to distraction. Individual printers vary, but in general dot matrix and letter quality printers are equally noisy, laser printers are relatively quiet, and ink jet printers are the quietest of all. If a printer's racket is too intense, you may have to resort to a sound hood that totally encases the printer—for another \$300.

Table 3: Ink jet and laser printers—typical characteristics

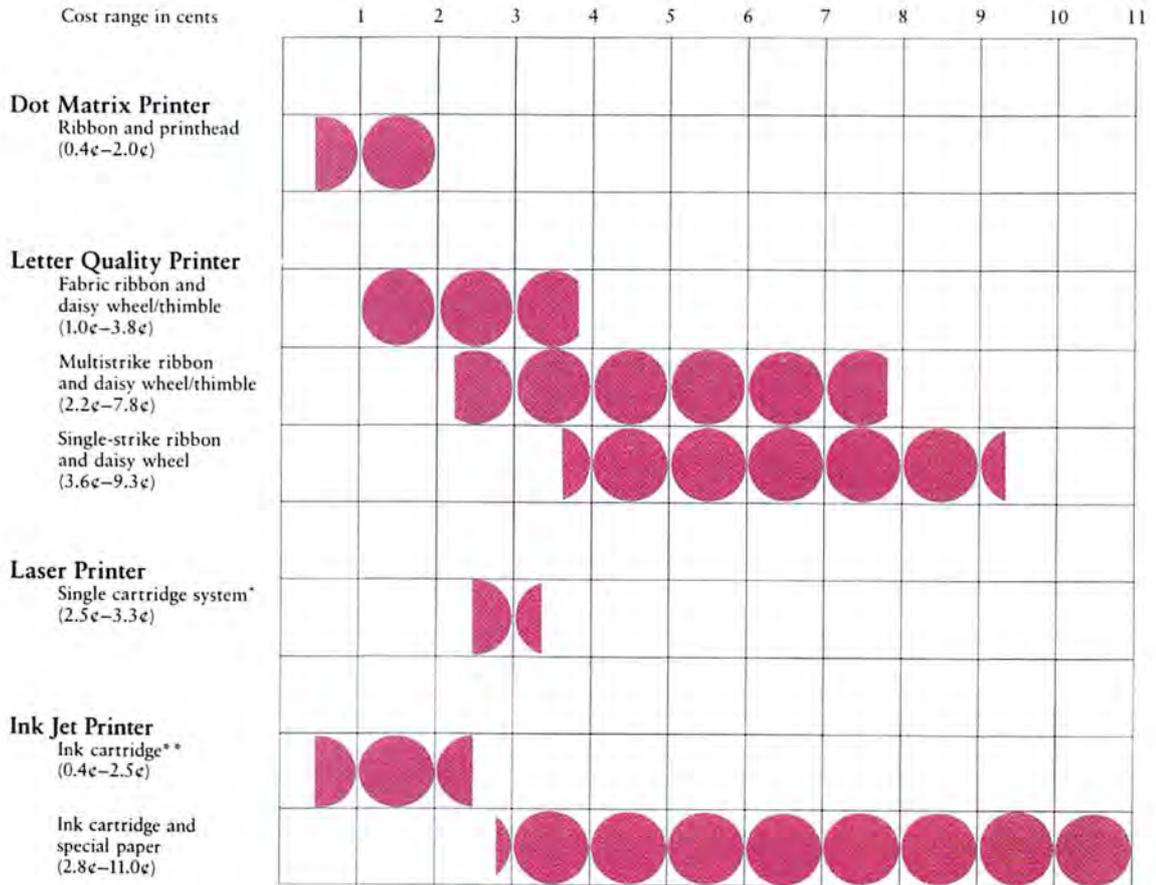
Price range	Speed (cps)	Carriage (inches)	Print resolution (graphics and text)
Ink jet			
\$450–\$1000	40 (color), 150 (monochrome)	8.5–15	70–240 dpi (graphics), printhead nozzles: 4–12
\$1000–\$3000	20 (color), 175–400 (monochrome)	10–17	120–240 dpi (graphics), printhead nozzles: 9–32
Laser			
\$3000–\$8000	8–10 ppm	Single tray—100 sheets (standard)	300 by 300
\$8000–\$19,000	12 ppm	Single or double tray—250 sheets (standard)	300 by 300
\$19,000–\$30,000	24–26 ppm	Single or double tray—250 sheets (standard)	300 by 300

Cost As you scale the heights in quality, number of print modes, and variety of fonts, be prepared to pay more. Dot matrix printers are generally the cheapest of those designed for heavy-duty business use. A simple dot matrix device with graphics capability can cost under \$600; an NLQ printer with 24 pins, three print modes, and eight fonts can run you anywhere from \$1000 to \$2000 (see Table 1).

The old adage—you get what you pay for—applies to letter quality printers. All things considered, they are generally more expensive than dot matrix printers (see Table 2).

Originally pricey mainframe devices costing upwards of \$350,000, laser printers have become available for the PC only in the last few years, at costs of \$3000 to \$7000. The initial cost, although higher than for other PC printers, equalizes over time when you consider the savings on maintenance and consumables. With few moving parts to break down, laser printers are fairly durable. Per page, the cost of a laser printer's consumables—toner and regular, single-sheet paper—may be half that of tractor-feed paper and multistrike ribbons for a letter quality printer.

Some laser printers rely on a single replaceable cartridge holding toner, photosensitive drum, and developer; others segregate these elements into individual cartridges. Laser printers also possess hefty



* Includes toner, developer, drum
 ** Assumes use of regular paper

Figure 4: Cost range for major consumables shown in cents per 300-word page. Costs were figured by adding the ribbon and print element prices for a sampling of the most popular printers in each category; the lowest and highest total are listed here. More expensive color printing prices are not included.

complemente of memory for full-page graphics manipulation—as much as 1.5MB for the Apple LaserWriter. Printer prices rise accordingly.

Ink jet printer prices typically range from \$450 to \$3000 (see Table 3), although powerful color ink jet printers can cost upwards of \$6000. The major consumables cost is the specially treated clay-coated paper recommended for achieving the best image.

As with any purchase, be aware of hidden costs; these include printer maintenance, cables, “optional” but necessary accessories such as tractor and sheet feeders, and consumables such as ribbons, daisy wheels, thimbles (another letter quality print element), ink cartridges, and toner. Most manufacturers offer higher-quality multistrike ribbons as well as lower-quality fabric ribbons (see Figure 4), which have twice the life of the multistrike ones.

Checklist of Features

Now that you’ve considered the major factors affecting a printer purchase, you should have an inkling of which kind you need. To further refine your choice, weigh the following general printer features carefully. They can affect how well a printer does its job—and how much you have to intervene on a day-to-day basis.

Fonts With the proper combination of fonts, a humdrum document can come to life. Most dot matrix printers rely on one or two standard built-in character sets that you can transform with various styles such as condensed or expanded.

Improving a dot matrix printer’s talents is a job for *downloadable fonts*—character sets that are stored in a printer’s memory in addition to its standard character set(s). You can switch fonts in the middle of a page because the necessary characters have been downloaded to the printer. Downloadable fonts are provided by the manufacturer’s software or third-

party font programs, or generated by programs you write yourself.

A few NLQ printers such as the Mannesmann Tally MT86 use downloadable fonts and font cartridges. Letter quality printers require you to switch daisy wheels for different fonts.

Laser printers are particularly adept at using multiple fonts. The HP LaserJet Plus, for example, can mix and match as many as 16 downloadable fonts on a single page and have ready access to another 16. The Apple LaserWriter can theoretically use any number of downloadable fonts on a page. Keep in mind that some laser printers—such as the HP LaserJet—rely on font cartridges; during a print session you are restricted to fonts on an installed cartridge, and you cannot switch cartridges in the middle of a page.

Epson/Diablo compatibility A printer may be labeled as Epson or Diablo compatible—an important consideration, since most word processing, spreadsheet, and graphics programs support these popular

For a final, ‘polished’ product, you can combine letter quality text and graphics on the same page and even incorporate digitized images.

printers. But you may still encounter problems running “compatible” software. For example, your printer may use a different default than the Epson for lines per inch. The result? Graphics and characters that are striped with white bars, as though seen through venetian blinds.

Carriage width and pitch selection A 15-, 16-, or 17-inch carriage is a must for printing large spreadsheets unless you use a utility program that prints sideways. Larger carriages are not standard and so will cost you extra. Epson’s FX-85 and FX-185—two

internally identical dot matrix printers with 10-inch and 15-inch carriages respectively—are priced \$200 apart.

You can compensate on a smaller printer if you can compress text or change pitch—in essence, cramming more characters onto a line. These days even the cheapest letter quality printers offer three pitch selections—10, 12, and 15 characters per inch; entry-level dot matrix printers offer at least three.

Paper handling There are several ways to feed, and occasionally mangle, paper in a printer. The friction approach, common to typewriters, easily accommodates all forms and sizes of paper. Many dot matrix

I *If you want to create eye-catching graphics displaying a vivid array of colors, consider a color ink jet printer.*

printers come with both friction and tractor feed mechanisms. Letter quality printers also typically use friction feed.

To print on fanfold computer paper, you'll need a tractor feed. Small dot matrix printers may have a fixed-width tractor. Adjustable tractors accept any size paper (up to the carriage width) and come in two varieties. Unidirectional tractors pull paper up through the printer, and bidirectional can move paper up and down—necessary for printing subscripts and superscripts, columns of numbers, mailing labels, and some graphics. Bidirectional tractor feeders can cost anywhere from \$150 to \$400 extra. Another option is below-platen sprockets, a feature that lets you tear off a billing form or check without first feeding in—and wasting—a blank one.

The price of single-sheet feeders varies directly with printer cost. A rule of thumb: The more complicated a feeder, the more likely it is to break down. Stick to simple feeders that handle one or two paper sizes; those that tackle paper, envelopes, and labels are cantankerous devices at best.

Another consideration, not to be taken lightly, is whether paper is fed from the front, rear, or bottom of the printer. This seemingly simple process can be unbelievably frustrating if the printer manufacturer hasn't thought it out. Test drive any prospective printer. Snap in the tractor feed, see how easily you can load the paper through the printer's innards, adjust the fanfold paper on the sprockets, and scroll it through the printer. Check whether the paper moves smoothly or bunches up at the sprockets and whether you can manually advance the paper.

Front panel controls Switches for on/off line, line feed, form feed, pitch change, and any other frequently used functions should be located on the printer's front panel for easy access. Preferably, controls for selecting such functions as compressed print should also be in front, but in some instances you may have to learn to access printer commands via a language such as BASIC, or worse, open the printer and flip DIP switches.

Bidirectional with logic seeking This is not the latest California craze but rather a printer's ability to print left to right and vice versa in the most efficient manner. Logic seeking determines the shortest path to the next print position. In other words, bidirectional printers go faster. Keep in mind that a printer may support bidirectional printing in draft mode but not in NLQ, microjustified, or graphics mode.

Buffer A buffer is a printer's data memory. It acts as a reservoir for data heading to the printer, in effect freeing up the PC sooner for other tasks. Storing downloadable fonts may affect the availability of the buffer for printing tasks. Not all printers feature buffers, and not all can be expanded as your needs grow.

Proportional spacing and microjustification The former feature, which allocates a set space to each letter, improves legibility and saves paper, especially in large-volume applications. The latter allows the printer to introduce spaces between words for creating even right margins and truly centered text. Letter quality and laser printers should provide both these features.

Hooking up Making the connection between a PC and a printer requires either a serial or parallel port. Parallel ports are the most widely used and usually permit greater speed, but the printer must be within

Manufacturers' speed claims for any type of printer are often—intentionally or unknowingly—inflated.

10 feet of the computer. A serial port lets a printer increase that distance another 40 feet. Some new printers are not restricted to one type of port; many can be purchased with removable serial and parallel interfaces.

As with all accessories, the necessary cables must be purchased separately. Cables can cause severe headaches—they come with several types of connectors, both male and female. Additionally, cheap cables often lack wires to some pins; though a cable may work for one model, it may not be sufficient for a model with more features.

Kick the Tires

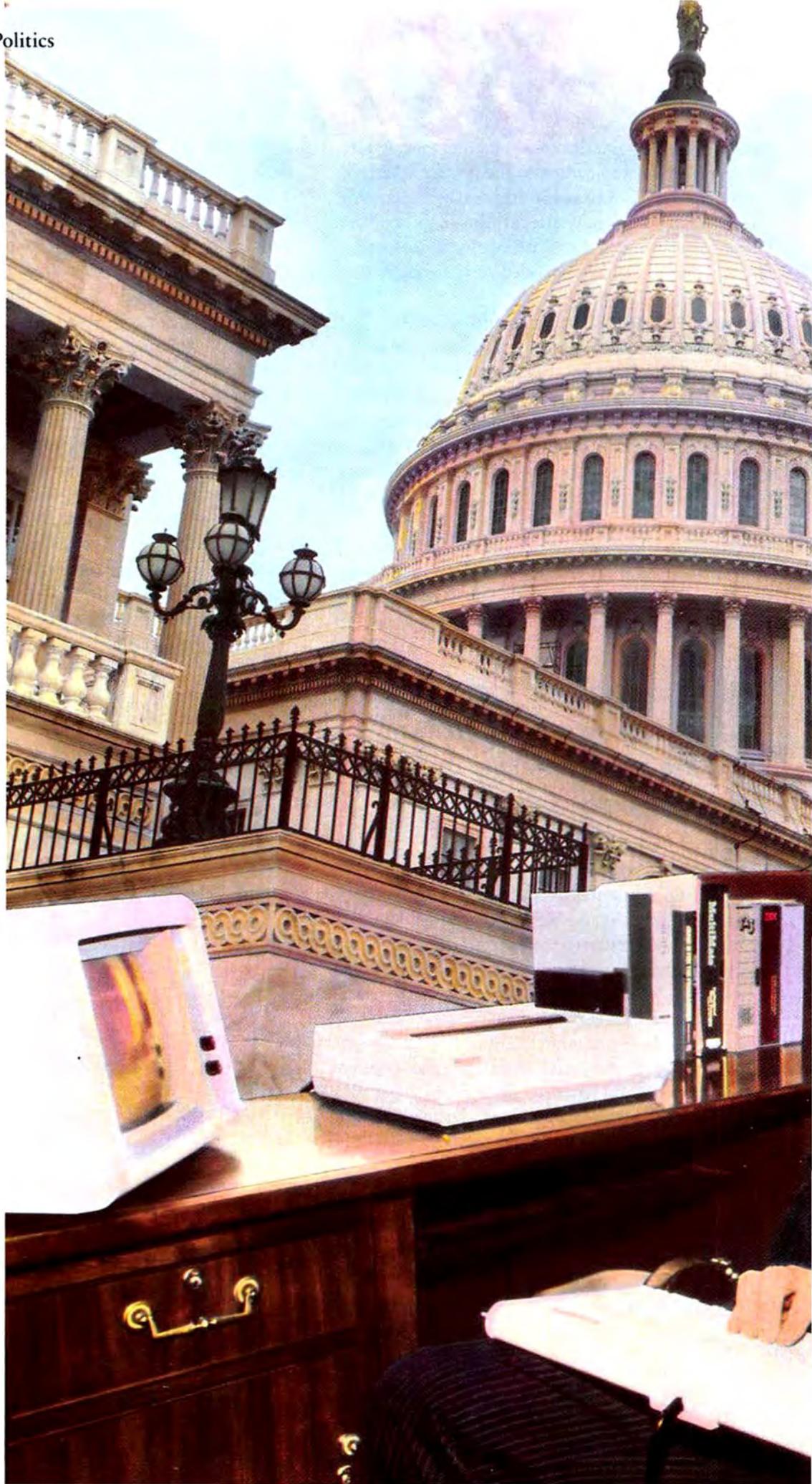
Evaluating print quality is largely subjective. Typically, the same document produced on two printers with identical technical specifications will vary in appearance. The wise course of action is to obtain sample output, or better yet, test the printer using your own letterhead and forms, and compare them to a typewritten standard.

Ask the salesperson to demonstrate installation, and check whether a diagnostics disk comes with the printer, along with comprehensible documentation.

A printer should come with at least a 90-day parts and labor warranty. Find out if you can get an extended warranty from the manufacturer or a third party; obtain all service agreements in writing. Mail-order firms offer printers at 20 to 45 percent off retail, but be wary of the potential pitfalls. (For related information see "Mail Order Drives" in "Sensible Storage," *PCW*, August 1985.)

Buying a printer need not be technically formidable, but ferreting out the information you need is a challenge. Take heart—doing your homework on basic printer facts will pay off when you make the right decision. ●

Don and Sharyn Conkey have sold, supported, and programmed computers for 17 years and are currently preparing training materials for PC users.



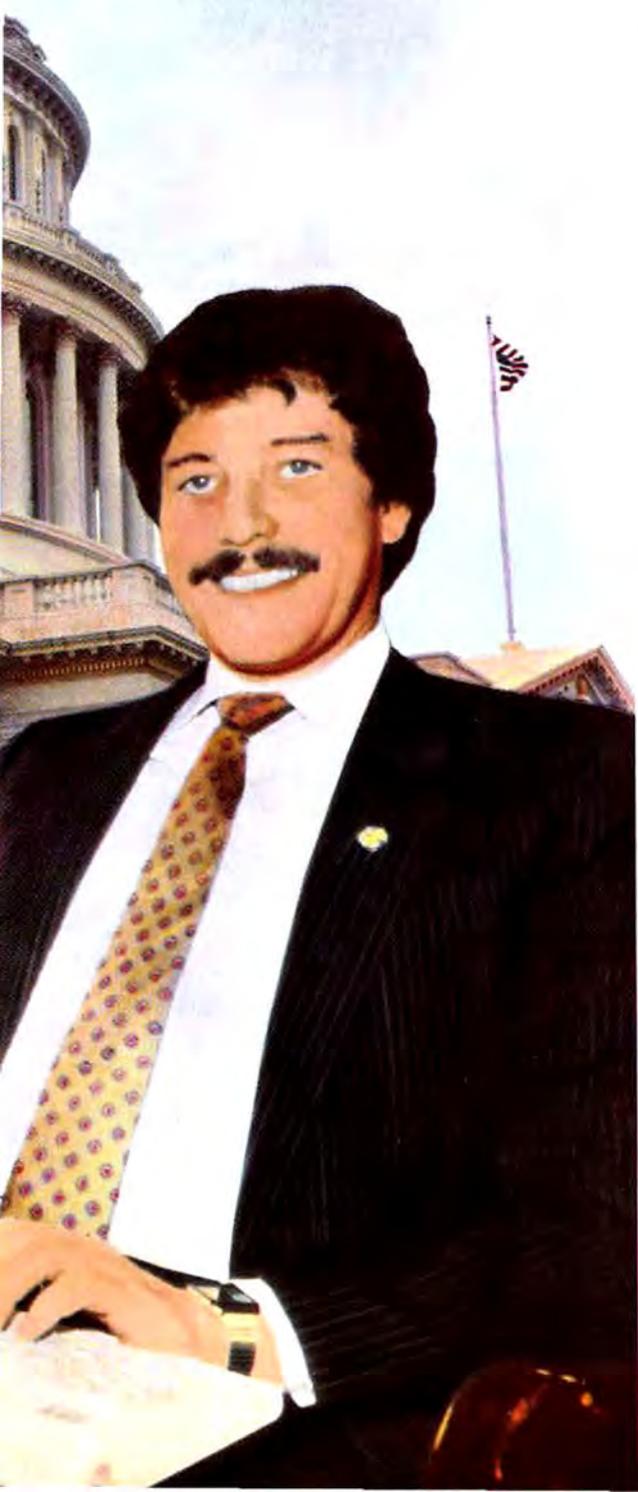
Computerizing Congress

Congress has turned to PCs to channel a rising tide of mail and keep track of an increasingly complex bureaucracy.

Edward Segal

||||| As one politician puts it, "When you're up to your waist in alligators, it's hard to remember that the goal is to get out of the swamp." Over the last 15 years, the Congress of the United States has slowly learned to ignore the alligators, climb out of a deepening swamp of paperwork, and join the computer age. Although minicomputers still dominate, PCs are increasingly being used to answer mail, draft bills, generate charts, and log on to information services.

Traditionally, Congress embraced new technologies soon after they were perfected—electric lights in the 1890s, an underground subway system in 1915, air conditioning in the 1930s, and electric typewriters in the 1940s. But as technology grew more sophisticated, Congress became more reluctant to change, fearing that new gadgets would somehow destroy the purity of the legislative process. Consequently, it was not until 1973 that the House of Representatives worked up the courage to permit electronic voting. Thanks to the computerized voting system, House



Bob Carr—Computer Crusader

An IBM PC AT sits on a credenza next to Bob Carr's desk in the marbled Rayburn House Office Building. A bookcase filled with magazines, instruction manuals, and computer books stands nearby. Representative Bob Carr (D-Michigan) symbolizes a new breed of lawmakers who actively seek to make PCs an integral part of their congressional lives. A former attorney, Carr was first elected in 1974, defeated in 1980, and elected again in 1982. During his two years between terms Carr found time to learn about PCs. "I taught myself about personal computers and programming by reading everything I could get my hands on," he relates. "If Bob Carr can learn this stuff, then anybody can."

In 1984, Carr asked HIS to design a multiuser network system for his six-person Washington office to replace a comparatively costly and bulky minisystem. HIS cabled together several PC ATs and a 72MB Novell hard disk server controlled by Novell's *Netware/E* software. Recently, an HP LaserJet Printer was added, thus speeding up the answering of mail. Carr's network is the first to be used in a House office.

Carr primarily uses *dBASE III*, *1-2-3*, and *pfs:file* for office automation. Large word processing projects are done with *MultiMate*, while *pfs:write* is used for simple correspondence chores.

Plans call for additional PCs and modems to be placed in Carr's East Lansing and Pontiac district offices so they can exchange legislative, case-work, and scheduling information over phone lines instead of sending disk copies back and forth in the mail.

Experience with computers, or at least an open mind about using them, is now an important criterion when Carr hires staff. "If they are part of the old typewriter bunch and have a 3-by-5 card mentality, they probably won't fit into this office, no matter what other skills they might bring to the job."

When his personal secretary retired, Carr experimented to see if such secretarial chores as scheduling, relaying messages, and answering correspondence could be parceled out among the rest of his staff. With the help of the AT, the experiment appears to be working.

Carr, who may be the first member of Congress to deliberately fill a staff position with a PC, says, "I need a personal computer, not a personal secretary."

Carr says that many of his congressional colleagues feel they can't assert control in their office unless "information is hard and physical and stored in drawers and cabinets. But if it's on bits and bytes and they need somebody to tell them how to retrieve it, they experience a deep feeling of loss of control."

The remedy to this Hill technophobia, Carr says, is for legislators "to know as much about computers as anybody else in the office. If my entire staff called in sick one day, I could operate the office myself."

However, Carr concedes he may be a special case. "It helps to be a good typist. I can see how some members are handicapped because they can't type."

While Carr has come a long way in automating his operations, he wants to go further. "I'd like to be able to answer more of my constituents' calls personally and have a data base I can call up to see how we have helped them in the past and what their concerns are."

Carr is also considering setting up a computer bulletin board to communicate directly with some of the people he represents, including students at the University of Michigan who use PCs. "I have a lot of people sending me letters generated on dot matrix printers," says Carr. "They ask me why they can't correspond with me through CompuServe or some other service."

Despite Carr's enthusiasm for personal computers, he acknowledges that a PC does have some limitations on Capitol Hill. "It isn't very good at shaking hands."

members now take 15 minutes to vote instead of an hour, saving an estimated 60,000 person-hours each year.

Early uses of computers in Congress included installation of terminals on the floor of the the House of Representatives. The two Democratic and Republican leaders used computer consoles to help keep track of how members voted. Now if a party

By the end of this year, 95 of 100 senators and more than half of the 435 representatives will have computers in their offices.

leader notices that a colleague has not yet voted, he or she can dispatch an assistant to remind the representative to vote before time runs out.

So far, the House and the Senate have been slow devising a comprehensive computer system plan, but where Congress as a body has generally feared to tread, its individual members have been eager to rush in. Otherwise, they would drown in a deepening morass of congressional committee reports, letters from constituents, and countless demands and requests for paperwork. By the end of this year, 95 of 100 senators and more than half of the 435 representatives will have computers in their offices. While minicomputers dominate in the Senate, the number of PCs in the House has increased to 300, a figure that is expected to double over the next few years.

It Came From the Business Sector

An important factor in the acceptance of computers in Congress is the influx of business professionals who have been elected to Congress or have been hired as staff. A growing number of representatives, senators, and their aides have used PCs in their previous jobs in the private sector (see the sidebar "Bob Carr—Computer Crusader").

on the Senate floor. The PC-compatible Compass contains a data base of previous parliamentary decisions and legislative histories of bills considered since 1980. For less recent histories, the aides can log on to

Most representatives have a free hand in deciding whether, when, and how to computerize.

the Senate Computer Center's on-line data bases with the Grid's telecommunications software, *Term*.

According to Alan Frumin, the assistant parliamentarian, the portable saves him valuable time that would otherwise be spent thumbing through volumes of printed congressional history. "I shudder to think what my job would be like without it," says Frumin.

To automate key office operations as quickly as possible, the Senate is in the midst of implementing a master plan. After several months of reviewing the

equipment of major vendors and conducting hands-on tests in the offices of a dozen senators, the Committee on Rules decided to restrict hardware selection to minicomputers offered by Data General, Honeywell, and Prime.

According to the Senate's master plan, by the end of 1985 an estimated 4000 terminals will be installed on the desks of receptionists, personal secretaries, administrative and legislative assistants, and press secretaries. The minicomputers will be supplemented with less than 100 IBM PCs, which will run *1-2-3* and *Answer* software to keep track of office expenses.

The PCs will also be used to access legislative information services provided by the Senate Computer Center. The center trains 1500 Senate aides each year on computer equipment and uses high-speed laser printers to churn out documents, including more than a million letters a month to constituents.

**HISTORICAL DEFICITS
1947-1988
(In billions of dollars)**

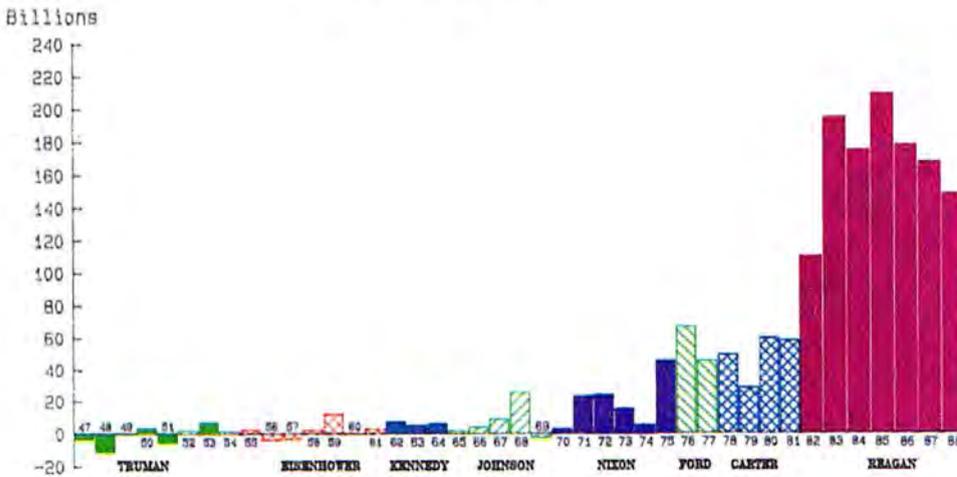


Figure 2: A Graph-writer bar chart generated by the House Budget Committee gets the point across faster than numerical statistics.

1985-1988 figures are President's Fiscal Year 1986 Budget.

House Budget Committee February 4, 1985



Freedom of Choice in the House

The House of Representatives has no master automation plan comparable to the Senate's. Most representatives have a free hand in deciding whether, when, and how to computerize. Moreover, their diversity of interests is not well served by a master plan. The same PC and software package used by a member who represents an urban district may not meet the needs of a farm district representative.

The House Information Systems (HIS), a department under the direction of the Committee on Administration, is responsible for all automation and communications technology in the House. The department oversees and consults on the acquisition, installation, and maintenance of computers. Training is another important function of HIS. Last year, the department trained hundreds of Hill aides and 50 representatives.

House leaders have demonstrated a comparatively liberal hands-off policy as to how members run their individual offices, as long as they follow certain general guidelines and choose from the approved equipment list issued by the Committee on House Administration. As of this writing, that list includes eight brands of word processing software, ranging from *pfs:write* to *MultiMate*; integrated packages

such as *Framework* and *Symphony*; *Multiplan* and 1-2-3 spreadsheets; data base managers such as *dBASE III* and *Data Base Manager 2*; and a long list of modems and printers. IBM PCs and compatibles predominate, but the Wang Personal Computer and Apple's Macintosh are also on the list.

Only a few of the more than 200 House committees and subcommittees now use computers. The Budget Committee, which analyzes spending proposals submitted by the president and monitors the status of all federal spending, uses PC XTs to produce continuously updated charts, tables, and graphs to help legislators make sense of an avalanche of statistics on how taxpayers' dollars are being used (see Figures 1 and 2). The committee has already installed seven XTs in the last few months, with more on order. Staffers rely heavily on *dBASE III*, 1-2-3, and *Graphwriter*.

Sue Harker, a Budget Committee information specialist, says the PCs "have improved our efficiency and effectiveness by 100 percent. Budget analysis tasks that used to take us hours now take minutes."

On Line on the Hill

Along with computer troubleshooting, HIS provides access to 11 on-line information and 6 administrative services through its Member Information Network (MIN). The MIN services enable congressional staffs to instantly retrieve facts, figures, and summaries of everything from the latest vote taken on the floor to the last federal contract awarded in a particular district.

One of the most popular services is from The Associated Press. The AP gives congressional aides access to its news wires in Washington, the 50 states, and all foreign capitals. Press secretaries can enter keywords to check on developments in any legislative area or simply print out all the news currently on the wire. It's a convenient way for congressional staffers to keep abreast of late-breaking news and lets the press secretary quickly determine how well the boss is being covered by the media.

The Legislative Information and Status system (LEGIS) provides daily briefings on the details and status of thousands of bills, resolutions, and amendments that have been introduced in the House and Senate (see Listing 1). The House Floor Proceedings

(FLOOR) contains the results of all votes, constantly updated summaries of debates, and notices of scheduled legislative agendas.

The latest information on federally funded programs is detailed on four different data bases. Statistical profiles of congressional districts, cities, towns, counties, and states are found in the Geographical Profiles service (GPRO). The Economic Indicators (ECON) provides offices with daily updated economic statistics about the national business climate. Additional research and overlapping legislative services are also available through the Library of Congress's Congressional Research Service.

■ Snubbing the Alligators

"Computer technology hasn't changed the legislative process," says House Republican leader Bob Michel of Illinois, "but it has added new dimensions to it."

Some of these dimensions are becoming apparent. When the 100th Congress meets two years from now, PCs will likely be the computer of choice in the House and will be fully integrated with other automation systems and information services; networking

among district offices will be commonplace, and constituents may communicate with their representatives by modem. A few legislators are already drafting laws on their PCs, and eventually printed copies of bills may be eliminated in favor of electronic versions. Some representatives may prefer to vote from their offices rather than make countless trips to the floor to vote in person.

Already, the halls of Congress ring with debates about the extent to which traditions should be tampered with to achieve efficiency. Yet, it seems clear that more computer technology will be necessary in order to effectively govern an increasingly complex nation. Congress has taken the first step by ignoring the alligators and trying to put its House (and Senate) in order. ●

Edward Segal, a Washington-based freelance writer, is also the press secretary to Congressman Mickey Edwards (R-Oklahoma).

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DS          ***** 99th CONG. STATUS PROFILE FOR S.610          *****
SPONSOR..... Mathias
DATE INTRODUCED... March 7, 1985
SENATE COMMITTEE... The Judiciary
OFFICIAL TITLE... A bill to amend section 1030 of title 18, United
                  States Code, to clarify coverage with respect to
                  access to computers operated for or on behalf of
                  the Federal Government.
COSPONSORS..... 3 CURRENT COSPONSORS --
  Mar 7, 85 Referred to Senate Committee on The Judiciary.
  May 9, 85 Referred to Subcommittee on Constitution.
  May 9, 85 Referred to Subcommittee on Criminal Law.
  May 10, 85 Committee on Judiciary requested executive comment
              from Justice Department.
COS          COSPONSORS..... 3 CURRENT COSPONSORS --
AS INTRODUCED... Leahy, Kennedy, Cohen.
BILL DIGEST .... Mar 7, 85. Amends the Federal criminal code
to make it a Federal offense to knowingly access a U.S. Government
computer without authorization or with authorization for
unauthorized purposes and by such conduct use or disclose
individually identifiable information which is protected by the
PRESS RETURN TO CONTINUE OR ENTER A REQUEST.

Privacy Act.
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Listing 1: A status profile of an anti-hacker bill on the LEGIS information service. Congressional aides use PCs increasingly to log on to information services and to track legislation, research federal grants, and follow the latest news.

Handoff to the PC

Sneaking in the back door via scouting and personnel departments, the PC is now competing with minicomputers in football coaching and play analysis.

John Faulkner

■■■■ Behind 20 to 17, on fourth down with inches to go and 12 seconds left in the game, the coach of the New York Jets makes the play call. The success of the play hinges on a myriad of factors, but the process of selecting it depends heavily on the game analysis provided by an IBM PC AT and customized software.

What was once scoffed at as a toy has become the mainstay of the last four National Football League (NFL) championship teams. Computers are used for everything from accounting, word processing, and personnel in the front office to scouting, play analysis, and player evaluation by the coaches and training staff.

As game plans become more sophisticated and parity balances the competition, the edge the computer gives a team can be subtle but significant. That a team can still compete without computer-aided game plans is a credit to the old school, but noncomputerized teams are rapidly disappearing. Almost all NFL teams now use computers in some phase of their operations, and the last eight teams that went to the Super Bowl depended on computers for game preparation. Roughly half the NFL teams use Qantel minicomputers and Sports-Pac customized software, but PCs are fast making inroads into all phases of the game. One team—the New York Jets—has converted completely to the PC.

■ The Computerboys

The use of computers in college and pro football has proliferated since Hank Stram's early days as an assistant coach at Purdue. In 1948 Stram experimented with a prototype computer to track player performance and evaluate play execution. Later, as head coach of the Kansas City Chiefs, Stram revolutionized the offensive

playbook with the aid of a computer by developing what is now called the multiple offensive set.

The Dallas Cowboys were the high-tech pioneers of pro football. In the early sixties the Cowboys' scouting department began using computers to track likely prospects. Later the offensive coaching staff switched to data processing to evaluate opponents' defenses. By the end of the decade the "Computerboys" were utilizing the computer in every phase of the game, while earning a reputation for a coldly efficient game plan.

The Cowboys currently use the Qantel/Sports-Pac system to track pro personnel, identify opponents' play selection tendencies, and evaluate their own players' performances. League rules require NFL teams to exchange their last three game films with the upcoming opponent. The Cowboys' coaches break the films down into the play-by-play, converting the plays into data that is fed into a spreadsheet. "What-if" questions are posed to determine probabilities



or tendencies on a multitude of down and distance situations. The Sports-Pac software can even take into consideration the time left in a particular quarter.

"The computer is really a broad brush stroke," says Dan Warner, Cowboys business manager. "It's a time-saver. You can do the analysis by hand, but with the computer you save about five hours."

The next step is to present the information to the players to help them prepare for the following week's game. The stereotype of the lumbering, slow-witted football player is a thing of the past. "Most people don't realize how much time the players spend in the classroom," says Warner. "It's two to one, classroom work to field work."

On Monday morning the players are handed "take-off sheets" listing hundreds of situations, which they are expected to digest in addition to their playbook. Defensive players usually receive raw spreadsheet data, while the offense generally looks at tendency charts of their opponent's defense.

NFL quarterbacks rarely see spreadsheet data until it's been analyzed and summarized by the coaches. "The printouts are available to us, but we don't usually look at them," says Joe Montana, quarterback for the San Francisco 49ers. "Coaches deal with them. I'm not involved in the selection of the plays unless something happens along the sidelines and the play doesn't come in on time."



The New York Jets' Mike Faulkner, assistant to the head coach, uses an IBM PC AT with customized software to analyze opponents' play selection tendencies. The Jets were the first NFL team to use ATs as replacements for costly minicomputers.

■ **The Vikings vs. Probability**
In the Minnesota Vikings camp, both offensive and defensive players receive summaries of spreadsheet data, says Mark Trestman, now in his first year with the Vikings as offensive backfield coach. As University of Miami head coach, Trestman last year brought quarterback Bernie Kosar to national prominence. "We use the readouts to determine tendencies in terms of percentages," says Trestman. The Vikings coaches determine the tendency percentages for such elements as coverage, fronts, and blitzes.

"I get a better feel for the team doing the analysis by hand," says Trestman, although he is quick to add that he's willing to learn new ways. "Everyone else here relies on the computer quite a bit. I'm open to learning."

The Vikings coaches use a DEC 11/780 to evaluate tendencies, which Dr. Mike Eayrs, director of research and development, prefers to call probabilities. "The closer the situation is to normal, the

harder it is to predict the probability of what play decision an opponent will make," Eayrs explains. "The more abnormal the situation, the more probability that they will react in a certain way." As Eayrs points out, there is a big difference between a situation when your opponent is first down and 10 on their 20-yard line at the start of the game (low probability) and when your opponent is trailing 20 to 17 on fourth and inches at your 20-yard line with 16 seconds remaining in the game (high probability).

Eayrs says that the computer functions primarily as a sorting tool and validation check. "The coaches normally know what play they want to call. The computer serves as a double check or confirmation of that decision."

■ **PC Play Action With the Jets**

The IBM PC AT was put to the test by the coaching staff of the New York Jets for the first time last year, and they've never looked back. They phased out the time-sharing system they had used for four years and converted to a system using ATs, XTs, and Compaqs.

During training season the personnel department at training camp can communicate with the public relations department at headquarters using IBM PC XTs equipped with *Smartcom* communications software. Now, detailed roster changes can immediately be transmitted home and dispersed to the sports media.

Because injuries play an important role in pro competition, training and medical treatment have been given more emphasis on NFL teams. A number of NFL trainers have turned to computers to aid in diet and exercise programs and to keep tabs on the increasingly complex field of sports medicine. Jets trainers use a Compaq Deskpro to track players' medical information, including histories and treatments.

Before the purchase of their ATs, the Jets' game analysis was done by hand. According to Jim Royer, director of player development, the Jets' analysis software, written in APL, is just as good as the Qantel/SportsPac system, but with some distinct advantages. "The bottom line is the AT does the job for the price," says Royer. "We paid \$6000 for something a team with a mini is paying several thousands more for. Response time may be milliseconds faster on a mini, but the response time we get is fine."

Another advantage of the AT is that the coaches needn't call in an outsider when they encounter a technical problem. Says Royer, "When you use a mini you're dependent on an outside source.

With the AT, I can do it myself." Royer has investigated fringe peripherals, such as a board to allow voice input and a graphics animation program to show plays in motion, but so far he is hesitant to spend the extra money. "I'm not a hardware freak. Things like that are just icing on the cake."

■ Overshift to PCs

The PC is also beginning to figure in other teams' futures. The Cowboys are exploring a change from the Qantel system to the PC, with an eye toward setting up local area networks. "We're definitely moving in that direction," says the Cowboys' Warner. "Several years ago that wasn't viable, but now a PC can handle the statistical demands required to analyze game data."

The Vikings have already introduced IBM PCs, and they use them primarily in the front office. The public relations department uses PCs extensively for press releases, information stories, and electronic mail.

Programmer Warren Kulick of the Denver Broncos says the organization recently incorporated PCs into its minicomputer system. When the Broncos upgraded their IBM System 34 to a 38, they began to use PCs as intelligent workstations.

However, PCs have taken on other roles in the organization. During home games the Broncos use a PC as a terminal in the press box to key the play-by-play into the remote System 38. By the end of the game, they have several statistical configurations that are particularly useful to the sports press.

Last year the Broncos began using portable Kaypros in their

scouting department. More than a dozen Kaypros out in the field telecommunicate scouting reports daily to the Denver home office.

Kulick says the Broncos are interested in developing a graphics animation application that would diagram plays in motion, just as the coaches now do by hand. A similar application has been incorporated in the NFL licensed simulation game *NFL Challenge* (see "NFL Challenge: Play-by-Play" in this issue). "We expect to have that capability in a year or two," says Kulick.

■ Adding to the Arsenal

The amount of information a football organization must coordinate—from the coaching staff's statistics to the training table regimen and the intricacies of players' contracts—is staggering. Over the years, computers have proven to be time-savers, giving coaches extra hours to devote to their players and other tasks. Increasingly, coaches have turned to PCs to save money as well as time. A computer cannot compensate for a lack of talent on the playing field or bad coaching decisions, but given a good roster and coaching staff, the computer becomes a formidable weapon in a team's arsenal. ●

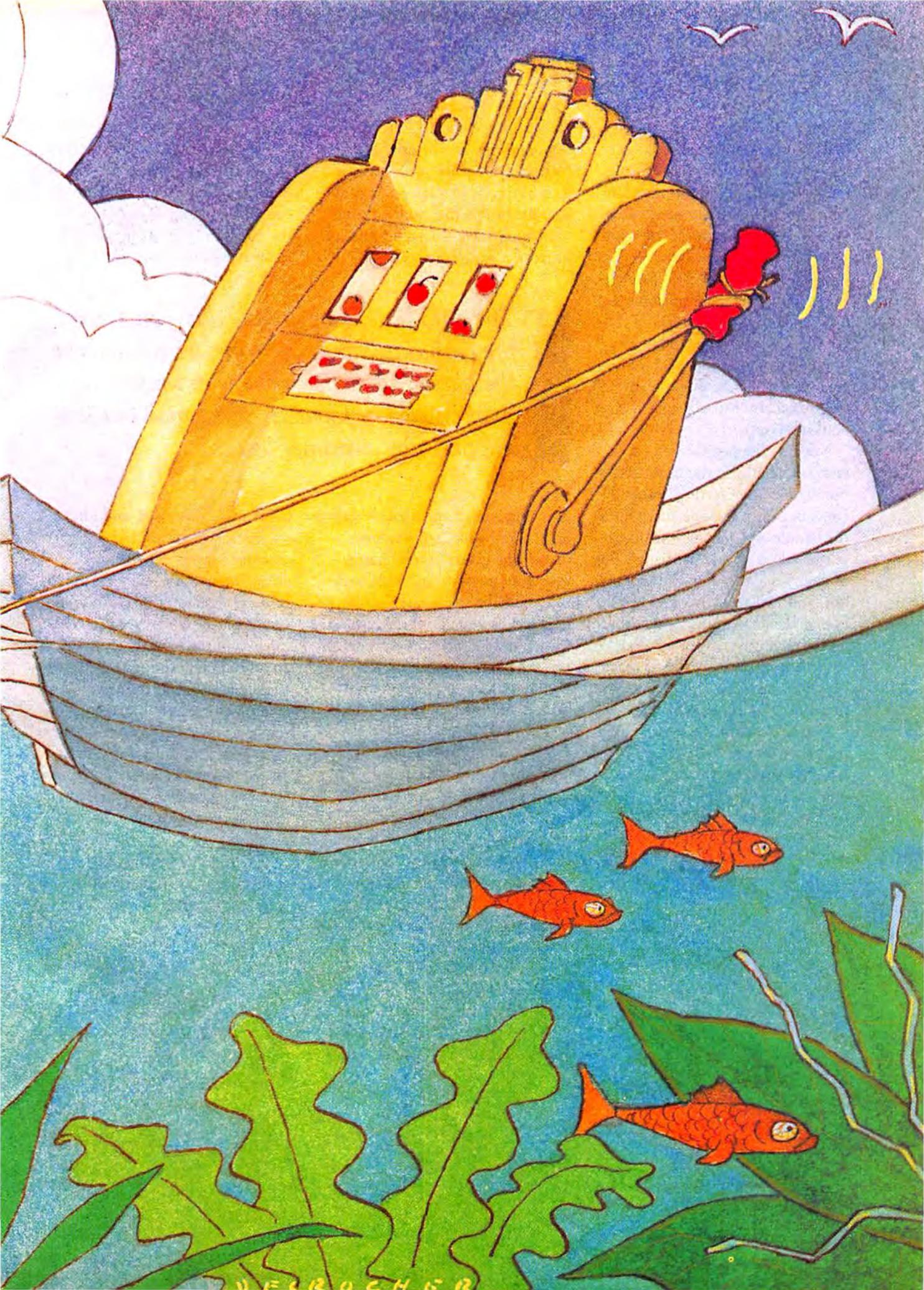
|| *John Faulkner is a freelance writer living in San Francisco.*

The Odds Always Favor the House

A new breed of slot machine, silently overseen by XTs, can make you feel good even as it cleans out your billfold.

Eric Olsen





Imagine this scene: Your pockets bulging with change, you saunter into a casino, intent on a modest evening of fun among the one-armed bandits, an hour or two of harmless diversion until your money or your arm gives out. But before you drop a single nickel into that bottomless pit, you slip a small plastic card bearing a magnetic strip into a box perched atop the machine, a card not unlike the automated teller card you use to get cash after banking hours.

Nothing happens at first—at least not anything you'd notice—but while you're feeding those coins into the machine and pulling the handle and staring transfixed at the kaleidoscopic whirring icons of cherries and plums and what-not, your existence is being acknowledged. Via fiber optic cables laid beneath the carpet, in a back room one of several PC XT's (each of which can serve up to 1000 slot machines) takes note.

The XT scours a data base for pertinent information about you, which it dispatches via other fiber optic cables through another XT functioning as an IBM PC Network file server, to still another

XT up on the floor, where the slots manager is working. Moments later, before you've really dipped into your cash reserves, before the biceps that are working the handle have felt even a twinge of pain, a waitress proffers a

the PC Network that links them. Prior to receiving a plastic card, players fill out a questionnaire on their preferences in entertainment, eating, drinking, and so on. With the aid of an XT, the house adds to an ever-expanding data base

The data base does double duty, enabling the casino to lavish appropriate goodies on the player while he or she is in town—and then engage in focused, direct-mail marketing once the customer leaves.

knowing glance and arrives with a Scotch and soda, your favorite drink. She greets you by name, asks how the wife and kids back in Omaha or Minneapolis are doing, tells you about the various shows and lounge acts coming up—she happens to know you're a big fan of Wayne Newton—and wishes you the best of luck.

Gamboling Along

At Harrah's Marina in Atlantic City, the XT has indeed become the slot machine's silent partner. The casino is the first in the nation to deploy an innovative turnkey system from Electronic Display Technology (EDT) that monitors slot machine activity and tracks players both on the scene and away from it. EDT, based in Las Vegas, designs and builds the black boxes (also known as data collection units), writes the software, outfits the XT's, and sculpts

the names, addresses, and idiosyncracies of committed slot-machine players. The data base does double duty, enabling the casino to lavish appropriate goodies on the player while he or she is in town—and then engage in focused, direct-mail marketing once the customer leaves. If the casino is hosting a title fight between Marvelous Marvin Hagler and his next victim, for example, it's a snap to target announcements to boxing aficionados in lieu of conducting a mass mailing with dubious success.

The impetus for this sudden curiosity about customer whims and wants is the gruel on which the

gaming industry feeds: money. An increasing number of casino operators are recognizing that profits don't accrue from high rollers but from volume operations, which in the casino business means slot machines. Slots may not possess the glitz of roulette or baccarat, but they're the golden goose for virtually every casino, with a guaranteed, house-controlled "hold" of 3 or perhaps 4 cents of every dollar played. In Atlantic City alone, casino operators bus in a million players a month, many of whom inevitably play one of the city's 14,000 slot machines.

Still, a slot machine with no one to nourish it is just so much plastic and metal studded with flashing lights, which is why casino operators spare no expense, including a computerized slot machine monitoring system like EDT's, in their quest for the casino industry's Holy Grail: total slot utilization.

■ Dialing for Dollars

Whatever the motivation, for players this new pitch translates into goodwill and service with a capital S. "The small-stakes players hear how the high rollers are treated—and now they can get that same attention," says EDT president William Dukes. The gambling might not be high stakes, but at \$800 to \$1200 per slot machine for EDT's system, the costs of player tracking are.

Slots devotees not only receive attention, they accumulate points based on how much they play—points that can be exchanged for free rooms, drinks, shows, prizes, and other perks. At the same time XTs on the network are trying to keep the customer satisfied (and in the building), other XTs are handling accounting and maintenance chores and recording coins deposited into each machine, handle-pulls, and coins paid out.

Harrah's tapped EDT's PC-based product rather than a mainframe- or mini-based system largely for reasons of reliability and data security. System developers felt it would be harder for miscreants to tamper with a number of PCs, one of which stands idle in the event another fails. For its Harrah's installation, EDT endorsed fiber optics as a means of keeping the thicket of wires to a minimum, satisfying an FCC requirement governing interference, and obtaining the enhanced security that fiber optic cable offers.

The system is new, however, and not without bugs, according to Alice Parker of Harrah's Marina, which has now tied 400 of its 1600 slots into the system. "From a player's standpoint it's been a great success, despite a few ups and downs," she says. "Since we installed the system, we've added 150 more slots."

Nothing succeeds like success, of course. At this writing, Harrah's Reno and Harrah's Tahoe have become the latest to embrace the EDT system, trusting their slots to the 8088. Which just confirms my suspicion that casinos are among the institutions least likely to gamble. ●

Eric Olsen is a freelance writer based in the San Francisco Bay Area.





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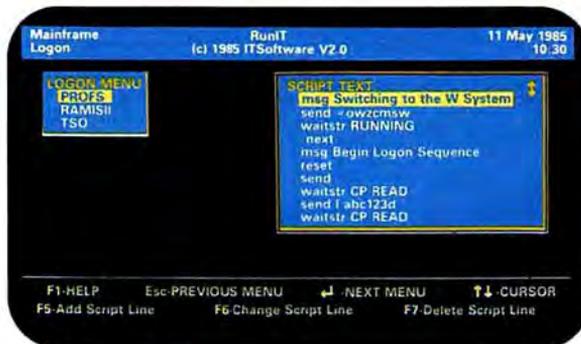
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Variable Card Size	YES	NO Files	NO
Multiple Card Decks	YES (1-10)	NO Files	YES
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Max. Characters Per Card	969	NO Files	480
Search	YES	NO Files	YES
Auto Alphabetize	YES	NO Files	YES
Print Card or Deck	YES	NO Files	YES
CALENDAR			
Daily Notes	YES	NO	NO
Mark Important Days	YES	NO	NO
APPOINTMENT BOOKS			
Multiple Appt. Books	YES (1-10)	NO	NO
"Things To Do" List	YES	NO	NO
Print Appointment Book	YES	YES	YES
ALARM CLOCK			
Display Time	YES	NO Alarms	YES
Hourly Chimes	YES	NO Alarms	NO
Display Alarm Message	YES	NO Alarms	NO
Number of Alarms	9	NO Alarms	Many
CALCULATOR			
On-Screen Tape	YES	NO	NO
Printing Tape	YES	NO	NO
Percentage Function	YES	NO	YES
Display With Commas	YES	NO	NO
Floating/Fixed Decimals	YES/Both	Fixed	Floating
Memory	YES	YES	YES
Insert Result in Work	YES	YES	YES
Max. Display Digits	15	18	12
Exponential Notation	YES	NO	NO
* Binary/Hex/Octal	YES	YES	NO
ASCII TABLE			
	YES	YES	NO
NOTEPAD			
Multiple Documents	YES (1-10)	NO	NO
Word Wrap	YES	YES	YES
Merge Files	YES	NO	NO
Change Margins	YES	YES	NO
Variable File Size	YES	YES	NO
File Size Limit	64K	50K	4.4K
Variable Window Size	YES	YES	NO
* Search & Replace	YES	YES	NO
* Block Moves	YES	YES	NO
* Auto Indenting	YES	YES	NO
* Page Break Display	YES	NO	YES
* Insert or Overtyping Mode	YES	YES	YES
* Cut Sheet Printing	YES	NO	YES
Print Document	YES	YES	YES
Print Window Only	YES	YES	YES
Undelete Key(s)	YES	YES	NO
KEYBOARD ENHANCER			
Number Keys Redefined	YES Up to 60	NO Macros	NO Macros
Total Keystrokes	YES 2500	NO Macros	NO Macros
GRABBER			
Cut & Paste between applications	YES	Import Only	NO
DOS FUNCTIONS			
See copy	YES	NO	NO
AUTO DIALER			
	YES	YES	NO
GENERAL CHARACTERISTICS			
100% Memory Resident	YES	NO	NO
Minimum Memory Used	40,000	61,300	77,200
Typical Memory Used	50,000-75,000	61,300	77,200
On-Line Help	YES	YES	YES
Moveable Windows	YES	YES	NO
Redefine Colors	YES	YES	YES
Expandable/Add Functions	YES	NO	NO
Can Remove Functions	YES	NO	NO
Integrated Interface	Excellent	Good	Good
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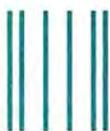
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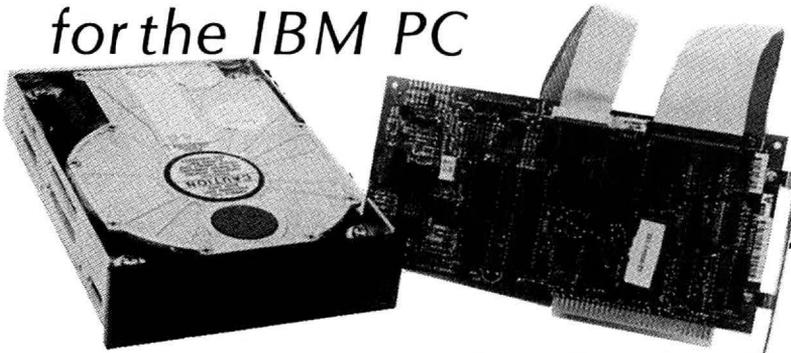
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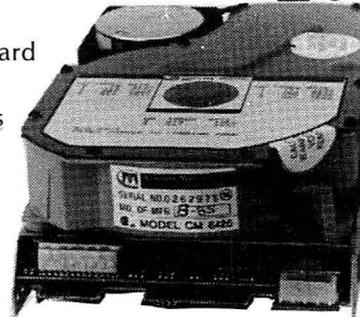


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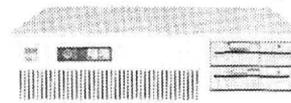
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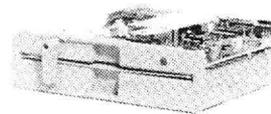
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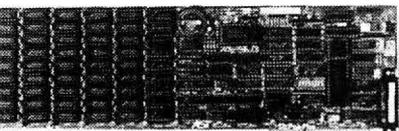
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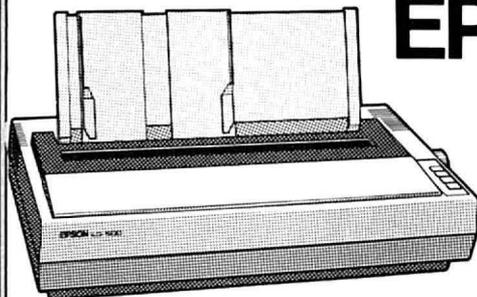
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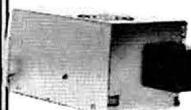
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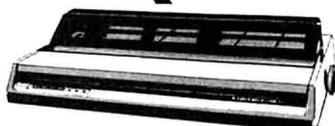
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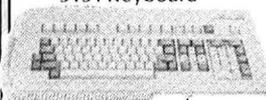


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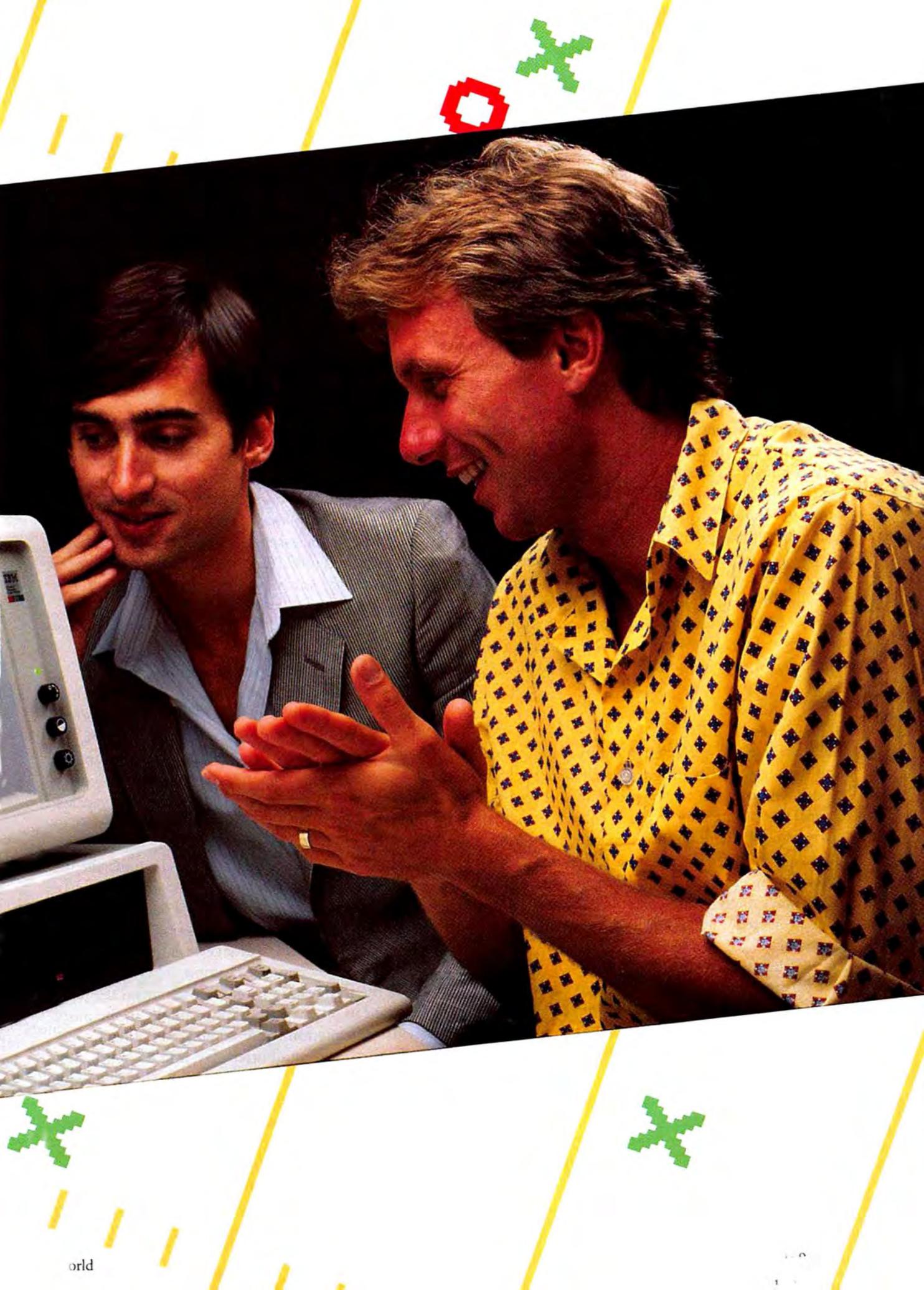
Pro football comes alive on the PC with Xor's sophisticated simulation game, *NFL Challenge*, and Joe Montana shows who's number one.

Eric Brown

Games have never been major players in the IBM PC software marketplace. The popular myth is that serious businesspeople don't have time for games. While it's true that PC users tend to eschew adolescent games, the bulk of which have been ported from the Apple II and CP/M worlds, they do manage to find time for more sophisticated diversions. Advanced entertainment packages such as Infocom's adventure games and Microsoft's *Flight Simulator* have proven enormously successful among PC users.

This year a new simulation game may repeat the success of *Flight Simulator*: Xor Corporation's *NFL Challenge*. Officially endorsed by the National Football League, *NFL Challenge* combines 1984 team statistics and probability algorithms, an exhaustive list of features, and arresting animation graphics and





comes up with a remarkable simulation of NFL football. You can play against another person or the computer, or you can let the computer play itself while you sit back and enjoy the show. Although *NFL Challenge* is targeted at knowledgeable football fans, the game is set up so even novices can start playing without prolonged research.

NFL Challenge is more than a game; it's a close simulation that can teach you a lot about football. Play results, and hence game results, depend largely on how your play selection works against that of your opponent. But *NFL Challenge* also draws heavily on leaguewide averages and player ratings taken from the end of the 1984 season. About the only factors not given probability curves are weather, crowds, and home-field advantage. For example, in both the computer game and in reality, the New Orleans Saints will almost always lose to the San Francisco 49ers, and Joe Montana will almost always have a good game. Montana proved this in person when I challenged him to play a quarter of *NFL Challenge* (see the sidebar "A Super Bowl Rematch With Joe Montana"). However, random variables have been factored into the game, and no play combination ever repeats exactly. Just as in the real NFL, on any given Sunday any team in football can win the game.

■ Heads or Tails

NFL Challenge's documentation is as colorful and well executed as the game itself. The package includes a plastic case for the program and team disks, a slim user's guide, and colorful offensive and defensive playbooks with graphic depictions of all the plays. You also receive the *NFL Illustrated Playbook*, a valuable reference that teaches the basics of formations, plays, tactics, and rules. The program is not copy protected, and an 800 support number is provided.

When you start *NFL Challenge*, a menu appears listing all 28 NFL teams. Once you select the home and visiting teams, another screen asks you to specify whether the coaches are human or computer. The image of a coin flips on screen, and the winner chooses to kick or receive.

Next the main screen appears, displaying a football field and two coaching menus. You can look at your roster or your opponent's roster or start the game. With two players, the person on the right uses the numeric keypad for cursor movement and menu selection, and the person on the left uses the function keys.

Once both sides start the game, the kicking team has the choice of three types of kicks: normal, onside, and squib. An arrow in the middle of the field traces the ball position; it moves downfield with the kick and then reverses direction for the runback.

Defensive and offensive play formation menus appear, and the 30-second clock begins to tick in the upper right corner of the screen. If the offense fails to choose a play before the clock runs out, a 5-yard penalty is marked off for delay of game. To suppress the 30-second clock and avoid being penalized, you press L, for Learn mode. The top status line also provides other game essentials such as the game clock, the score, and indicators that show the yard line, the down, and the yards needed for a first down (see Screen 1).

■ Play Selection and Deception

The offensive menu contains six main formation groups, coded by color, consisting of 47 offensive plays. White is for short yardage situations, yellow is for long yardage, and blue, purple, and red signify a variety of run and pass plays in between, each succeeding color indicating more long yardage opportunities. The sixth category includes rarely used special plays such as punts and field goals on unexpected downs and the quarterback downing the ball. On defense, four general categories provide 26 defensive alignments: short yardage, 3-4 defenses (three defensive linemen and four linebackers), 4-3 defenses (the reverse), and long-yardage situations.

When you make a selection, a play list appears above the formation menu. On each menu the plays are listed in order of risk. For example, in the purple offensive formation the first choice is Fullback Dive, a fairly safe bread-and-butter play, and the tenth choice is All Streak, a risky, long-yardage pass play in which the quarterback is vulnerable to a blitz. Similarly, with the 4-3 formation, the first choice is 30 Willy, a balanced zone defense, whereas the seventh is 11 Blitz Slot Man, which skimps on the defensive secondary to put the punch into a massive quarterback blitz.

When both adversaries are human, each coach tries to second-guess the other. Although final play choice is not apparent until both sides have made a selection, you can get hints by looking at your opponent's formation menu.

However, there are ways to deceive the other team as to what play you select—both sides of the keyboard have cancel keys that back you out of your current menu. You can cancel your choice at the last moment and quickly enter another, or cancel repeatedly, making your choice just before the 30-second clock runs out.

The division of menus between formations and plays and the ability to change your mind before the play begins emulate the deceptions in actual NFL action. In the pros, the defense constantly changes its position before the snap to confuse the offense, and the quarterback always has the option of calling an audible from the line of scrimmage if he doesn't like what he sees in the defense. However, if you and your opponent want to avoid all these trigger-finger games, you can suppress the play selection windows and make your choices from the printed play lists.

■ Animated Graphics

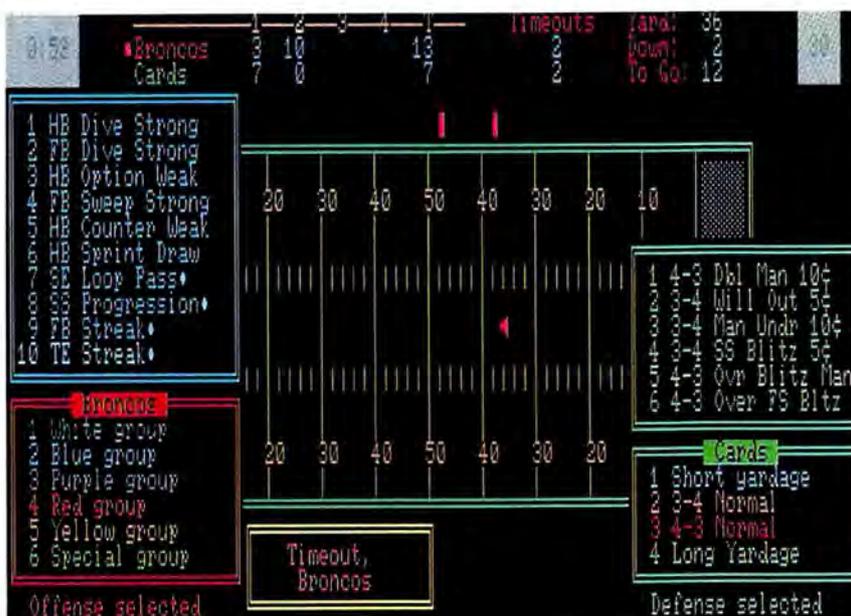
When both coaches have chosen a play, a message appears indicating the play selections, and the screen breaks into graphics mode. A bird's-eye view of the field appears, with the offensive players represented as Os and the defense as Xs, just as a coach

diagrams a play in the NFL. The huddle breaks, and the players move smoothly to their scrimmage positions (see Screen 2). The play runs in graphics animation, and all 22 players move around in realistic patterns, rushing, blocking, passing, and running. A football-shaped blip serves as the ball, and a dotted line indicates the first-down marker. The play repeats instantly in slow motion; you can rerun the instant replay or disable it entirely. Holding down the <Space> bar speeds up the animation.

The realism of the animation is remarkable. True, the players don't glide with the fluid motion of an O. J. Simpson, and bugs occasionally cause players to move erratically, but the animation is far more sophisticated than anything previously available in microcomputer sports games. Although NFL teams now rely heavily on computers (see "Handoff to the PC"), so far no one has come up with the kind of animation that distinguishes *NFL Challenge*.

Once the instant replay is over, the screen reverts to the game field, and a message appears listing the play, the yardage gained or lost, and the key players on each side. The arrow on the playing field moves accordingly, and the formation menus reappear, ready for the next play. If you don't have a graphics system, the screen blanks out during the simulation, but the result of the play is still displayed.

(continues on page 175)



Screen 1: The main field screen of NFL Challenge. Play list menus appear atop formation menus when you make a selection.

A Super Bowl Rematch With Joe Montana

When Joe Montana agreed to play a quarter of *NFL Challenge* with me, I wasn't the least bit nervous. It didn't bother me that he had led the San Francisco 49ers to two Super Bowl championships or that he is the highest-rated quarterback in the history of the NFL. I knew I was going to win because I understood computers. Sure, Joe might be king of the heap out on the playing field, but now he was playing on my turf, a gridiron of colored pixels atop an IBM PC.

Joe came in tanned and relaxed from a summer at his beach house with his wife, Jennifer. On his right hand he wore the Super Bowl ring he had earned for teaching Dan Marino a lesson in quarterbacking last January. Although the rigors of training camp and the media spotlight were right around the corner, Joe was nonchalant; remarkably, he exudes this same laid-back confidence in a fourth-quarter, third and long situation of a crucial play-off game.

Before the contest Joe sat down to try out *NFL Challenge*. To my surprise, he seemed perfectly at home with the keyboard and the logical progression of the menus. I knew he was a fast learner, but this was ridiculous.

"You don't own a computer, do you, Joe?" I asked, my voice quavering as dreams of glory flickered.

"I've got a DEC Rainbow 100 Plus," he answered as he checked out the play selection. "One of the main things I bought it for was this nutritional system. You put in your body weight and tell the computer what you want to do: decrease, maintain,

or increase your body composition. You tell it what limits you want on your proteins, carbohydrates, and fats. Then it gives you your workout schedule."

Oh well, so much for the keyboard handicap. We started looking over the plays. Although he hadn't heard of some of their names, most of the plays themselves looked familiar.

"Every team has different ways to call plays," he told me. "Basically, we use a number system for blocking, and codes followed by words for passing." However, the number of plays listed in *NFL Challenge* (47 for offense and 26 for defense) doesn't compare to the 49ers' exceptional arsenal. "We average around 75 to 80 different pass plays a game, but most teams don't get anywhere near that. Most teams are in the 30s."

The hour of the contest arrived, and we chose our teams from the opening menu. Joe picked the 49ers and suggested I take the Colts, but I wasn't so easily fooled. I chose one of the few teams in the NFL that might stand up to Joe and the gang—the Miami Dolphins. After all, it was possible Marino had just had a bad day in Palo Alto.

Joe won the toss and elected to receive. Suddenly I could see it all in front of me as if I were watching it on TV. Reggie Robie booted a long, high kick to Dana McLemore, who stormed through the Dolphins special teams defenders for a 27-yard run.

"Alright!" yelled Joe as he quickly turned to his play lists. It was

first and ten on the 41, and Joe tossed a Strong-side Quick Pass to Dwight Clark. Like a fool I blitzed my linebackers, leaving myself open under the coverage. First down.

This time I lay back in a dime defense, waiting for the pass, but Joe handed off to Wendell Tyler who swept around the weak side. "Oh yeah!" Joe shouted. "Get outside, Wendell. Hey, where you goin'?" Wendell missed the hole that might have given him a shot at the end zone, but he made a good 6 yards on the play.

On third and four I played for the run, only to watch the ball sail over my head into the arms of streaking wide receiver Freddy Solomon. First down again. A quick screen to tight end Russ Francis made it second and five, and a Split End Loop Pass secured yet another first down. I was growing just a bit irritable. My opponent was already on my 23-yard line, and I'd barely had time to catch my breath.

Then Joe flipped the ball back to Roger Craig, who managed to get outside for a 9-yard gain. On second and one on the 14-yard line, it was beginning to look like the the Super Bowl all over again.

Pure desperation directed my next call, the riskiest defensive play in the book—a free safety blitz. Fortunately, Joe called an equally risky Slot X, Y, Z streak.

"I might need help," he said as he saw the eight rushers draw a bead on his on-screen doppelgänger. "Oh, man. What's he throwing to the weak side for?" Pass incomplete.

"Alright, third and one," I said. Finally I had the advantage. Now all I had to do was distract him, ask him a question, anything. "Now, Joe, when you're standing there on the line, what do you look for in the defense at the last minute?"

"It depends from team to team," Joe answered thoughtfully, removing his attention from the screen. "Some teams try to disguise defenses. Others line up and show you what they're doing right away. Some have real sophisticated defenses, and others only use two or three . . ." It was working. The 30-second clock was running down, and he hadn't given a thought to his next play. I nodded, showing interest, all the time ready to plug in my two-digit play code in the last second. "But mostly you try to get a reading from the defensive secondary, usually the safeties right from the start, and then the corner . . ." At the last moment Joe glimpsed the 30-second clock and quickly punched in a code to avoid the delay of game.

"Oh no, that's not what I wanted to do," Joe groaned as he called a Fullback Draw against my Buck Strong maximum run defense. The pass fake didn't fool anybody, and the fullback ran into the waiting arms of my 6-man line. No gain.

"Gotcha!" I yelled. It was a cheap victory, but it worked. At least I would hold him to three points. "Fourth and one on the 14. I guess we'll be seeing Wersching now."

(continues)

"No way, I'm going for it," said Joe.

"What, are you crazy?" I scoffed. But Joe was confident in his offense, and I set up in Buck Soft formation, waiting for the run. Of course Joe opted for the pass instead and rolled out weak side to toss it to Dwight Clark in the end zone. Boom. Another immaculate reception, and six points appeared on the board. The screen filled with a garish display announcing the touchdown, and Joe rubbed his hands in glee. The extra point was good.

From there it was all downhill. My returner fumbled the ball on the kickoff, and a few moments later, Ray Wersching kicked it through the uprights, making the score 10-zip. Finally, Marino got a chance to perform his passing magic with Clayton and Duper. We spiraled our way downfield to the 49er 40-yard line, where Joe called a vicious pass rush. Fred Dean managed to get his hands in Marino's face, and Marino threw the ball into the arms of Ronnie Lott for an interception. Once again Joe marched down for a field goal. Rallying back, the Miami offensive machine rolled down to the 49er 10-yard line, only to be stopped by a heart-breaking goal-line stand. My field goal didn't give me much pleasure, as a few minutes later the quarter ended with a score of 13 to 3.

"Turn out the lights..." I crooned mournfully.

"I want to play some more," Joe complained. "I got the ball. Shoot, I could have had a touchdown."

But the rules are the rules, and Joe's agents were looking at their watches. Joe was already late for a golf tournament.

At this point, I was too crestfallen to come up with any insightful last-minute questions, so I asked him how he liked *NFL Challenge*.

"I think it's great," he said. "I especially like the idea that you can use the Undo key to see what would happen if you had called another play. You don't get that luxury out on the field." He paused a moment before leaving. "Hey, this game isn't available on the DEC Rainbow, is it?" I shook my head no. "Well, maybe I can find some people who can port it over..." he trailed off thoughtfully.

"Good luck with the golf game," I said.

"Yeah, I only have one stroke," he laughed as he walked out the door. "Keep it high and let it fly."

Afterwards, I cheered myself up. It was absurd to think I could beat Joe Montana at his own game. After all, Joe has often been cited as one of the smartest quarterbacks in the league. And since *NFL Challenge* provides such a close simulation, Joe had an advantage from knowing his own team so well. It was a classic Bill Walsh offense he showed me, balanced, surprising, and based on short passes. No doubt, Dan Marino could have done a much better job with the Dolphins than I had, even if he had never used a computer before. Maybe next year.

If you want to see how another play might have worked, you can turn back the clock by pressing U for Undo. Undo takes you back to the previous down and yard and plays out the results of your new selection. As soon as the replay finishes, the program returns you to your original situation, ignoring the results of the Undo.

Due to random variables introduced in the game, the same play combination will almost always replay differently. However, this doesn't mean the results are left purely to chance—the outcome is usually logical. For example, if you call a screen pass against a heavy blitz (and the two teams are fairly evenly matched), you will succeed almost every time you replay the down, but the pattern and the number of yards gained will vary.

On fourth-down plays a special menu shows the offensive options: going for it, punting, or kicking a field goal. The program shows field goal and extra point attempts graphically but represents punts, kickoffs, and special teams plays with only a moving arrow on the main field screen.

Nonanimated graphics displays also indicate interceptions, fumbles, and touchdowns. These messages, augmented with various comedic melodies, taunt the loser and allow the victor to gloat momentarily before play resumes.

Penalties, Injuries, and Substitutions

In *NFL Challenge* penalties and injuries reflect average league probabilities rather than individual team and player tendencies. When a penalty occurs, a distinctive beep sounds, and a window appears in the

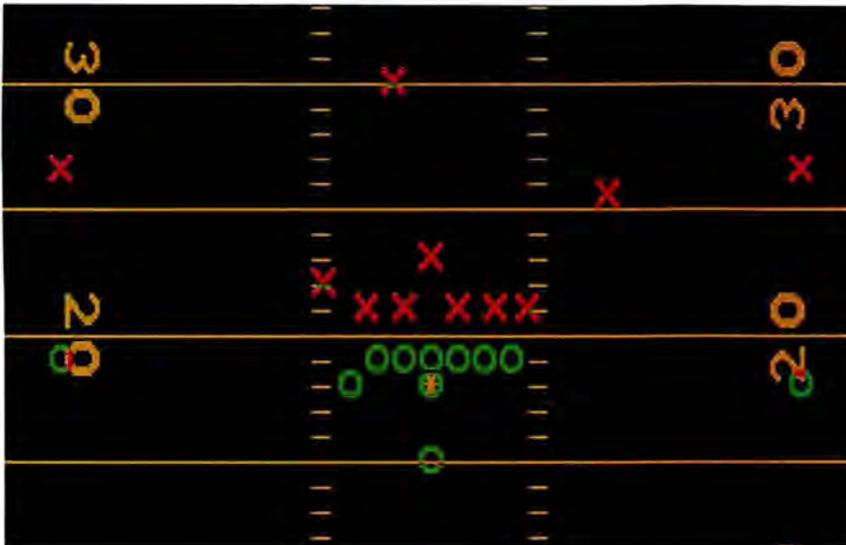
middle of the screen describing the penalty and who incurred it. If the penalty is not automatic (such as a personal foul), the opponent can choose whether to accept or decline it.

Injury messages appear in special windows at random intervals. These messages indicate how long a player will be out (ranging from several minutes to the entire game) and display a roster menu of available substitute players. Normally the program sends in the player with the next best rating. However, if you want to take control of injury substitutions, you can press M for Manual mode and choose the new player yourself. Another message appears when the injured player has recovered and is ready to play.

You can substitute players and exercise other coaching options at any time by calling up the coaching menu. The first choice displays the roster, which lists all available players by number, along with their ratings in major performance categories (see Screen 3). Pressing <CursorRight> (or <F4> on the left) shows statistics for height, weight, years in the NFL, and speed. The two columns on the right indicate starting players and special teams players.

To change a starting position, you select the new player, which brings up a secondary menu listing all players at that position. Simply move the cursor from the old player to the new and press <Enter>.

Because the program almost always chooses the best substitution automatically, many users will never want to modify their rosters. However, the default starting lineups and substitutions don't take into account the particular team you are playing. If you



Screen 2: Players line up at scrimmage in graphics animation mode. O's represent the offense, X's stand for the defense, and the ball is indicated by a football-shaped blip.

know the two teams well, you may decide that a certain player is a better matchup against a particular opponent than the player chosen by the program.

Even if you never switch a player, the roster can show you the relative strengths and weaknesses of your team. If your best running back only rates in the low 80s and your quarterback rates in the high 90s, you may want to select more passing plays. On the

other hand, if you're in charge of the L.A. Rams and you ignore halfback Eric Dickerson, your chances of winning will decrease considerably.

The roster's other benefit is that it enables you to keep the simulation up-to-date during the season. The documentation provides instructions on how to edit a copy of each team's roster using any word processing program, allowing you to change individual player ratings to reflect trades, injuries, slumps, and surges. Some players may want to sit down at the PC with the sports page each week and copy in the new

Screen 3: NFL Challenge play results are based primarily on 1984 player ratings found on the roster menu. You can make a copy of the rosters and edit them with a word processor to keep them current throughout the season.

Broncos		Cards						
No.	Pos	Run	Revs	Blk	Pss	Kick	Strt	ST
1	P	..	..	..	..	83		P
3	K	..	..	..	..	94		K
7	QB	78	..	..	..	90		QB
8	QB	72	..	..	..	84		
20	DB	79	91	78	..	..		LCB
22	DB	67	82	66	..	..
23	RB	91	86	79	..	..		HB
24	RB	83	68	73	..	..
26	RB	81	66	73	..	..
28	DB	68	82	67	..	..
31	DB	76	93	73	..	..		RCB
33	RB	80	80	74	..	..
39	RB	80	68	75	..	..
43	DB	78	93	76	..	..		FS
45	DB	76	90	76	..	..		St
47	RB	86	85	79	..	..		FB AR

Screen 4: You can display game statistics at any point in the game.

TEAM STATISTICS		Broncos	Cards
BALL CONTROL	First Downs	5 - 3 - 10	0 - 4 - 4
	Rushing - Passing - Penalty	1 - 7 - 14.3%	0 - 9 - 0.0%
	Third Down Conversions	14:25	15:00
	Time of Possession		
YARDS	Total Net Yards	33 - 146	29 - 177
	Total Plays - Average	33 - 4.4	29 - 6.1
	Net Yards Rushing	23 - 4.3	3 - 2.7
	Rushing Plays - Average	9 - 5	21 - 13
	Net Yards Passing	1 - 1.1	6 - 6.5
	Attempts - Completions - Ints.	1 - 1 - 0.0%	5 - 3 - 60.0%
	Average Per Pass Play	1 - 1 - 0.0%	5 - 40
SPECIAL/ OTHER	Punts - Average	3 - 36.0	6 - 39.2
	Return Yards	1 - 1.0	4 - 6.7
	Penalties - Yards	1 - 1.0	4 - 24
Fumbles - Lost	1 - 1.0	3 - 0	

statistics. For example, you may want to prune the 49-player rosters provided by the program to the 45-player rosters required for the 1985 season. You could even make a copy of the team disk and recreate the 1967 Green Bay Packers or put together a dream team of all your favorite players. The ability to modify statistics may lead to cheating, but it saves the program from obsolescence and provides a depth and versatility lacking in most games.

The main problem with the roster is that it doesn't include players' names. An appendix listing players' names alongside their numbers would improve the game greatly.

■ The Extra Points Are Good

The other coaching menu options allow you to see the opponent's roster, call a time-out, or enter 2-minute mode. In the 2-minute drill, ballcarriers attempt to get out-of-bounds to stop the clock, and the quarterback tries for longer, riskier completions. You can enter or exit this hurry-up offense mode as often as you want.

Other game functions—such as exiting the game, saving it, or starting a new game—can be invoked with mnemonic, single-letter commands. You can retrieve any saved game from a directory as often as you want, but you won't be able to replay it. The retrieve feature only lets you continue playing from where you left off.

At the end of each half, *NFL Challenge* displays a screen of game statistics (see Screen 4). This chart can also be called up at any time by pressing R (for Results).

Other commands affect the appearance and speed of the game. You can turn off the animation, adjust message duration, and decrease the amount of information that appears in messages. You can also freeze the game at any time, which is especially helpful in the graphics mode when you want to see how a play develops.

When you select extra-fast mode, the computer takes over both teams' play selection, bypasses graphics animation, and eliminates play selection windows and other special displays. The dizzying speed of extra-fast mode makes it difficult to watch, but it's helpful if you want to see the final score quickly. Unfortunately, the score appears for only a moment before the two teams play each other again. Extra-fast mode would be much more useful if *NFL Challenge* paused longer after each game.

From the Persona menu, you can change the coach from computer to human or vice versa at any point in the game. You can shift the persona of a computer coach between conservative, balanced, and aggressive for both offensive and defensive teams.

■ Probability and Fun

There's one thing I haven't mentioned in all this discussion of probability and features: *NFL Challenge* is great fun. It's been a long time since a program has consistently kept me up until 3 in the morning. For both casual football fans and serious Monday morning quarterbacks, the game offers exciting entertainment and an excellent education in the finer points of the game.

The game presents endless possibilities: Some people may want to play a game concurrently with the actual contest on TV. Other players may want to record the play combinations of a real game and replay them on the computer. No doubt we'll eventually see *NFL Challenge* fanatics set up leagues with weekly schedules, referees, cheerleaders, and tailgate parties.

The summer of 1985 was full of talk about the personal computer slump, disenchanted users, and PCs gathering dust in closets. Perhaps PC users are looking for some relief from all these deadly serious business applications. Sophisticated simulation games such as *NFL Challenge* might provide the spark that's been missing from the world of PCs. ●

|| *Eric Brown is an Associate
Editor at PC World.*

|| *NFL Challenge
Xor Corp.
5421 Opportunity Ct.
Minnetonka, MN 55343
800/635-2425, 612/938-0005
List price: \$99.95
Requirements: 256K, one disk
drive (graphics adapter and
graphics monitor required for
graphics animation)*

Dot Matrix Triple Play

The latest in dot matrix printing offers a triple bang for the buck: text that approaches true letter quality, speedy draft printing, and graphics you can display with pride. Brother, NEC, and Toshiba lead the way in the 24-pin pack.

Jeremy Joan Hewes

Over the last year, laser printers have dazzled the PC community with fast performance, fine print quality, and multiple typefaces in assorted fonts. While the laser printer grabs the limelight, that old standby, the dot matrix printer, has quietly been making some technological leaps of its own. The latest models from

Japan feature high-quality text, fast printing, and a variety of graphics capabilities. For the first time, dot matrix output can compete with that of daisy wheel and other letter quality printers.

The key to the versatility of the new dot matrix printers is a 24-pin printhead, which uses many more dots to form a character than the 9-pin printhead used in earlier dot matrix models. The 24-pin technology was originally developed by Japanese manufacturers to print the complex kanji characters of the Japanese alphabet; since then, the companies have added English and several other alphabets.

In the past year a number of manufacturers, including Dynax (Brother), Epson, Fujitsu, C. Itoh, NEC, and Toshiba, have introduced fast, high-quality dot matrix printers. This review compares the performance of Dynax's Brother DM40, NEC's Pinwriter

P5, and Toshiba's P351. All three printers were tested in draft, near letter quality (NLQ), and condensed printing modes using *WordStar*, *1-2-3*, and *ChartMaster*.

The three printers provide various degrees of software compatibility. Because printer manufacturers have not adopted a standard set of commands to invoke such features as condensed print, underlining, and font changes, each printer has its own command set. If the software you use does not include a printer driver with the specific commands for your printer, you may be unable to use all of the printer's features or even to get it to print a single page.

To avoid adding to the confusion created by the often-conflicting command sets, some printer manufacturers have adopted commands that emulate the most popular printers, usually the Epson models and the IBM Graphics Printer. Because the 24-pin machines also provide NLQ printing, they often emulate established models of daisy wheel printers to take advantage of expanded letter

and line spacing. The three letter quality printer manufacturers most commonly emulated are Diablo, Qume, and NEC.

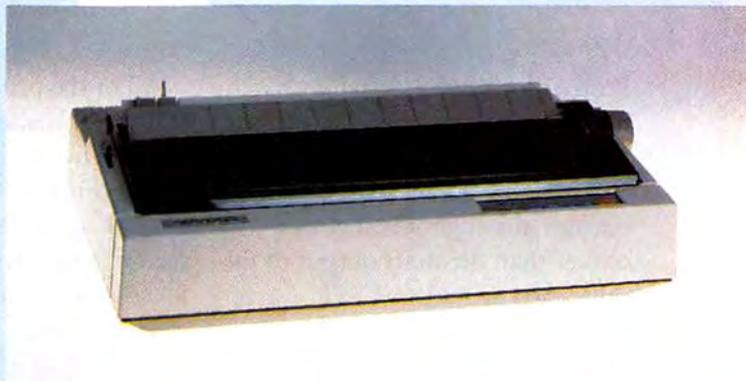
■ Brother DM40

The Brother DM40 is the slowest of the three printers, but offers the best output in NLQ mode. It prints more quietly than the Toshiba or NEC, although its fan is relatively noisy when the printer is turned on but not in operation.

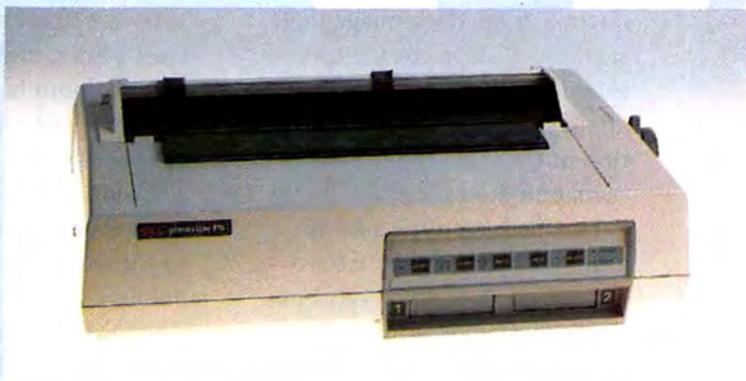
Print quality. The Brother shines in NLQ mode. Its characters' individual dots are not discernible, and the text is uniformly dark. Unlike the other printers, the DM40 uses the same typeface for both 10-pitch and 12-pitch NLQ output. However, the typeface is easily readable, with a squarish, wide appearance. (See Figure 1 for a comparison of printers in NLQ mode.)

In contrast, the DM40's draft text is more difficult to read than draft output from the NEC and

The Brother
DM40



The NEC
Pinwriter P5



The Toshiba
P351



the Toshiba (see Figure 2). Its draft typeface suffers from severe attenuation, and, unlike the NLQ type, the characters lack serifs—the tiny “tails” at the top and bottom of most letters that enhance their readability. Because the

and letter quality modes. However, when printing a 1-2-3 worksheet of 31 rows and 14 columns in condensed mode, the Brother was speedier than its counterparts. See Figure 5 for comparative speeds of the three printers.

The 24-pin technology was originally developed by Japanese manufacturers to print the complex kanji characters of the Japanese alphabet.

Brother forms each letter with a minimum of pin strokes to achieve maximum speed, its draft text is considerably lighter than its NLQ output, although it is slightly darker than the draft output of the other two printers.

When printing a 1-2-3 worksheet in condensed mode using the draft typeface, the Brother produces a crisp, dark image that seems well suited to the spreadsheet format (see Figure 3). In this application, the vertical orientation of the type adds to its readability.

For the large type used in graphics produced by *Chart-Master*, the DM40 merely emulates the 9-pin Epson models (see Figure 4). When and if a printer driver is developed specifically for the DM40, it should produce better images than the sample shown in Figure 4.

Speed. The DM40 was the slowest of the three printers at producing a six-page, double-spaced *WordStar* document in both draft

All of the printers' speeds are considerably slower than those advertised by the manufacturers. The Brother specifications list draft speed at 160 characters per second (cps) and letter quality at 80 cps for 10-pitch type and 96 cps for 12-pitch type. The significant speed differences could result from several factors, including the software used, the spacing between lines, and the width of the print column (the wider the column, the faster the printer's average speed).

Compatibility. Of the three printers, the Brother comes closest to showing off its full range of capabilities with existing software. The DM40 emulates the Epson dot matrix models for draft and graphics printing and the Diablo daisy wheel printer for NLQ mode. Consequently, the Brother is immediately usable with almost all application software. In NLQ mode, the printer performs minute adjustments in letter and line spacing that were formerly limited to daisy wheel printers.

Special features. By using the control codes listed in the manual, you can direct the DM40 to print

in any of several additional styles, including enlarged print, enlarged condensed print, proportional type, and superscripts and subscripts. Usually you have to write brief BASIC programs to invoke these features (examples are provided in the manual), although some application programs, such as 1-2-3, allow you to add one or more control codes to their printing commands.

The DM40 is the only printer of the three to provide a tractor-feed mechanism as standard equipment. This paper-holding device is essential to keep fanfold paper from sliding from side to side during long printing jobs. The Brother can also handle single sheets and envelopes, and an automated cut-sheet feeder is available as an option.

The Brother accommodates paper up to 15 inches wide; it prints up to 136 columns per line in 10-pitch type, 163 in 12-pitch type, and 272 in condensed type.

Ease of use. The DM40 is simple to install and configure. The printer's front panel houses switches for selecting among the four built-in typefaces, changing between draft and NLQ mode, feeding paper by line or page, and setting the printer on or off line.

Documentation. Like too many other printer manuals, the Brother's is deficient. Although it provides detailed charts of the character sets and listings of all control codes, nowhere does the manual contain the essential information that the DM40 emulates the Diablo and Epson printers.

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	2000	1000	4000

Figure 1: Printer output in NLQ mode: Brother DM40, NEC Pinwriter P5, Toshiba P351 (top to bottom)

Figure 2: Printer output in draft mode: Brother DM40, NEC Pinwriter P5, Toshiba P351 (top to bottom)

Figure 3: Printer output in condensed mode: Brother DM40, NEC Pinwriter P5, Toshiba P351 (top to bottom)

Figure 4: Chart-Master graph printed with the Brother DM40

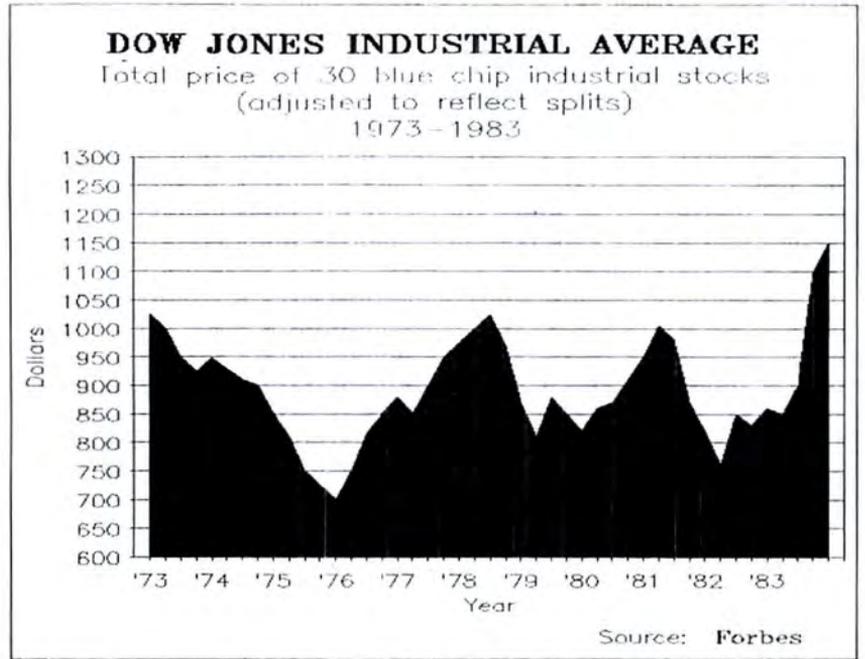
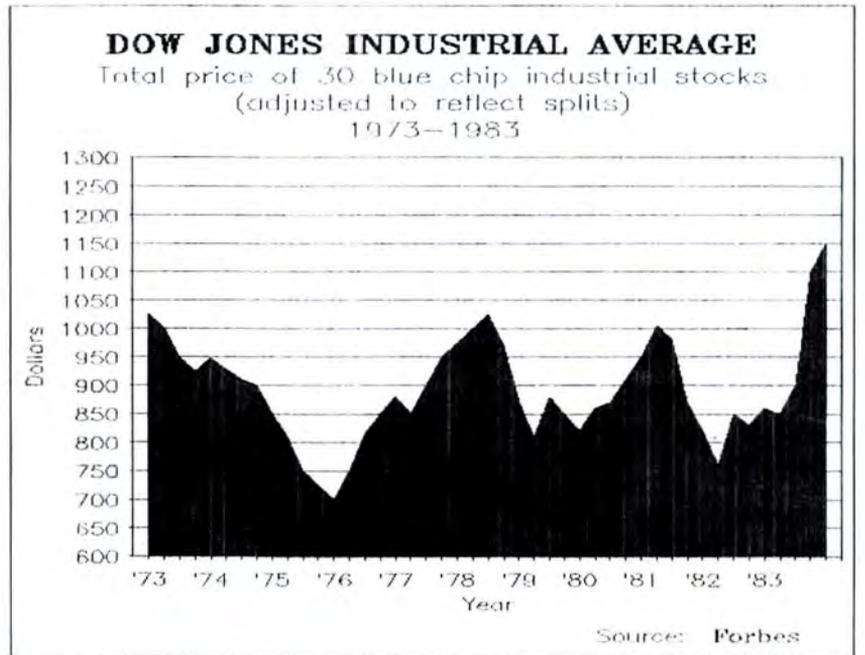


Figure 6: Chart-Master graph printed with the NEC Pinwriter P5



The manual has some amusing Japanese-to-English translation gaffes, such as suggesting that you adjust the tractor "if paper is sagged or excessively tensed."

In a nutshell. At present, the Brother DM40 is the most versatile of the printers under discussion. Although its graphics capabilities are not yet tapped by most popular programs, it produces excellent copy in NLQ mode and delivers acceptable speed relative to print quality in both modes. The DM40's major drawback is that it cannot accommodate cartridge fonts or an expanded buffer to store data or fonts.

■ NEC Pinwriter P5

The NEC Pinwriter P5 has the distinction of being the fastest and loudest of the three printers discussed here. Although the fan is reasonably quiet, the Pinwriter's high-pitched whine during operation may drive some users from the room. The printer features a quiet mode, which muffles the sound considerably but also slows the NEC to half speed.

Print quality. The NEC's NLQ text is slightly fuzzier and less uniformly dark than the Brother's. The unit tested produced a few characters on each page that were noticeably blacker than the rest of the text, perhaps because of an unevenly inked ribbon.

The standard draft typeface is more readable than that of the Brother. The printer's condensed type is adequately dark and quite

readable, and its graphics are comparable with the Brother's (see Figure 6).

Speed. The Pinwriter is the fastest printer in both draft and NLQ modes. As noted, all three

The Pinwriter also allows you to create custom characters. The accompanying technical manual explains this procedure and provides two BASIC programs to get you started.

■ *The NEC offers more built-in fonts than its competitors, featuring eight resident font types and eight additional cartridge fonts.*

printers' literature cites greater speed than was measured here. NEC Information Systems claims 290 cps in high-speed draft mode and 100 cps for letter quality.

Compatibility. The NEC ranks second in compatibility with major application programs. For graphics and draft printing of documents or worksheets, it emulates the common Epson dot matrix models and performs efficiently and reliably. However, the Pinwriter does not emulate any of the three leading letter quality printers, including NEC's Spinwriter. Instead, it emulates another 24-pin dot matrix printer, the Epson LQ-1500 (see *From the Hardware Shelf* in this issue). Because this Epson model is only a few months older than the Pinwriter, few application programs support it. However, *MultiMate*, *Volks-writer Deluxe*, and *WordStar 2000* all include drivers for this printer.

Special features. The NEC offers more built-in fonts than its competitors, featuring eight resident font types and eight additional cartridge fonts. RAM cartridges can expand the printer's standard 8K buffer to 24K or 40K.

Ease of use. The Pinwriter is easy to set up and operate. Front-panel switches allow you to select font and printing modes, invoke the quiet feature, and advance the paper. The printer comes with a cut-sheet guide that automatically advances each sheet to create a 1-inch margin at the top of the page. If your software provides its own default top margin, you will have to override it when using the paper guide. You can avoid the extra top margin by winding the paper in manually.

During printing of the six-page document, the fanfold paper slid 1/2 inch or more to one side, clearly changing margin width on both sides of the text. If the printer I used is representative of the model, the optional tractor would be advisable for long printing jobs.

Documentation. The Pinwriter's two manuals are thorough and informative. The short *User's Guide* covers the basics, and the substantial *Technical Reference Guide* provides details of control codes, custom characters, and programming.

In a nutshell. The NEC Pinwriter P5 is especially well suited to business tasks that require varied fonts and sizes of print, particularly any custom-designed character sets. Its chief drawback is that it cannot yet perform all letter quality operations with most software.

Toshiba P351

The Toshiba P351 is a successor to the company's model 1351, featuring a newly engineered and insulated cabinet to reduce printing noise. In both speed and sound, the Toshiba ranked in the middle of the three printers tested.

Print quality. The Toshiba ranked last in print quality. Though easily readable, its NLQ text is lighter than that produced by the Brother or the NEC, and it shares the fuzziness of the NEC's output.

The draft text is similar to the NEC's, although lighter. The serif typeface is much easier to read than the Brother's draft output. In the spreadsheet format, the Toshiba's condensed type is dark, crisp, and easy to read.

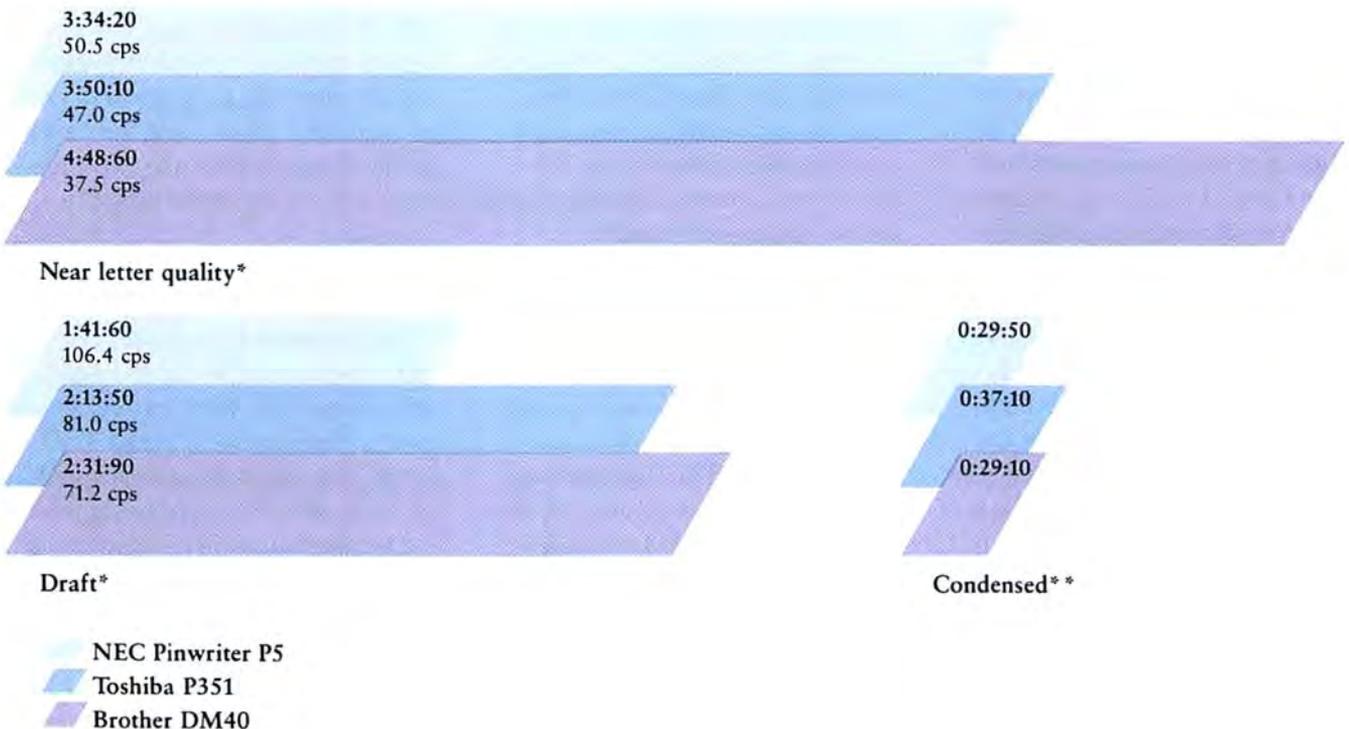
Although the manual includes some instructions for using the

printer's graphics capabilities, the P351 is not currently compatible with any printer selection offered by the popular *Chart-Master* program. Consequently, no sample graphics are included here.

Speed. The Toshiba ranked second in both draft and NLQ printing speed, but the advertised printing speeds for the Toshiba are much faster than the figures in Figure 5. The company claims up to 288 cps in draft mode and up to 83 cps in letter quality mode.

Compatibility. The Toshiba printer emulates only one letter quality machine, the Qume Sprint 11. This allegiance is fine for utilizing most draft and NLQ features,

Figure 5: Comparative printing speeds in minutes:seconds:milliseconds and characters per second



* Based on 10,811-character, double-spaced file printed with WordStar
 ** Based on a 1-2-3 spreadsheet of 31 rows and 14 columns

but the machine's failure to emulate a popular dot matrix model as well prevents it from working with most graphics applications programs. Fortunately, M.A.P. Systems, an independent software firm in Houston, supplies a separate printer driver called *Paper-screen* that allows the P351 to emulate an Epson dot matrix printer.

Special features. The Toshiba offers one feature its competitors lack—the ability to use fonts that are downloaded from disk. The printer also has the largest selection of fonts: 5 built-in fonts, 10 fonts available on cartridges, and 40 additional fonts on disk.

Ease of use. Like its rivals, the P351 is easy to set up and operate. Its front-panel switches handle fewer functions than those of the other two printers, controlling paper feed, advancing to the top of a form, and setting the printer on and off line. Font changes are made with the DIP switches on the back of the printer or with software control codes.

The P351 features the same pesky automatic sheet-feeding mechanism as the NEC printer. Tests were done with the optional tractor installed to avoid coping with the change of margins.

Documentation. The Toshiba manual is clearly the best of the three. It includes a helpful question-and-answer section and a list of compatible printers that can be selected from a program's configuration menu in case the P351 is not included.

Best use. The Toshiba P351 is especially useful for anyone whose

work requires printing in a wide variety of type styles. The machine's ability to utilize disk-stored fonts makes it infinitely expandable. The printer is the most expensive of the three, but its versatility could make the investment worthwhile.

■ Move Over, Daisy Wheel

No single printer stands out as a clear winner or loser. The Brother DM40 provides the closest approximation of letter quality text, but does so at the price of slower operation. The NEC Pinwriter turns in the fastest performance, but makes a racket in the process. Although the Toshiba is currently incompatible with most graphics programs, the ability to receive downloaded fonts sets the printer ahead of its competition in variety of type styles.

While the problem of software compatibility with the 24-pin models still awaits resolution, it appears that the search for the full-function printer is over. No longer must you buy a dot matrix printer for speed and graphics and a daisy wheel printer for quality output. Along with the advent of the laser printer, the introduction of 24-pin dot matrix printers may signal the end of traditional impact printers. ●

Jeremy Joan Hewes is a Contributing Editor for PC World and coauthor of Writing in the Computer Age and Word Processing on IBM PCs. She is currently writing The Author's Computer Tools, to be published next year by Harper & Row.

Brother DM40
Dynax, Inc.
6070 Rickenbacker Rd.
Commerce, CA 90040
213/727-1227
List price: \$1495

NEC Pinwriter P5
NEC Information Systems, Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
617/264-8000
List price: \$1445

Toshiba P351
Toshiba America, Inc.
2441 Michelle Dr.
Tustin, CA 92680
714/730-5000
List price: \$1699

Chart-Master
Decision Resources
25 Sylvan Rd. S
Westport, CT 06880
203/222-1974
List price: \$375
Requirements: 192K, two disk drives, color graphics board, serial port

The R:base Express

With its new program, Microrim has added programmability and an application generator to R:base's already impressive speed and user interface. The result is a full-featured, elegant data management system.

Warren Sirota

||||| Microrim, publisher of the R:base series, has been pursuing the high-end PC data management market dominated by Ashton-Tate's *dBASE II*. Last year, Microrim touted its *R:base 4000* as an easy-to-use alternative to *dBASE II*'s complexity, but the Microrim program didn't quite measure up (see "A Champion Among Middleweights," *PCW*,

Vol. 2, No. 7). Its Achilles' heel was its lack of a programming language for creating custom applications. But with the almost simultaneous introductions of *R:base 5000* and *dBASE III*, Ashton-Tate has started looking over its shoulder.

■ R:base Refined

R:base 5000 builds on the strong points of *R:base 4000* and overcomes most of its weaknesses. (*R:base 4000* is still available from Microrim.) The earlier product was already a strong relational data manager, able to link as many as 40 tables in a data base. It was particularly noteworthy for its speed and its prompt mode, which leads the user painlessly through complex queries (and was quite probably the inspiration for *dBASE III*'s similar Assist mode).

R:base 5000's design has righted several of its predecessor's failings. *R:base 4000*'s limited report design capabilities have been expanded in *5000* to give users almost complete control over a

report's appearance; and where *4000* allows only 10 variables per report, *5000* permits 40. Most important, *R:base 5000* has transformed *4000*'s simple command-file programming into a full interactive programming language.

Microrim has gilded the package with an array of extras. In addition to the main data management module, the product offers the FileGateway (a program that translates files from leading spreadsheets and data management programs into *R:base* format), a program editor, and a compiler. *Clout*, an optional natural language query system (see the sidebar "Clout") is available as an accessory. Microrim topped the package with its pièce de résistance, the Application Express, perhaps the best application generator yet implemented on a personal computer. (See Figure 1 for an overview of *R:base*'s features.)



Quick and Clean Applications

The Application Express is a menu-driven system that makes it exceptionally easy to build data bases and full-scale, menu-driven custom applications. It automates the processes of designing menus and maintaining files, tasks that account for roughly 90 percent of data base coding. Then it writes the code itself.

One flank of Microrim's aggressive marketing campaign suggests that you can develop an application in 9 minutes with the

Application Express. For this review I created an application to handle time billing for a single consultant. Including the time I spent learning the program and designing the data base, this relatively complex application required several days to implement—a very short time for such a task, but not 9 minutes. Microrim's bombast notwithstanding, the Application Express is indeed a remarkable component. Its combination of power, flexibility, and

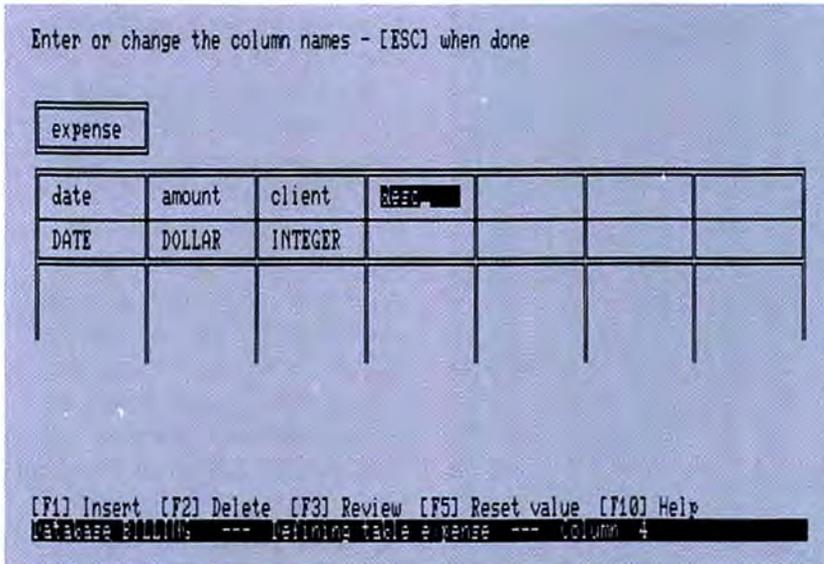
ease of use leaves little room for improvement.

The Express cannot, however automate the first and most important step in creating an application: planning the data base structure. After that step is complete, you turn to the Application Express to set up the tables, a task made simple by the graphic display of the Express's data base definition screen (see Screen 1). You can use the Express to add tables to data bases at any time, but to add, change, or delete columns in a table that already contains data, you must turn to the *R:base* Expand, Change Column, and Remove Column commands.

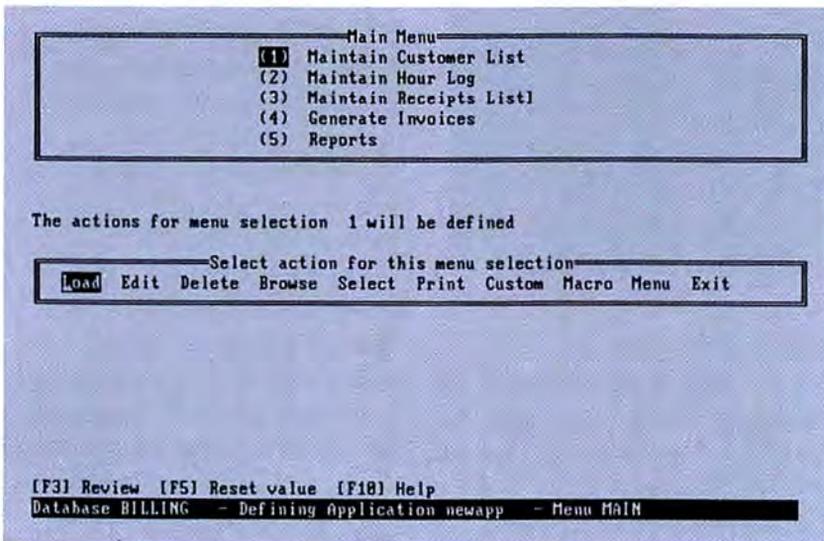
Once the tables are set up, you create an application by building a tree-like hierarchy of menus. The Express offers a choice of either vertical, "pick-a-number"-type menus or horizontal, 1-2-3-style menus in which you select an option by typing the first letter of the item or highlighting the choice and pressing <Enter>.

You start by typing in the choices for the top-level (main) menu. The Express then asks you to define the results of each menu choice (see Screen 2). You can direct the program to a submenu, an editing task, a custom program you've written, or several other options.

An Express-designed application can include only three levels of menus. You define menu choices in layers—you must define each choice on the main menu before defining any submenus. Pressing <F3> shows you where you are in the menu hierarchy. Any time you aren't sure how to define an action, you can press <Esc>



Screen 1: The data base definition screen of the Application Express shows you exactly what you're doing. The Express prompts you for each column name and data type.



Screen 2: The main menu for the time billing application. The options at the bottom of the screen define the actions available for each menu item.

for a default value. The Express lets you change definitions later to fine-tune applications.

The choice of actions available in the Express covers most procedures you'll need for an application, including all table manipulation, querying, and printing functions. When you want to step outside the Express *modus operandi*, however, you can write custom procedures with *R:base's* programming language. In the billing application I developed, I wrote a procedure to speed up report generation, sending information to memory variables rather than using *R:base's* standard table cross-reference method. The Express's Custom and Macro options serve as hooks for linking custom procedures to the menu system. If you choose Custom, *R:base* will take you to REdit, the program's text editor, so you can write the code you need. With Macro, you name an existing procedure to run.

Birth of a Language

R:base 4000 came under heavy criticism for its lack of a "serious" programming language. *R:base 5000* has a programming language you rarely have to use, thanks to the Application Express. But when you want to write a procedure, *R:base 5000* has the necessary equipment.

Programming in *R:base 4000* consists of writing command files containing a sequence of *R:base* commands, much like DOS batch files. *R:base 5000* uses the same concept, but Microrim has greatly expanded the number of available commands.

Unlike its previous incarnation *R:base 5000's* language is interactive, thanks to the introduction of

the Fillin command, which prompts the user for information, and IF ... THEN ... ELSE logic, which reacts to a user's choice. The *R:base* command for handling menus is particularly innovative. All the logic for displaying menus and registering menu choices is included in the Choose command. You supply the menu text and a name for the menu; Choose does the rest. The program lacks a Case statement—a shortcut to nested IF ... THEN ... ELSE statements—an omission that detracts from the elegance and readability of *R:base* code but does not reduce the power of the language.

Another of the language's enhancements is the ability to use WHILE ... ENDWHILE loops, which are exited with the use of Break statements. You can call one procedure from another and even pass parameters between procedures, although the receiving procedure will know these parameters only as %1, %2, and so on. A smart programmer will assign meaningful names to these variables in the first line of the procedure and add a line to check that the correct number of variables was received. The program does not allow you to limit the scope of variables as you can in *dBASE III* or Pascal, so you must be careful to avoid duplication of variable names in nested procedures.

The most annoying quirk of the programming language is its failure to support parentheses or compound arithmetic expressions. Setting variable *D* to be the sum

Maximum records: limited by storage	
Maximum record length (characters): 1530	
Number of digits of precision: dollar 16	
integer 9	
real 6	
Maximum fields per record: 400	
Maximum number of sort keys: 10	
Features:	
<input type="checkbox"/> 8087 support	<input checked="" type="checkbox"/> Text editor
<input checked="" type="checkbox"/> On-line help	<input checked="" type="checkbox"/> Command language
<input checked="" type="checkbox"/> Menu- or command-driven	<input type="checkbox"/> Macro capabilities
<input checked="" type="checkbox"/> DOS 2.00 subdirectories	<input type="checkbox"/> Statistical functions
<input checked="" type="checkbox"/> Password protection	<input type="checkbox"/> Ceraphics capabilities
<input checked="" type="checkbox"/> Date formatting	<input checked="" type="checkbox"/> Relational structure
<input checked="" type="checkbox"/> Date operations	<input checked="" type="checkbox"/> Data entry validation
<input checked="" type="checkbox"/> Calculated fields	<input checked="" type="checkbox"/> Global search and replace
<input checked="" type="checkbox"/> Customizable data entry screens	
File conversion:	
<input checked="" type="checkbox"/> ASCII	<input checked="" type="checkbox"/> Multiplan.SYLK
<input checked="" type="checkbox"/> 1-2-3.wks	<input checked="" type="checkbox"/> dBASE II
<input checked="" type="checkbox"/> VisiCalc.DIF	
Report generator:	
<input checked="" type="checkbox"/> Report from multiple files	<input type="checkbox"/> Multiple levels of subtotalling
<input checked="" type="checkbox"/> Customizable formats	<input type="checkbox"/> Save to disk

Figure 1: An *R:base* checklist

of variables *A*, *B*, and *C*, for example, requires the two statements

```
SET VARIABLE D = A + B
SET VARIABLE D = D + C
```

dBASE programmers will also be dismayed that *R:base* lacks a macro capability. (*R:base* uses the term *macro* to refer to command files, which are not macros in the *dBASE* sense.) This may inconvenience macro aficionados but doesn't diminish the functionality of the language. The *R:base* and *dBASE* languages are functionally

equivalent; I can't think of a programming task you could accomplish with *dBASE III* that you couldn't handle with *R:base 5000*.

Asking the Right Questions

Fancy applications aside, a data base program is only as good as its query system. Getting data into a file is straightforward, but getting data out can be complex because data from different tables must be logically connected and summarized in a number of ways.

Clout

David Jenkins

Clout, Microrim's "Conversational Language Option" for *R:base*, is the first of a long-awaited breed: a natural-language interface for PCs. With it, Microrim promises, you can query an *R:base* data base in the same vernacular you'd use to query a co-worker. And with the accompanying FileGateway, you can use everyday language to draw information from files created in 1-2-3, *dBASE*, *pfs:file*, *VisiCalc*, *Multiplan*, and ASCII formats.

Data base query languages are infamous for their exacting and cryptic syntax. A typical *R:base* query might read 'SELECT *lastname first-name tel* FROM *clients* SORTED BY *lastname* WHERE *state* = "CA"'. To get the same information using *Clout*, however, you could type 'Show me the names and telephone numbers of our

customers in California, in alphabetical order by last name'.

Clout users can remain blissfully ignorant of the structure of the data base at hand. Instead of looking up the field name for *telephone number*, for instance, users can revert to the English phrase. Nor do they need to know the file in which each piece of information—first name, last name, and telephone number—is stored. Like *R:base*, *Clout* can seek information in up to 40 tables, but unlike with *R:base*, no procedure need be specified. *Clout* itself determines which tables contain the relevant information. Even more valuable is *Clout's* ability to automatically cross-reference between files.

Unlike most query languages, *Clout* is forgiving of syntax. You can put a phrase just about anywhere that makes sense in a query. For example, the *Clout* user could rearrange the earlier query, changing it to 'Show me, in alphabetical order by last name, the names and telephone numbers of our customers in California'.

The Man Behind the Curtain

Clout's seeming magic depends on an elaborate internal dictionary. *Clout* starts with a vocabulary of 300 words and phrases commonly used in questions, and it recognizes words in either uppercase or lowercase, plural or singular form, and in any standard verb form. Its built-in concordance includes frequently used words like *a*, *and*, and *the*; questions such as *how many*, *what*, *where*, and *when*; comparatives such as *greater than* and *not equal*; sorting words such as *order by* and *rank*; negatives such as *rather than* and *except*; numeric operations such as *sum*, *count*, *total*, *average*, and *standard deviation*; and such terms as *about* and *approximately*.

For each data base you must also build an additional dictionary to amplify the field names in the data base. For example, *invoice number*, *inv #*, and *number of the invoice* can all be specified

as referring to a data base field called *invnum*. This data base dictionary can contain up to 500 words, bringing the program's total vocabulary to 800 words and phrases. *Clout* checks each word in a query against the two dictionaries, translates it, and proceeds with its search.

If a word is not defined in *Clout's* dictionaries, *Clout* rises to the occasion. Instead of showing an error message, *Clout* will ask you to clarify the word before it gathers the information and asks whether it should add the word permanently to the dictionary. *Clout* treats misspelled words with equal aplomb. If you typed, "Which employes were hired this year?" for example, it would ask, "By "employes" do you mean "employees"?" before it searched for your answer.

Flies in the Ointment

Although *Clout's* natural language interface has undeniable appeal, its drawbacks are hardly trivial. As in any English-language conversation, misunderstandings can occur, and they occur a

little more easily with *Clout*. You can pose a question in plain English, but obtaining the precise answer is not a foregone conclusion.

Using *Clout's* tutorial data base, for example, I asked several questions about security clearances. The first query: "Did Smith have clearance on telemetry?" The answer: "No!" Then I asked, "Did Colter have clearance on telemetry?" Again the answer was "No!" But when I asked, "Did Smith or Colter have clearance on telemetry?" the answer was "Yes!"

When consulted about this fairly major glitch, Wayne Erickson, *Clout's* author, professed no surprise. "Obviously, you'd have to use some care about how the question is asked," he said. In this case he assumed the problem was with the way *Clout* interpreted *or*, taking *Did Smith* as one question, the rest of the sentence after the *or* as another—and for some reason, the answer to *Did Smith* is *yes*. He sug-

gested that inserting parentheses around *Smith or Colter* would solve the problem, as indeed it did on a subsequent test. Parentheses, however, are not part of "natural language."

Indeed, with *Clout*, as with a human being, it is sometimes necessary to ask a question in alternate ways in order to extract the answer you need. *Clout's* menus enable you to study the data base dictionary and table structure at any time for help in framing your question, and familiarity with the program does foster a sense of what will and won't work. It is, nonetheless, a program failing that users must maintain responsibility for such verification.

English: The Universal Query Language

Although *Clout* is designed to work with *R:base* files, Microrim is pitching it to users of *1-2-3*, *dBASE*, *Multiplan*, and other programs as well. The key that unlocks these other files is Microrim's FileGateway utility. This program of-

(continues)

fers quick conversion of files from popular packages and ASCII files into the *R:base* format that *Clout* understands.

Despite the efficiency of the file conversion utility, using *Clout* with non-*R:base* files is not as practical as Microrim intimates. Since *Clout* cannot read the foreign formats, those files must be translated each time they are updated. Although conversion is relatively painless, keeping the *Clout*-able files up-to-date can require a great deal of time and record keeping.

Clout: A Harbinger?

Clout's advantages lie in its interface and power, not in its run time; it is slow compared to conventional query languages. *Clout*'s niche is in turnkey systems for occasional users—those who need the information in a data base but don't have the expertise required to obtain it via the program's native query system. If you already know *R:base*, *Clout*'s benefits are overshadowed by its drawbacks.

If it were possible to do without dependability in a query language, *Clout* would pack a respectable punch. But *Clout* can't come close to the precision of the natural language query systems implemented on mainframes—or to traditional query languages on PCs.

Although often ingenious in design and reasonably easy to use, *Clout* is menaced by nagging uncertainties that impugn its numerous virtues; reliability is simply not a feature that most users are willing to compromise. Microrim deserves kudos for the attempt, but *Clout* stumbles in providing foolproof data retrieval. For now, *Clout* is best seen as an unevenly implemented harbinger of interfaces to come.

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R:base's data retrieval system is flexible and complete. You can combine tables for a query with *R:base*'s complete set of relational operators, including Project, Union, Join, Intersect, Subtract, and Append. The query language is a variation of IBM's SQL/DS with a straightforward syntax (see Figure 2). An *R:base 4000* limit that persists in *5000* is the ceiling of 10 sort fields per query. *R:base 5000* exhibits creditable speed in sorting and searching (see Table 1), beating *dBASE III* in most tests. (Indexing a file does not increase sort speeds, because *R:base* uses indexes only for searches.)

You can completely bypass *R:base*'s query syntax by using Prompt mode. Typing PROMPT on the command line calls up a menu of *R:base* commands. You name the command you want to use, and *R:base* takes it from there, asking you for each piece of information it needs and building the command for you.

Generating Reports and Forms

You can automate queries by building reports. *R:base*'s menu-driven report mode is a modified version of *R:base 4000*'s optional report module. It gives you precise control over the appearance of a report. The only fine point it omits is an ability to align decimal points in real numbers. (This does not affect the formatting of dollar values, which are a different data type in *R:base*.)

Typing REPORTS at the R> prompt calls up the Reports main menu (see Screen 3). The first step in defining a report is choosing the Edit option to create page headers

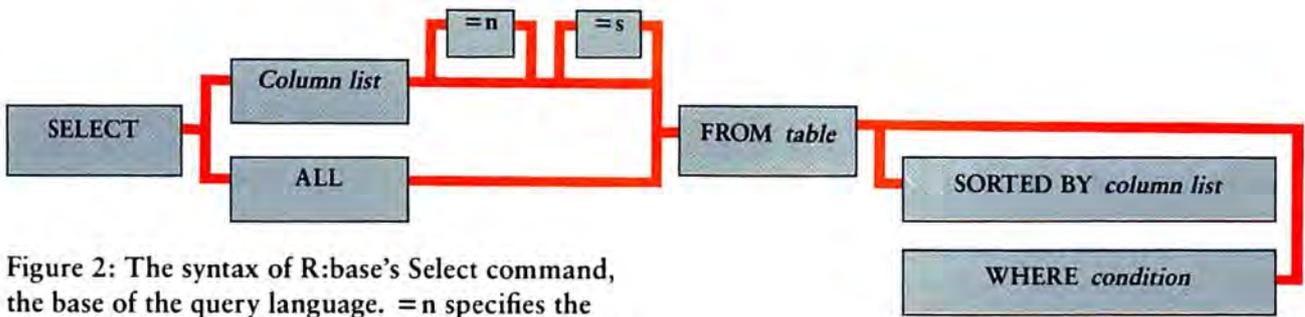


Figure 2: The syntax of R:base's Select command, the base of the query language. =n specifies the number of records to display; =s requests column totals.

and footers, column headings, and other text. Choosing Edit takes you to a blank screen on which you design the report using REdit. The screen is a tabula rasa, allowing you complete freedom of text placement, except that reports can't be wider than 131 characters. After you lay out the skeleton of the report, you use the Locate mode to specify where variables should be printed. You can use up to 40 variables in a report.

You can draw information from other tables or include results of calculations by defining special variables for those elements with the Define Variables option. R:base provides a variable for including the system date in a report. Like the programming language, the variable-definition process does not recognize parentheses or complex arithmetic statements. To create a mailing address line containing city, state, and zip code, for instance, I had to define three variables, one concatenating the city name with a comma, the second adding that variable to the state name, and the third combining the first two.

After all variables are defined and located, you can define "breakpoints" to insert subheadings, subtotals, or page breaks

where a field value, like customer name, changes. You can have up to ten levels of breakpoints, each with its own heading, detail, and footing lines (see Screen 4).

Once the report is defined and saved, all it takes to print it is to type PRINT *report name* at the R:base prompt. You could also type PRINT *report name* WHERE CLIENT# EQ 1 if you wanted to print a bill for client 1 only.

The procedure for designing data entry forms is similar; you create heading text and then locate variables. The form-creation mode has no provision for defining variables. Such a feature would, for example, allow you to have R:base look up the client name in the client table when you type a client number for the hours table. It is possible to program such a procedure using a roundabout method, but given R:base's usual attention to niceties, I'm surprised the option isn't more accessible.

■ Frosting Features

Microrim devotes a lot of advertising to extras like its compiler, data dictionary, and editor. With the exception of the Application Express, however, these accessories do not add much to the luster of the package. In some cases the advertising claims are misleading.

REdit, the program's text editor, is primitive, lacking block operations and split-screen capabilities, but it suffices for the limited amount of editing apt to be done in R:base. It would have been nice, however, if Microrim had followed Ashton-Tate's lead and allowed you to specify your own text editor for use within R:base. You can, of course, use the text editor of your choice to create R:base programs.

The compiler included with R:base is not really a compiler in any recognizable sense. The advertisements and documentation speak of binary code, but RCompiler is a *tokenizer*—it creates smaller code, which can be run only from within R:base. RCompiler speeds up applications and encrypts code so that intruders cannot read your programs, but the increase in speed is not dramatic. Application developers disappointed in the compiler should note that run-time modules of R:base that can be distributed with applications are available from Microrim in packages of five for \$450.

R:base's FileGateway offers quick conversion of 1-2-3, pfs:file, dBASE, VisiCalc, Multiplan, and

ASCII files into *R:base* format. Most of the conversion is automatic and easy. FileGateway makes assumptions about file characteristics, asks you to confirm them, and then converts. For instance, it analyzes the content of foreign files and categorizes each field by data type (text, date, integer, and so on). Unfortunately, FileGateway transfers are one-way only; *R:base* itself creates only *R:base* or ASCII formats.

Some data management shoppers will find *R:base*'s edge to be its password protection. Three types of passwords are available. An owner password enables the holder to change a data base's structure. You can also restrict access to specific tables by assigning each table either modify or read-only passwords.

Microrim also brags about *R:base 5000*'s data dictionary, a claim that could be misleading. (A data dictionary maintains information about what programs access what tables and how data in different tables is related.) *R:base* does indeed maintain such a lexicon, but it is primarily used internally by the program. The effects can be seen in such features as the List command, which reports the table and column names in each data base, but don't look for the dictionary on screen or in the documentation.

A worthwhile extra is the access to DOS commands that *R:base* provides; the procedure for changing subdirectories and copying files to the printer is the same whether you're looking at the

Table 1: DBMS timing comparison*

	R:base 5000	dBASE III	Cornerstone	Power-base
Conversion to ASCII	2:45	0:52	6:18	6:20
Conversion from ASCII, screening records for substring	0:37	0:27	1:56	2:45
Sort on nonindexed field	1:31	3:30	4:10	6:41
Sort on indexed field	1:31	2:59	N/A†	4:13
Index building	0:57	1:23	N/A†	10:58
Search on indexed field	0:01	0:01	N/A†	0:01
Search on nonindexed field	0:04	0:08	0:32	0:49

*Tests done on a data base including 600 100-byte records, using a Corona PC-II with a 10MB Shugart hard disk and 512K RAM. Indexes and sorts were on numeric fields. These figures are for comparison purposes only.

†Actual performance depends on many factors.

†Cornerstone does not use indexes

DOS C> prompt or the *R:base* R> prompt. Also, *R:base* is not copy protected, so it's easy to use on a hard disk system.

■ Brass Tacks

Microrim suggests you use a hard disk system with *R:base*. Indeed, the program does a lot of disk reading. I found it annoyingly slow on a dual-floppy-drive PC but pretty snappy on an enhanced AT. The program's speed seems to be independent of the amount of memory present in the system. Microrim specifies that a non-IBM computer must be 100 percent compatible to run *R:base* because some screen output is hardware dependent. Microrim technical support has even reported problems with IBM PCs equipped with an external disk drive.

Microrim makes it as easy as possible to use *R:base*. The program provides extensive on-line

help in addition to its handy prompt mode. The documentation contains two excellent tutorials, one introductory and one advanced, plus an impressive course in data base design. A reference card and a separate reference manual are also included. The documentation's main flaw is an incomplete index. Microrim provides 30 days of free telephone support to registered owners. After that, support costs \$150 per year, so it's wise to do a lot of programming in the first month.

■ Summing Up

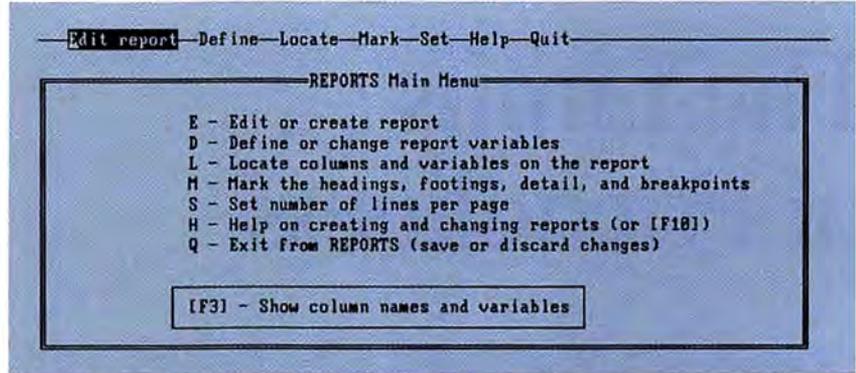
Will *R:base* be the new data management standard, as its advertisements claim? Its new programming language matches *dBASE*'s for power, and its report abilities surpass *dBASE*'s. *R:base* lacks its rival's macro capability, but the primary new feature it

does offer—the Application Express—certainly compensates for that.

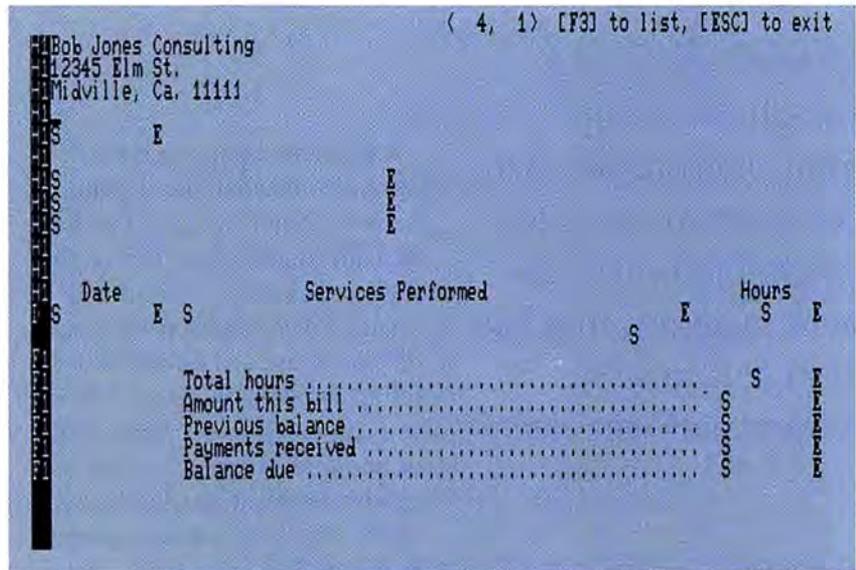
The Application Express streamlines applications development, but that's not to say it makes the task child's play. A data management novice could probably use the Express to program a simple application like mailing list maintenance—the manual's step-by-step data base design lessons are a definite boon. But there's no substitute for knowing the difference between a bad data design and a good one. If your office depends on complex applications, you'll probably still need a data management pro to develop them, but the Express can do most of the coding—and that saves time and money. Even without the Application Express, *R:base 5000* is a strong data management package; and with it, *R:base 5000* is a knockout. ●

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*R:base 5000
Microrim, Inc.
3380 146th Pl. SE
Bellevue, WA 98007
206/641-6619
List price: \$700
Requirements: 256K (320K recommended), DOS 2.00 or later version, two disk drives (hard disk recommended)*



Screen 3: R:base's Reports main menu. The report definition procedure is completely menu-driven.



Screen 4: An invoice for the time billing system shows how reports are designed. The S's and E's mark the placement of variables. The characters in the left-hand column mark the heading, detail, and footing lines for the first breakpoint. Other text will be printed on the report as shown.

The Limits of Friendliness

Infocom takes user-friendliness to the point of absurdity with *Cornerstone*, a middle-weight data management program that has good features but average performance.

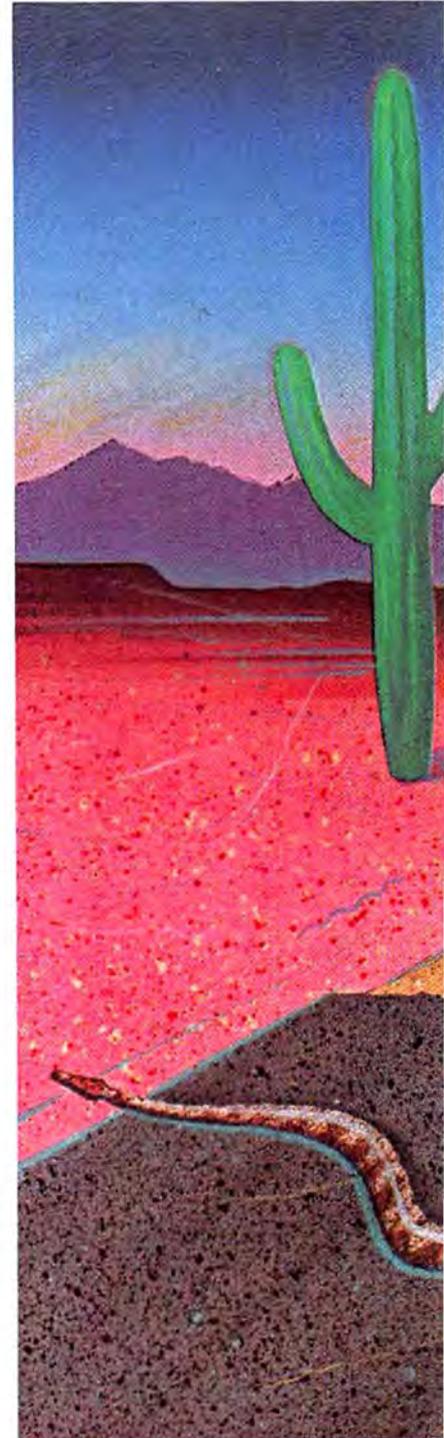
Bill Crider

■■■■ I live in the rugged Arizona desert, where there are two ways to get anywhere—the easy way and the quick way. You can ride in the air-conditioned comfort of your family sedan on a paved road, or you can head cross-country in a four-wheel-drive vehicle, eating dust while the bumps rearrange your internal organs. Because of the mountainous terrain, a town 10 miles away going cross-country might be 30 miles away by paved road. The road takes longer, but it's free of potholes, cacti, and rattlesnakes.

Using data management software is somewhat like traveling in Arizona. You can take a fast but difficult route, or you can go the slow and easy way. Command-oriented data base software like *dBASE* is fast and powerful but full of potential hazards. Although you can quickly sort a data base or find a record, you can just as quickly unintentionally erase your whole data base. Menu-oriented programs like Infocom's *Cornerstone* are safer and easier to use but slower to perform such crucial tasks as sorting and selecting records.

■ Documentation and Tutorials

If software were only a matter of packaging and documentation, *Cornerstone* might win as program of the year. The introductory manual, *Read This First*, tells you how to install the program and begin running it. (*Cornerstone* is copy protected, but it





comes with a backup disk. You can also install it on your hard disk and run it without the floppies.)

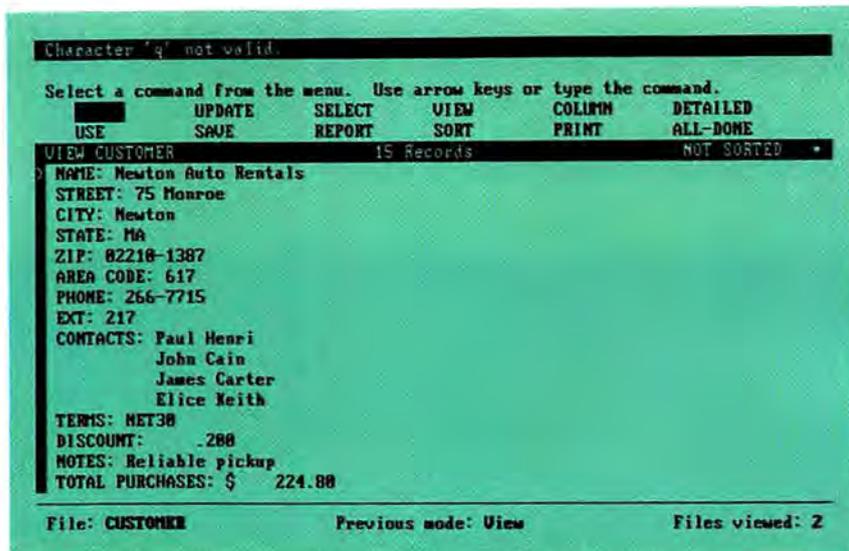
A beginner's guide and two reference texts make up the balance of the documentation. Infocom also includes a keyboard template and a quick-reference card. The materials' layout, typography, and organization are excellent, and screen illustrations and cartoons abound. Best of all, the documentation is written in conversational English.

Cornerstone features a good tutorial that uses realistic examples from data bases supplied with the program. Ten lessons cover all the program's major uses and features. You alternate between working with an on-line program mock-up and working with the actual program while reading directions in the beginner's guide.

■ User-Obsequious

Cornerstone is not just user-friendly, it is downright obsequious. The first thing you see when you open the box is a button that says, "Don't Panic." Underneath that is a brochure titled *Customer Assurance Program*. By the time I got that far, I was beginning to wonder if perhaps I should be more scared than I was. The brochure informed me that I had 90 days in which to make phone calls to Infocom for assistance. Calls are not toll-free, but the company does answer the phone promptly.

Everything in *Cornerstone* is done by menu choice. This method is satisfactory until you



Screen 1: The *Cornerstone* program screen provides so many lines of program information that it leaves little room for the data.

get lost in the complex menu structure. Tracing your way through these menus is like driving the Los Angeles freeways. It can make a seasoned data base user yearn to cut across country with a query language—and *Cornerstone* has none.

Two lines of the screen show available commands. You select your choice by pointing with the cursor and pressing <Enter> or by typing enough of the command to identify it and then pressing the <Space> bar or <Enter>. If you use the typing route, you often have to type two or three letters to identify a command.

The program screen displays an overabundance of information (see Screen 1). An error line informs you when you make a mistake, a command line highlights items chosen from the menu, a prompt line suggests your next action, and two status lines display such information as which file you are using

and the number of open files. Perhaps a case could be made for a novice needing so much information, but all those messages are just as likely to confuse a beginner.

Cornerstone's help function elevates the term *context-sensitive* to new heights. You can get help with error messages, menus, and even with which values are acceptable for the field you are editing. *Cornerstone* not only knows which menu you are using, its conversational screens often include the name of the file and field you are using and what you are trying to do with them. It sometimes says such things as 'Given what you have typed so far, here is what you can do ...?' (Gads! These things will soon be reading our minds!)

If you can't find what you need by using the help function, the options function provides lists of what you can do at any given time. This intelligence may take the form of an expanded menu, a list of acceptable values for a field, or a list of files to use. In many respects this feature is more useful than the help function.

One unique user-friendly feature relates to date fields. If you don't have a calendar handy, you can use phrases like "last Tuesday," "next month," or "tomorrow" as dates, and *Cornerstone* will calculate the correct calendar date for you. Such recognition of English phrases has evolved from Infocom's interactive adventure games. I hope the company carries this trend further and develops the ability to use English-language queries in place of menu selection.

Cornerstone lets you design your own forms and save them for later use. If you try to abandon a form without saving it, the program reminds you that you have not saved it and asks if you want to do so. If you say no, it saves the form anyway—just in case you change your mind.

Have you ever become impatient with someone who was so friendly he or she monopolized your time, preventing you from getting any work done? That was my reaction to *Cornerstone*'s menu system after using the program a few days. All the status lines, menus, checks, and double checks began to intrude. Infocom could greatly improve the program by adding a method of turning off some of the status lines and double checks to increase operating speed. The question is: Which is more important—user-friendliness or user-effectiveness?

Speed Limits

Although the desirability of extensive menus may be a matter of personal preference, few users will appreciate *Cornerstone*'s sluggish screen performance. Scrolling through a sorted list takes about 1 second per line. Going to the end of a file of just 35 records takes almost 3 seconds. This is unbearably slow compared to most other data management software.

Compared with other middleweight DBMSs, *Cornerstone* sorts at an average speed, but it sorts considerably slower than powerful programs such as *R:base 5000* and *dBASE III*. Working on a hard disk PC with the same data base of 35 names and addresses, *Cornerstone* takes 22 seconds to sort the file alphabetically by last name and 22 seconds to sort on the telephone number field. The program takes 38 seconds to sort 35 records on a currency field (see Table 1 in the article "The R:base Express" in this issue for speed comparisons with other data management programs).

When you work with a data base, you usually want to work with a subset of the file. For example, you may want to see only customers who have made purchases over \$500 in the last six months. Giving the program such criteria is called selecting, and the resulting subset is called the working set or update set.

Cornerstone does not go through the whole file to select a working set. It selects just 17 records (all the screen can display) and then stops. While most data bases immediately report how many records are in your working

set, *Cornerstone* reports only how many it has found in relation to the whole file. For example, '17...35' means it found at least 17 records that meet your criteria, but the number could range as high as 35 (the number of records in the file). To receive a report with a precise number, you must scroll through the whole file.

Technically Correct

Despite slow screen performance and an overemphasis on user-friendliness, *Cornerstone* packs a lot of data management power. Its list of features rivals that of other middleweight data management programs such as *Power-base* and *Six* (for specifics,



compare Table 1 with "A DBMS Compendium" at the end of the "Review" section in *PC World*, April 1985).

A unique and powerful feature of *Cornerstone* is its ability to set up subrecords. Like memo fields in *dBASE III*, subrecords are actually stored in a separate file. Unlike memo fields, they are displayed and edited as part of the data entry screen.

Subrecords cannot be indexed, subtotaled, or sorted, and you can't have subfields of subfields. Any data base can have up to eight fields with subrecords, and any field can have up to 255 subrecords. This capacity is extremely useful for fields that might have



multiple values. For example, a customer data base in *dBASE* would require a separate field for each contact in a company. With *Cornerstone* you can set up one contact field and define it to allow subrecords. As you develop more contacts with that company, you can add them.

All *Cornerstone* fields are variable in length. You specify column width, but the actual data can be up to 255 characters. Thus, even if you have defined your customer names to be 10 characters, you can still enter a longer name without its being truncated. When you print a report in columns, data that is too long will wrap around within the column format.

With *Cornerstone* you can set up relationships between files so that they exchange information. For example, your purchase order

file need not contain the names and addresses of the people you purchase from. That information could be stored in a supplier file, with a relationship specified to the purchase order file. When you issue a purchase order, *Cornerstone* could automatically display the address and phone number. Setting up such relationships saves data entry time and reduces the possibility of operator error. Any file can be related to as many as 30 other files, but you can have only 8 files open at a time.

Cornerstone provides nine data types. Integers (numbers without fractions) and Numbers (any numbers, including fractions) are stored with 15 digits of precision. String data is any set of up to 255 characters, including alpha-numeric. Date data types store the year, month, and day of any day after A.D. 1. Dates can be displayed in any of 100 formats, and date arithmetic can be performed on any date since the beginning of the Gregorian calendar. Time data can be displayed in any of 10 formats, and time arithmetic is also supported. Boolean data can be displayed as T/F, True/False, Yes/No, or Y/N. Subrecord data (data entered into a subrecord field) is treated as character data but cannot be indexed or sorted.

Enumerated data is data that you have specified to be entered into a field. For example, if you set up a field called Type for your customer file, you might specify that it accept only three values—“Current,” “Past,” and “Prospect.” You can specify up to 255 values

for an enumerated field. Enumerated data is always character data, but instead of sorting in alphabetical order, it sorts in the order you set up when you defined the enumerated field.

Derived data is character or numeric data taken from another field in the current file or another file. Deriving data is useful when you want to perform a calculation on the data before you enter it into the target field. For example, you could derive the tax amount for an order by multiplying the total amount by the tax rate instead of manually calculating and entering the tax. Once derived data is in the field, you cannot edit it. Its value is fixed by the value of its source field.

Cornerstone minimizes data entry error by allowing you to specify that data must match data in another file. For example, to prevent issuing purchase orders to vendors not on an approved list, you can specify that the vendor name on a purchase order must match a name in the vendor file.

A very convenient feature of this program is its ability to use initial values. If you use a value frequently, you can instruct the program to always enter that value into a particular field. For example, if most of your customers are from your town, you might want to have the town and state names automatically entered as initial values. If you add a customer from another town, you can always edit the fields to change the values. Initial values can be used with any data type except derived data.

With *Cornerstone*, data entry forms and report formats are designed interactively. You see the information displayed immediately on the screen. If you don't like it, you can easily change it. You can

Table 1: Cornerstone parameters

Requirements	RAM 256K	
	Hard disk	No
	Key disk	No
Features	8087 support	No
	On-line help	Yes
	Menu- or command-driven	Menu
	DOS 2.00 subdirectories	Yes
	Data encryption	No
	Date formatting	Yes
	Date operations	Yes
	Calculated fields	Yes
	Customizable data entry screens	Yes
	Text editor	No
	Command language	No
	Macro capabilities	No
	Statistical functions	Yes
	Graphics capabilities	No
	Relational structure	Yes
	Data entry validation	Yes
Capacity	Maximum records	32,700*
	Maximum record length (characters)	4000
	Number of digits of precision	15
	Maximum fields per record	158
	Variable record length	Yes
	Maximum number of sort keys	Unlimited
	Global search and replace	No
File conversion	ASCII files	Yes
Predefined formats	1-2-3.wks	Yes
	VisiCalc.DIF	Yes
	Multiplan.SYLK	No
	dBASE II	Yes
	pfs:	Yes
	MailMerge	Yes
Report generator	Report from multiple files	Yes
	Customizable formats	Yes
	Multiple levels of subtotaling	Yes
	Save to disk	Yes

*Dependent on record length (up to 8,000,000 characters).
The working set is limited to 32,700 records.

even increase or decrease the default column width for any field. When you have designed a report format, you can see the actual data in that format on the screen, send it to the printer, or send it to a disk file for later editing with a word processor. The forms and report generators in *Cornerstone* are a distinct improvement over most DBMS generators.

Give Me Back My Jeep

I wouldn't send a newcomer to Arizona on a cross-country jaunt in a four-wheel drive; I would recommend taking the highway. Similarly, I would not expect a novice to immediately grasp a command-oriented data base. Still, several comparable menu-driven data management programs are almost as easy to learn as *Cornerstone* without wasting your time with endless menus and prompts. What's more, most of these middle-range data management programs are significantly less expensive. Even if you prefer the comfort and safety of a paved highway, you might want to look around for another route. ●

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*Cornerstone
Infocom, Inc.
125 Cambridge Park Dr.
Cambridge, MA 02140
617/492-1031
List price: \$495
Requirements: 256K (512K
recommended), DOS 2.00 or
later version, two disk drives*

Elegant Enhancers

Do you find yourself typing the same commands and phrases over and over?

Wouldn't you rather have the computer remember most of them and do the retyping for you? Four utility programs are ready to help you save time and drudgery.

Rick Altman

Keyboard enhancement programs enable you to assign a long string of characters to a single key or a simple combination of keystrokes. That string of characters, called a macro, can include often-used phrases, DOS or program commands, or combinations of commands and text. Almost anything you would normally type can be recorded in a keyboard macro. But keyboard enhancement has recently come to mean much more.

The current crop of keyboard enhancement programs (also known as macro processors) can call up extensive interactive menus, create striking user-defined displays and help menus, have macros call other macros, pause for hours or even days before issuing commands, and—the ultimate in automation—set a string of up to 64,000 keystrokes in motion at the touch of a single key. For the new user, macro processors conserve keystrokes, while the more experienced power user can rely on them to automate complex

command sequences and help build intricate systems of menus and help screens. The question is not whether you should use one of these products but merely which one.

The four programs evaluated in this article represent the best and the brightest in keyboard enhancement. Two of the programs, *ProKey*, version 4.0, from RoseSoft and *SmartKey*, version 5.0, from Software Research Technologies, are innovative updates of long-established products. Two newcomers, *SuperKey*, version 1.0, by Borland International and *Keyworks*, version 1.1, by Alpha Software, benefit from the experience of other programs and add some new twists. Among these four you're almost certain to find the macro processing tool best suited to your working style and level of computer expertise.

If you are a newcomer to keyboard enhancement, any one of

this quartet will dazzle you. If you're already a power user looking to upgrade and you've developed a certain style of working with macros, take a close look at these programs: The wrong choice might necessitate a frustrating process of breaking old habits.

■ On the Key Ring

Macro processors work by intercepting keystroke signals en route to the CPU. These four macro programs are RAM resident; that is, they are usually loaded into memory once when the computer is started, and remain active but "in the background" even as other application programs are loaded into and emptied from RAM.

Keystrokes can be recorded in a macro "on the fly" during the course of any application. All the macro programs discussed provide a Learn mode, in which you simply tell the program when to start and stop recording your keystrokes; everything between those two signals is stored as a macro—but only in RAM, so you must save the current key definitions to a disk file if you plan to use them again.

These keyboard enhancers allow you to write macro files to permanent disk storage while you're working in another application program, unlike earlier macro processors, which forced you to exit the application to run them. All the programs store macros as plain ASCII files, so they can be edited with any word processor or text editor. This also means that you can use a word processor to create a group of macros at once.

Because the macros are stored in a disk file, you can build separate sets of macros for various application programs, moving the appropriate macro files into and out of memory as needed.

Each of the enhancers enables you to create macros containing fixed- or variable-length fields that let you enter data in the middle of a macro. Variable-length pauses are terminated by pressing <Enter>; fixed-length pauses end when a specified number of keystrokes has been pressed.

The four programs also feature a time delay that can cause a macro to wait a specified length of time before continuing its playback (see Table 1). For example, you could telecommunicate an important data file when long distance rates are low by telling *ProKey* or *Keyworks* to wait a specified number of hours before

through the use of passwords; *SuperKey*'s encryption scheme is the most sophisticated.

SuperKey and *SmartKey* support date and time stamping within macros, so that you can stamp the beginning and end of a work session and maintain tight control of successive versions of a document. *ProKey* offers a makeshift date-stamping feature consisting of a BASIC program and a batch file to create a macro containing the current date. *ProKey* doesn't supply time stamping, and *Keyworks* provides neither time nor date stamping. *SuperKey* and *Keyworks* both feature extensive context-sensitive help screens, available at any time.

With any of the programs, an imaginative user can create a macro that calls another macro so that text or commands can be efficiently combined. Better yet, a

■ *These keyboard enhancers allow you to write macro files to permanent disk storage while you're working in another application program.*

executing a macro's string of modem commands.

ProKey, *SuperKey*, and *SmartKey* include files to convert your keyboard to an alternative layout, such as the AT, Dvorak, or IBM Selectric keyboards. Those three enhancers also support one-finger operation mode, in which keys normally pressed in combinations may instead be used in sequence.

SuperKey, *SmartKey*, and *Keyworks* provide file encryption capabilities, protecting sensitive data

macro can even be defined within another. You could have one macro that typed a prompt to the screen and defined a macro that stored the response. Such nesting of macros is one of the most powerful capabilities of these programs.

The products all use built-in macro editors that enable you to revise or adjust definitions without leaving the current application. However, only *Keyworks* provides

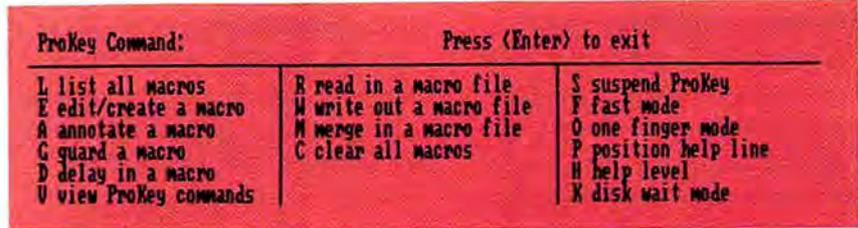
a full-screen pop-up editor, with which all the currently loaded macros can be edited at once; the other programs permit you to edit only one macro at a time. Except for *Keyworks*, all the programs also enable you to enlarge the DOS typeahead memory buffer from its normal capacity of 16 keystrokes to between 64 and 128 keystrokes. It's a rare typist who can get more than 128 keystrokes ahead of the PC's processing.

Although the four programs function similarly and share numerous features, their differences are significant. Individual nuances or styles of operation might make your purchase decision easy. Ironically, while the objective is to save keystrokes in application programs, all four packages are often slow and awkward at internal housekeeping.

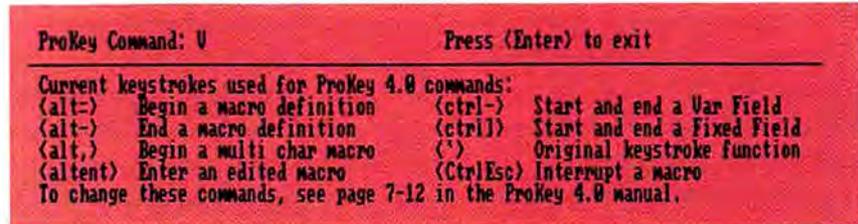
ProKey 4.0

ProKey is the dean of macro programs, but its current version suggests that RoseSoft did not expect such stiff competition from the upstarts so soon. Still, *ProKey* performs its tasks with an elegance that reflects its three previous versions and its position as the most popular keyboard enhancement package.

ProKey's array of features, although conservative compared to the other programs', might have made menu use a chore. But unlike its competitors, *ProKey* keeps its menu structure simple and eschews submenus (see Screen 1).



Screen 1: ProKey's single level command name is in keeping with the program's conservative style.



Screen 2: This command summary is the extent of ProKey's on-line help. Hopefully, you won't want to change these commands—the manual lacks pages 7 through 12.

ProKey is the only program of the four that allows you to place the command or menu key (the key used to summon the keyboard enhancer's main menu) directly into a macro. The other three actually perform the command and throw you into the main menu, or just type the command's ASCII equivalent. But with *ProKey* you can create macros that call up the main menu and invoke a command from that menu. This capability becomes even more valuable as you begin to develop extensive macros that take multiple trips to the main menu.

Another major plus is *ProKey's* ability to create "guarded" macros, which remain active even as other macro files are loaded into and emptied out of RAM.

ProKey is amiable enough to let you give a macro a name relevant

to its purpose. Macro names can contain up to eight characters. Instead of simply assigning an unrelated key to create the salutation section of a letter, for example, you can name the macro SALUTE. To play it back, you'd type <Alt>, SALUTE <Enter>.

Certain other features, however, betray *ProKey's* old-fashioned design. For example, you can't create pop-up message or help windows via display or text macros.

Another flaw is the program's awkward control of defaults. Unfortunately, RoseSoft may have relied too heavily on its assumption that *ProKey* will be used with batch files. The program makes no provision whatever for permanently changing defaults for the

command key and other keys, such as those for beginning and ending definitions, creating fields, and changing modes. Instead, *ProKey* allows you to change them only when you install the program before each session. To change a default, you're forced to save the current definitions to disk, save your application work, reset the computer, and try your luck with those unwieldy DOS commands. The manual recommends using batch files to send commands like PKLOAD/xb[F8]/xe[F9]<Enter> (which loads *ProKey* into memory and changes the keys that define the beginning and end of the macro to <F8> and <F9>, respectively).

While poor documentation plagues all four programs, *ProKey*'s woes are curious in light of RoseSoft's apparent efforts to improve its manual. The index is incomplete and ambiguous in places and refers to wrong pages more than a few times. Oddly, the manual contains no mention of directories or paths, referring instead only to logged drives—an unfortunate omission that may result in macro files being stored in the wrong directory. *ProKey*'s on-screen assistance doesn't make up for the manual's defects—Screen 2 demonstrates the paucity of *ProKey*'s on-line help.

SmartKey 5.0

SmartKey, version 5.0, is perhaps the most frustrating keyboard enhancement program of the lot. Originally designed to run under the CP/M operating system, the program's first stab at the MS-DOS world two years ago was less than a triumph. In many respects

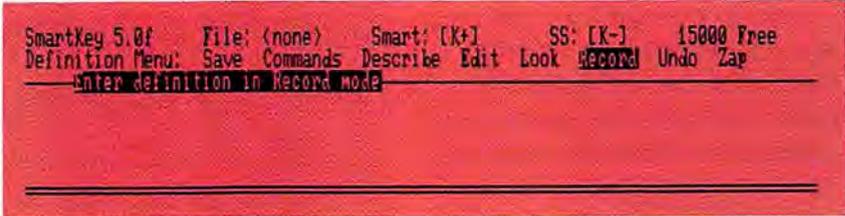
SmartKey has done an admirable job of catching up since then.

Unfortunately, it remains the surliest program of the four. It has no on-line help and few shortcuts to save you from continuous menu scrolling. With this program, intensive work setting up an integrated string of macros might send you up a wall. And unlike *ProKey*, *SmartKey* does not provide a means for macros to invoke the main menu and a command from that menu.

What *SmartKey* does offer is a "supershift" key, and if you're willing to overlook the program's imperfections, that alone could make you a believer. The other three programs give you the usual four ways to redefine a key: upper- and lowercase, <Ctrl>, and <Alt>. But *SmartKey* gives you

another shift state—it lets you designate any key as the supershift. Furthermore, the supershift is a toggle key, which many users prefer to a key that must be pressed in conjunction with another. Because the supershift can be combined with any other shift state, this option opens up a whole new corridor of definable keys. To invoke the original meaning of the key you select as the supershift, merely type it twice.

SmartKey is also the only program that explicitly allows you to move a definition from one key to another on the fly. You may seldom need to change a definition, but when you do, neither *SuperKey* nor *ProKey* will be nearly as friendly. *Keyworks* embellishes



```
SmartKey 5.0f   File: (none)   Smart: [K+]   SS: [K-]   15000 Free
Definition Menu: Save Commands Describe Edit Look Record Undo Zap
Enter definition in Record mode
```

Screen 3: It takes about seven moves to reach *SmartKey*'s keystroke command to start recording.



```
SmartKey 5.0f   File: (none)   Smart: [K+]   SS: [K-]   15000 Free
SmartKey Main Menu: Exit Define List Modify Options File
Return to application or DOS
```

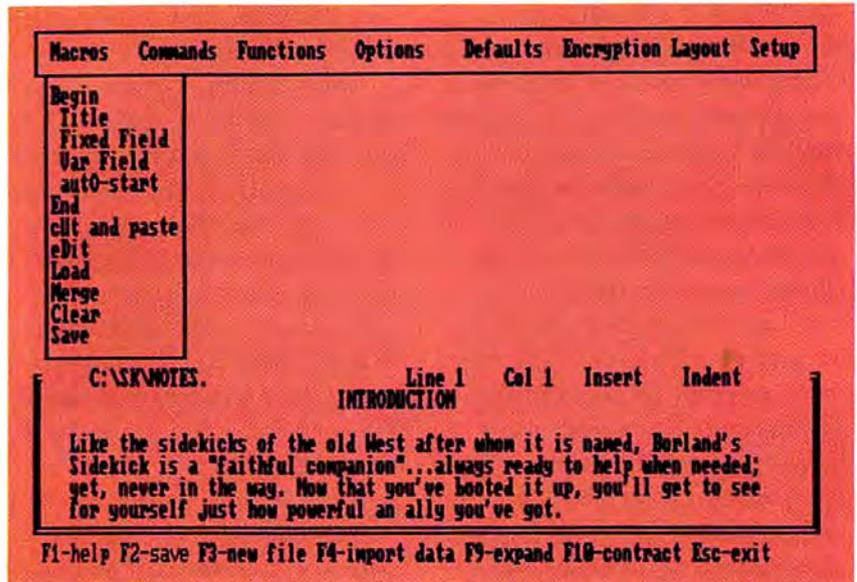
Screen 4: The *SmartKey* main menu starts out ready to do nothing at the touch of a key.

this feature with its full-screen pop-up editor; you simply edit the key name to move a definition. *SmartKey* provides constant access to a range of DOS commands. Unlike *Keyworks*, unfortunately, *SmartKey* cannot format a disk when you get a 'disk full' message.

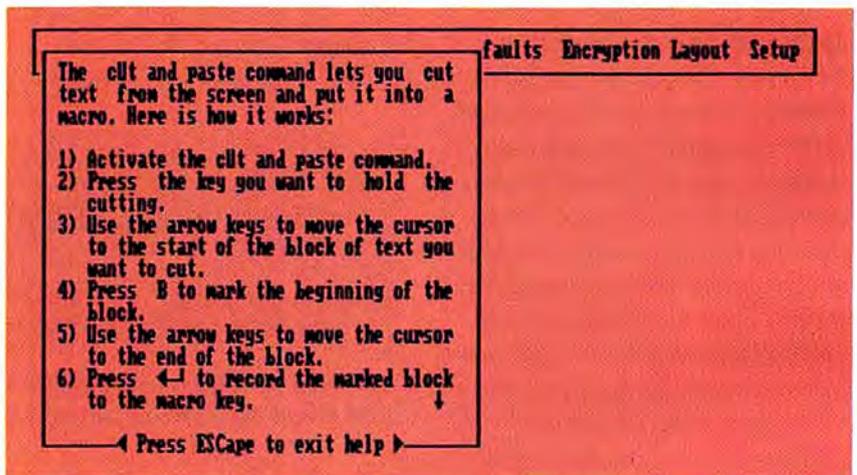
SmartKey has almost caught up when it comes to the capabilities that are now standard in keyboard enhancement programs (see Table 1). Yet considering that this version is its fifth try, you'd expect a better mode of operation than reliance on tedious and poorly designed menus. The record function (the Learn mode), for example, is hidden two levels deep in menus (see Screen 3). Moreover, the main menu (Screen 4) defaults to Exit instead of something useful.

SmartKey should have been designed to allow you to set up a macro that scoots through the menus and submenus. But the program will not permit its own command key, [SMART], to be included in a macro as *ProKey* does. *SmartKey* is designed to do up to 60,000 things with one keystroke, yet all the menus must be entered manually. Very peculiar—and not very slick.

SmartKey's display macro capabilities work in conjunction with nested macros, enabling you to set up display windows that make life easy for someone trying to use one of your applications. The display macros can be used artistically,



Screen 5: SuperKey (the top menu) can coexist and even cooperate with Borland's SideKick.



Screen 6: Help screen for SuperKey's Cut and Paste feature. A similar screen is available for every other feature of the program.

but they are not quite as easy to create as the equivalent text-only macros in *Keyworks*.

Moving from the beautiful to the ugly, there's the manual. The documentation is so poorly written, organized, and produced that it's almost worthless. In fact, it unintentionally reinforces the menus, which provide the only real hope of learning the program.

Clearly, *SmartKey* is not a program for the novice macro maker. It's aimed at the power user who is less interested in aesthetics and ease of use than in simply getting down to the business of creating macros that enter programs, perform extensive functions, prompt users, save material, and exit—all at the touch of a key.

SuperKey 1.0

In Borland International's first attempt at key enhancement, the innovative software company did so many things right you'd suspect it had secretly been making macro programs under a different name. *SuperKey* is relatively easy to use and understand. And just when you're convinced it's a nice macro processor that takes care of the little things well, it blows your socks off with a high-powered capability that belies its rookie status.

A tour of *SuperKey*'s menus is unpleasantly reminiscent of *SmartKey*'s. In *SuperKey* poor design surfaces in a different, though

equally frustrating form: you're expected to type a W to shoW titles, a D to eDit, a U to cUt and paste, and so on. With luck, the next version of *SuperKey* will pay a bit more attention to the science of mnemonics. In version 1.0, the

used in any application you choose. You can easily include 1-2-3 spreadsheets or SDIR (sorted directory) listings in text files. Interestingly, this cut and paste facility is available in Borland's *SideKick*, and at least one of *Su-*

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only good thing about the menus is that you don't have to use them unless you want to.

SuperKey enables you to almost completely bypass the menus with an alternative set of two-stroke commands that cover a wide array of frequently used features: begin and end macros, fixed fields, variable fields, cut and paste, list macros, and list the last 255 keystrokes entered at the DOS prompt (the DOS command stack). Instead of having to type <Alt>-/ M B (for Macro Begin) and the key to define in order to create a macro, you can merely press <Alt> and the key to define. Furthermore, <Alt> and all of the defaults can be permanently changed on the fly, unlike in *ProKey*.

But *SuperKey*'s cut and paste feature is its ace in the hole. The program can take any portion of any screen from an application program or DOS function and assign it to a key. The data from the screen can then be moved and

perKey's rivals, *Keyworks*, enjoys peaceful coexistence with *SideKick*. As Screen 5 shows, *SuperKey* and *SideKick* also work together well.

SuperKey excels in its control of the format of data in fixed and variable fields. You can call for all data entered at the keyboard to be converted into upper- or lowercase, automatically centered, or justified left or right. You can also stipulate that all numbers be given commas and decimal points in the appropriate places. Best of all, *SuperKey* is the only macro program that provides data verification for fixed and variable fields. You can limit the data entered to numeric only, uppercase alphabetic only, lowercase alphabetic only, or alphabetic only.

SuperKey's comprehensive system of on-line, context-sensitive help is superb (see Screen 6). No

Table 1: Comparison chart of features

	ProKey	SuperKey	SmartKey	Keyworks
Cost	\$130	\$69.95	\$49.95	\$89.95
Size of resident file	37K	38K	7K	45K
Size of help file	None	38K	None	52K
Memory required	38K	48K	21K	39K
Copy protected	No	No	No	No
Keypad definable	Yes	Yes	Yes	Yes
Redefine command key	Yes	Yes	Yes	Yes
Playback speed control	Yes	Yes	Yes	Yes
On-line help	No	Yes	No	Yes
Guarded macros	Yes	No	No	No
Display macros	No	Yes	Yes	Yes
Customized menus	No	No	No	Yes
Skip macro key	Yes	Yes	No	Yes
Load macro file from within a macro	Yes	No	No	Yes
Move macros	No	No	Yes	Yes
Supershift key	No	No	Yes	No
Sample macros included	7	10	7	6
Maximum strokes in macro	7500	64,000	60,000	7000
Maximum definable macros	300	300	300	300
Layouts included	9	1	1	0
Date/time stamping	No	Yes	Yes	No
Cut and paste	No	Yes	No	No
One-finger operation	Yes	Yes	Yes	No
Variable tones	No	Yes	No	No
CLS capability in macro	No	Yes	No	No
Screen saver	Yes	Yes	Yes	Yes
Keyboard lock	No	Yes	Yes	No
Typeahead buffer	15 to 128	128	64	No
File encryption	Yes	Yes	Yes	Yes
DOS command stack	No	255	64	No
DOS functions	No	No	Yes	Yes
Directory			Yes	Yes
Copy a file			No	Yes
Erase a file			Yes	Yes
Rename a file			Yes	Yes
MKDIR, CHDIR, RMDIR			CHDIR	All
Format a disk			No	Yes
Type a file			Yes	No

(continues)

Table 1 (continued)

	ProKey	SuperKey	SmartKey	Keywords
Macro creation				
Built-in editor	Yes	Yes	Yes	Yes
Full-screen editor	No	No	No	Yes
With word processor	Yes	Yes	Yes	Yes
"On the fly"	Yes	Yes	Yes	Yes
Fields				
Fixed and variable	Yes	Yes	Yes	Yes
Formatting options	No	Yes	No	No
Data verification	No	Yes	No	No
Maximum delay (wait)	256 hours	60 seconds	255 seconds	18 hours
Macro directories				
Display actual macros	Yes	No	Yes	Yes
Display titles	Yes	Yes	Yes	Yes

matter where you are in a *SuperKey* function, typing <F1> will instantly give you a screenful of instructions concerning the menu or submenu you are pondering.

For the most part, you have to dig pretty deep before Borland's inexperience begins to show, but there is one glaring flaw: *SuperKey* offers no convenient way of retrieving macros from memory to review their meanings, unless you remembered to assign titles to each. If you didn't, *SuperKey* only acknowledges that a key has been defined; it won't give the definition. Title or no, the only way to see the actual keystrokes is to use your word processor (assuming the macros have been saved to disk) or to use the edit function and view them one by one. *Keywords'* full-screen editor provides a much better solution.

While concocting macros on the fly is a breeze, using the built-in editor or a separate word processor is laborious. The syntax is cumbersome, and there is no clear delineation between the key being redefined, the title of the macro, and the macro itself. This promises to be troublesome for the user intent on writing display macros, which can be created only with a word processor or text editor (an awkward design problem in itself). Because no actual *SuperKey* function is used to create them, on-line help is not available.

While *SuperKey* may be the bonus baby of macro programs, its authors still have a bit of polishing to do. The manual is better-written and easier to follow than the other manuals, and the on-line help is terrific, but some rough edges remain. *SuperKey* does not protect you from endless loops, and it asks for reconfirmation before defining a primary QWERTY

key—your own tastes will determine if these are advantages or drawbacks. And if you don't have an IBM PC or a close compatible, insist on trying *SuperKey* before you buy it.

Finally, the delay range for suspending a macro in mid-execution is a somewhat limited 60 seconds. If you want to create a lengthier pause, you will have to nest many delays back-to-back. If one of your requirements is a program that will pause for several hours, *SuperKey* won't fill the bill.

Keywords 1.1

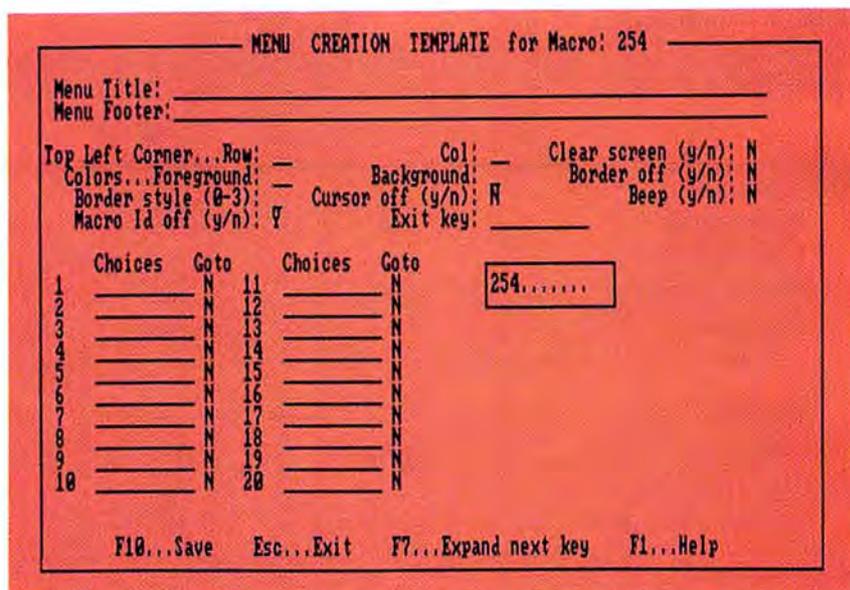
Alpha Software's *Keywords* represents yet another new wave of keyboard enhancement programs. While allowing even a neophyte to perform routine macro wizardry, *Keywords* goes a step further into extensive, sophisticated menu making, benefiting the

user who plans to share his or her programs with others. *Keywords* also offers the slickest on-line editor and the most complete assortment of DOS functions that are available within any application program. And while this program, like those before it, still labors under a few unwieldy commands, it promises an exciting test drive for anyone in the key enhancement market.

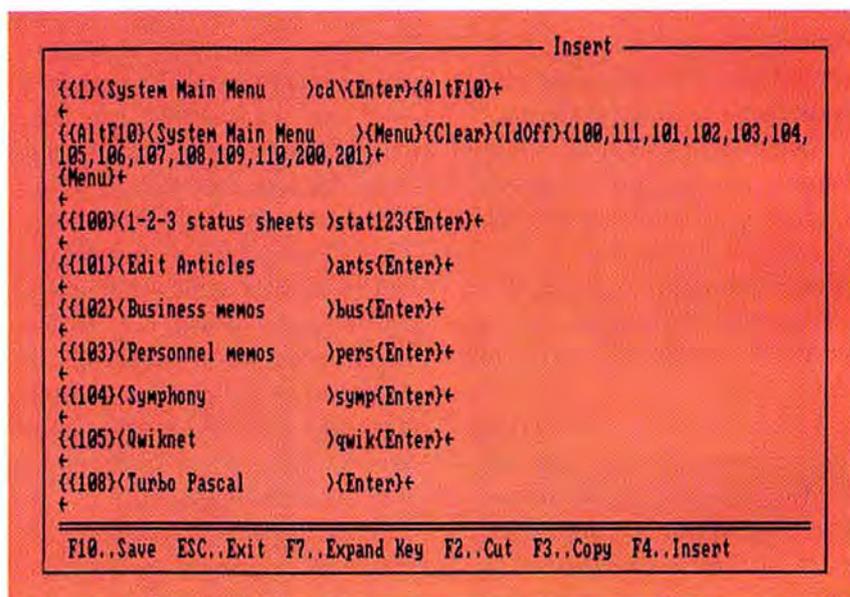
Keywords comes with a small manual—a pamphlet, really—whose size suggests that either the program is easy to learn or the documentation is insufficient. Actually, both are true: *Keywords* is the easiest of the four programs to start up, but the documentation falls short of helping you master the program's more advanced features. The <GreyPlus> key invokes the main menu, the gateway for all *Keywords* functions, and context-sensitive help is available every step of the way.

For conventional tasks, *Keywords* operates in much the same way as the other programs. Its pull-down menus are the simplest to use, with well-chosen mnemonics and clear submenus, yet it offers no shortcuts like *SuperKey*'s set of two-keystroke commands. Its command key is well placed and scrolling through menus is easy, but unlike *ProKey*, *Keywords* won't let you include the key in a macro. Nested macros are easier to create than with *SmartKey* but not quite as easy as with *SuperKey*. *Keywords* did not go the extra yard and offer one-finger operation or alternate keyboard layouts.

As Table 1 illustrates, *Keywords* is a bit stark when it comes to



Screen 7: This *Keywords* screen makes creating moving-bar menus very easy. Just fill in the blanks. Once you learn the commands, you may find it easier to create menus in the macro editor.



Screen 8: The *Keywords* macro editor lets you create or alter any currently loaded macro.

flashier aspects like formatting options in fields, DOS command stacks, and displaying system date and time. But where it counts, *Keywords* advances the art of macro building several giant strides, gaining the most ground with its menu-making capabilities.

With *Keywords* you can create pop-up moving-bar menus to control and access all your other macros or special applications within other programs (see Screen 7). The menus can display the re-defined keys along with 20-character descriptions of macros, or they can display descriptions without the keys. In addition, *Keywords* supports numbered macros (from 10 to 255) that can be defined with the <Alt> key in combination with the numeric keypad. Numbering macros avoids wasting key definitions on sequences that will appear only in menus.

If that isn't enough, *Keywords* also allows one macro to read in another macro file, much as *ProKey* does. Used in conjunction with nesting and time delays, this menu-making feature is the most powerful capability ever to hit keyboard enhancement. (For more on using *Keywords* to set up menu systems, see "Transfer of Power," *PCW*, July 1985.)

Is there a cloud behind this silver lining? Only that learning to make menus isn't the piece of cake the manual claims. At the same time, using any of the other macro programs to create the kind of menus possible with *Keywords* would require a programmer. *Keywords* is the only program that has already set up the matrix for menu making, although it is a bit difficult to master.

Even if you don't care about making menus, *Keywords'* on-line editor (see Screen 8) is another coup. While other programs allow you to edit a definition of your own choosing, *Keywords* enables you to edit an entire *file* of definitions, using a full array of cursor commands. Typing <GreyPlus>-E displays every macro in memory, and you can change any aspect of any of them. You can also copy, insert, and delete specific blocks of data. It's a delight to combine macros, discard unused parts, and create long strings of nested, looping macros. The *Keywords* editor also offers an "expand key" (<F7>): By pressing it and typing, say, <Alt>-P you embed an {Alt P} into the definition with the correct syntax (that's a savings of five keystrokes every time you need an {Alt P}. Alpha should have set the expand key's default to on; instead it is a toggle that automatically turns off after each use.

One more boon: DOS command capability (see Screen 9). When you press <CursorUp> at the prompt for a file name, the *Keywords* file-pointing feature makes file specification a snap by displaying a moving-bar menu of the disk directory. *Keywords* also comes equipped with several .EXE and .BAT files that, in conjunction with sample macro files for *WordStar*, 1-2-3, and so on, provide convenient start-up menus for experts and novices alike.

For anyone who wants to establish menu-driven programs or help screens for others, or just fix the awkward interface of an otherwise good program, *Keywords* wins hands down. If its command key could be programmed in a macro and if *Keywords* offered abbreviations to submenu features, it

would be nearly flawless. While *Keywords* may not have the most features of the programs reviewed, its repertoire is the best suited to producing macros and menus conveniently.

Can I Borrow the Keys Tonight?

Despite this glowing assessment of *Keywords*, the most important factors in your choice of a keyboard enhancement program are personal taste and individual requirements. The idea is to save time and keystrokes and to make your computing more productive and efficient.

One last consideration is that two of the programs, *ProKey* and *SuperKey*, may slightly slow the operation of some application software. Table 2 shows a speed comparison for some typical *WordStar* operations with and without each of the keyboard enhancement programs loaded in memory. The file we printed was short; the effect with a longer file may be more annoying than the numbers indicate.



Screen 9: *Keywords* offers constant access to DOS functions. Most impressive and useful is its ability to format a disk from within any application program.

Table 2: The effect of macro programs on WordStar operations*

	No keyboard enhancer	ProKey	SmartKey	SuperKey	Keyworks
Load WS	7.5	8.0	7.4	8.0	7.0
Load file	9.0	10.2	10.2	10.2	10.0
Scroll one screen	0.2	0.2	0.2	0.2	0.2
Scroll five screens	7.5	2.8	2.6	2.8	2.5
Move block from beginning to end of 29K file	25.2	27.0	26.2	27.2	26.2
Print 3K file	1:28.1	1:54.2	1:37.0	1:53.5	1:30.0

* Durations are in seconds. The tests were performed on a 512K system with two floppy disk drives. The editing tasks used a 29K document file; the print file was 3K. Thus, the differences in printing speed may be more dramatic with longer files.

ProKey is the only program that can accommodate very long delays in macros, keep some macros loaded throughout your work session, and use 8-character macro names. If your macros contain a great many pauses with fixed or variable fields, *ProKey* might be the easiest to use because of its unique ability to include its command key in a macro.

If you frequently need to steal a screen from 1-2-3 and place it in your *WordStar* document, *SuperKey* is the tool of choice. And despite its clumsiness and especially poor manual, *SmartKey* provides the extra capacity of the supershift key—at a bargain-basement price. If you are a one-handed typist, by choice or necessity, any of these three programs will stand you in good stead. Of course, if you want to set up accessible systems so others can use your macros or application programs, *Keyworks* gets the nod.

No choice here is right for all users—that would make life too

easy. Perhaps someday a power user will create a macro to help make such a decision. The macro might use a *Keyworks* menu, a *ProKey* time delay, the *SmartKey* supershift key, and *SuperKey*'s data verification and formatting. You'd probably never see (or need) your keyboard again. ●

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ProKey, version 4.0
 RoseSoft
 4710 University Way NE #601
 Seattle, WA 98105
 206/524-2350
 List price: \$130
 Requirements: 64K, one disk drive

SmartKey, version 5.0
 Software Research Technologies
 3757 Wilshire Blvd. #211
 Los Angeles, CA 90010
 213/384-4120
 List price: \$49.95
 Requirements: 64K, one disk drive, DOS 2.10 or later version

SuperKey, version 1.0
 Borland International
 4585 Scotts Valley Dr.
 Scotts Valley, CA 95066
 800/255-8008, 800/742-1133
 California
 List price: \$69.95
 Requirements: 128K, one disk drive, DOS 2.00 or later version

Keyworks
 Alpha Software
 30 B St.
 Burlington, MA 01803
 617/229-2924
 List price: \$89.95
 Requirements: 128K, one disk drive, DOS 2.00 or later version

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Rotary Voice Coil (RVC)
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With an ATplus drive, you can
build the PC-AT IBM should have
built in the first place.

THE BALANCING ACT OF 1985.

You didn't buy an IBM PC-AT just to balance your checkbook. You bought it to crunch lots of numbers and words, in the shortest possible time. A labor saver. A time saver. Hence, a money saver.

So, do your part for effective money management; hard disk storage is no place to be penny-wise and pound foolish.

TELL 'EM YOU NEED HIGH SPEED AND DATA PROTECTION.

These and other important features do add cost, but that makes a premium drive.

Anything that can be made, can be made cheaper, sell for less, offer lower performance, and probably die young.

Remember, usually you get what you pay for, and you ALWAYS get what you don't.

ALL HARD DISKS ARE NOT CREATED EQUAL.

There are vast differences in the speed and reliability of Winchester hard disks. Since the IBM PC-AT is an incredibly fast machine, a slow drive can make an AT run like an XT.

So, before you get stuck with a slow drive in your AT, save your boss two grand and buy an XT.

Or better yet, buy the AT and avoid any drive with Access Times over 40 milliseconds.

RELIABILITY: WHERE HAS ALL THE DATA GONE?

Now tell 'em the drive must have a data protection scheme. One that's easy to use and reliable.

Winchester heads read and write while "flying" a few microns above the data surface. If the heads contact the recording media, you risk a head crash, and significant or total data loss.

So, even a fast drive without data protection is virtually worthless. Frankly, we'd rather sleep at night.

BEWARE OF USER-DEPENDENT PROTECTION SCHEMES.

Some drives have a safe landing zone for the heads, but you need to call a separate program to send 'em there. If you don't call that program, and most folks won't, the heads in these drives ALWAYS land on data when powered down.

The slightest bump or vibration can move the heads, wiping out those data tracks. And the R/W heads can become contaminated, thus increasing the error rate, slowing down average access until the whole drive fails.

Consequently, those drives offer a very high risk of head crashes, a false sense of security, and little else.

What's your data worth? \$200? \$400? Specify AUTOMATIC data protection. ATplus has it. And it doesn't cost, it pays.

PEACE OF MIND.

Specify AUTOMATIC park and lock of the heads on power down.

This system provides unparalleled head crash protection, by sensing power loss to the drive, and retracting the heads to a dedicated landing zone before they can land on your data.

Since this is 100% automatic, user-dependent risk is eliminated.

OUR DRIVES HAVE ALL BEEN TO BOOT CAMP.

Avoid drives that CLAIM PC-AT compatibility but can't BOOT the AT. By the time you juggle the

diskettes necessary to use one of those drives, the phrase "user-hostile" will have deep personal significance.

We believe that computers ought to serve people, not the other way around.

BEWARE OF THE BARGAIN BAND-SCHLEPPER.

Avoid drives with inexpensive Band-Stepper positioner technology. These were pretty good way back in 1980, considering that's all anyone had. But by today's standards, they're inaccurate and very mechanical.

They waste time looking for the right track to read or write. And they're worth no where near the price you'll pay for 'em - in more ways than one.

THE HIGH TECH SOLUTION.

Specify state-of-the-art ROTARY VOICE COIL (RVC) head positioner and CLOSED LOOP SERVO technologies.

This system uses a DEDICATED SERVO SURFACE (DSS) for continuous head location information.

The RVC and DSS use a large scale microprocessor to translate new track-seek commands into current that is applied directly to the RVC.

This moves and holds the R/W heads at the exact track intended.

Speed is dramatically increased since head movement is created electronically, with minimal mechanical interfacing.

BESIDES BEING THE SOLE SOURCE.

Specify names you know and can trust. Like Control Data Corporation, a world leader in hard disk technology. And CORE INTERNATIONAL, a growth company with over ten years in computer technology, design and manufacturing.

ATPLUS: IDEAL FOR THE SPECS MANIAC.

ATplus High Performance Hard Disk Upgrade kits, available in 20, 30, 40, 56, and 72 MB capacities.

They have ALL the above features and none of the shortcomings of "bargain" drives.

And your AT will accept any two ATplus drives, for up to 144MB of bootable, reliable, DOS and XENIX supporting high-performance on-line storage, all inside the box.

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That only ATplus Hard Disk Upgrade Kits from CORE will do.

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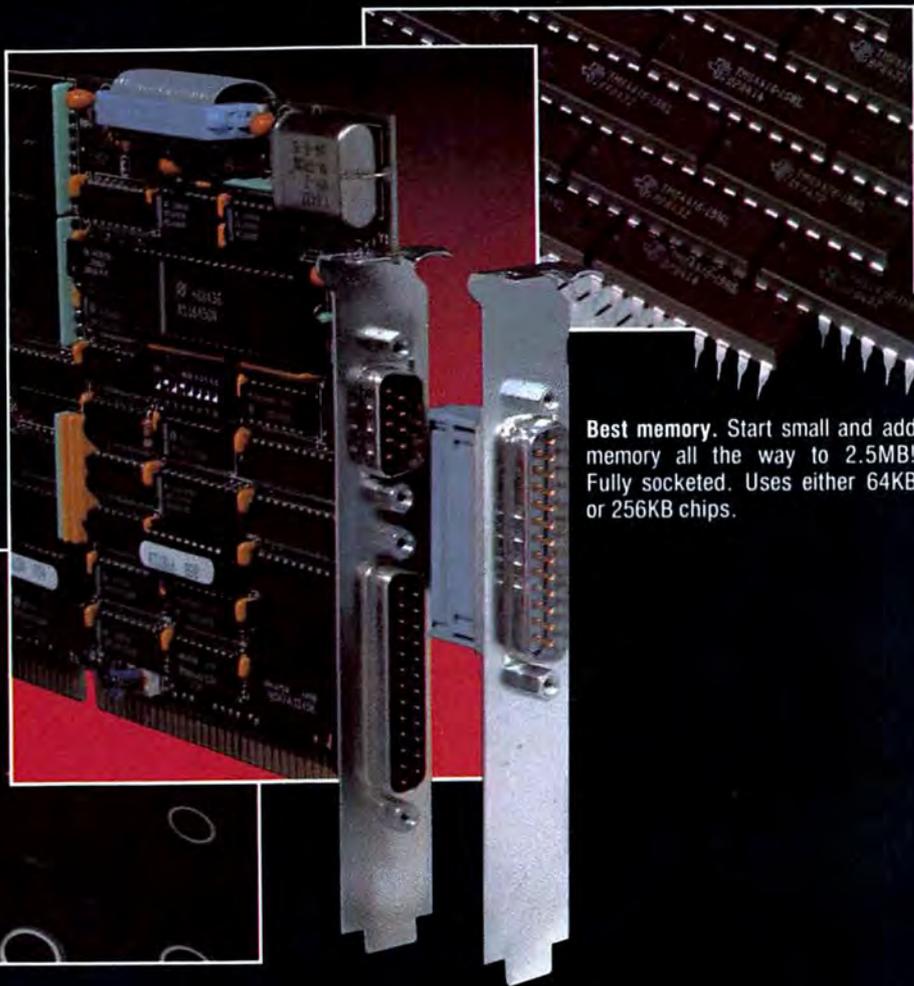
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F-18 Carrier Approach



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F-16 from Control Tower

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The C for Microcomputers

PC-DOS, MS-DOS, CP/M-86, Macintosh, Amiga, Apple II, CP/M-80, Radio Shack, Commodore, XENIX, ROM, and Cross Development systems

MS-DOS, PC-DOS, CP/M-86, XENIX, 8086/80x86 ROM

Manx Aztec C86

"A compiler that has many strengths... quite valuable for serious work"

Computer Language review, February 1985

Great Code: Manx Aztec C86 generates fast executing compact code. The benchmark results below are from a study conducted by Manx. The Dhrystone benchmark (CACM 10/84 27:10 pl018) measures performance for a systems software instruction mix. The results are without register variables. With register variables, Manx, Microsoft, and Mark Williams run proportionately faster. Lattice and Computer Innovations show no improvement.

	Execution Time	Code Size	Compile/Link Time
Dhrystone Benchmark			
Manx Aztec C86 3.3	34 secs	5,760	93 secs
Microsoft C 3.0	34 secs	7,146	119 secs
Optimized C86 2.20J	53 secs	11,009	172 secs
Mark Williams 2.0	56 secs	12,980	113 secs
Lattice 2.14	89 secs	20,404	117 secs

Great Features: Manx Aztec C86 is bundled with a powerful array of well documented productivity tools, library routines and features.

Optimized C compiler	Symbolic Debugger
AS86 Macro Assembler	LN86 Overlay Linker
80186/80286 Support	Librarian
8087/80287 Sensing Lib	Profiler
Extensive UNIX Library	DOS, Screen, & Graphics Lib
Large Memory Model	Intel Object Option
Z (vi) Source Editor -c	CP/M-86 Library -c
ROM Support Package -c	INTEL HEX Utility -c
Library Source Code -c	Mixed memory models -c
MAKE, DIFF, and GREP -c	Source Debugger -c
One year of updates -c	CP/M-86 Library -c

Manx offers two commercial development systems, Aztec C86-c and Aztec C86-d. Items marked -c are special features of the Aztec C86-c system.

Aztec C86-c Commercial System	\$499
Aztec C86-d Developer's System	\$299
Aztec C86-p Personal System	\$199
Aztec C86-a Apprentice System	\$49

All systems are upgradable by paying the difference in price plus \$10.

Third Party Software: There are a number of high quality support packages for Manx Aztec C86 for screen management, graphics, database management, and software development.

C-tree \$395	Greenleaf \$185
PHACT \$250	PC-lint \$98
HALO \$250	Amber Windows \$59
PRE-C \$395	Windows for C \$195
WindScreen \$149	FirstTime \$295
SunScreen \$99	C Util Lib \$185
PANEL \$295	Plink-86 \$395

MACINTOSH, AMIGA, XENIX, CP/M-68K, 68k ROM

Manx Aztec C68k

"Library handling is very flexible... documentation is excellent... the shell a pleasure to work in... blows away the competition for pure compile speed... an excellent effort."

Computer Language review, April 1985

Aztec C68k is the most widely used commercial C compiler for the Macintosh. Its quality, performance, and completeness place Manx Aztec C68k in a position beyond comparison. It is available in several upgradable versions.

Optimized C Macro Assembler Overlay Linker Resource Compiler Debuggers Librarian Source Editor MacRam Disk -c Library Source -c	Creates Clickable Applications Mouse Enhanced SHELL Easy Access to Mac Toolbox UNIX Library Functions Terminal Emulator (Source) Clear Detailed Documentation C-Stuff Library UniTools (vi, make, diff, grep) -c One Year of Updates -c
---	---

Items marked -c are available only in the Manx Aztec C86-c system. Other features are in both the Aztec C86-d and Aztec C86-c systems.

Aztec C68k-c Commercial System	\$499
Aztec C68k-d Developer's System	\$299
Aztec C68k-p Personal System	\$199
C-tree database (source)	\$399
AMIGA, CP/M-68k, 68k UNIX	call

Apple II, Commodore, 65xx, 65C02 ROM

Manx Aztec C65

"The AZTEC C system is one of the finest software packages I have seen"

NIBBLE review, July 1984

A vast amount of business, consumer, and educational software is implemented in Manx Aztec C65. The quality and comprehensiveness of this system is competitive with 16 bit C systems. The system includes a full optimized C compiler, 6502 assembler, linkage editor, UNIX library, screen and graphics libraries, shell, and much more. The Apple II version runs under DOS 3.3, and ProDOS, Cross versions are available.

The Aztec C65-c/128 Commodore system runs under the C128 CP/M environment and generates programs for the C64, C128, and CP/M environments. Call for prices and availability of Apprentice, Personal and Developer versions for the Commodore 64 and 128 machines.

Aztec C65-c ProDOS & DOS 3.3	\$399
Aztec C65-d Apple DOS 3.3	\$199
Aztec C65-p Apple Personal system	\$99
Aztec C65-a for learning C	\$49
Aztec C65-c/128 C64, C128, CP/M	\$399

Distribution of Manx Aztec C

In the USA, Manx Software Systems is the sole and exclusive distributor of Aztec C. Any telephone or mail order sales other than through Manx are unauthorized.

Manx Cross Development Systems

Cross developed programs are edited, compiled, assembled, and linked on one machine (the HOST) and transferred to another machine (the TARGET) for execution. This method is useful where the target machine is slower or more limited than the HOST. Manx cross compilers are used heavily to develop software for business, consumer, scientific, industrial, research, and educational applications.

HOSTS: VAX UNIX (\$3000), PDP-11 UNIX (\$2000), MS-DOS (\$750), CP/M (\$750), MACINTOSH (\$750), CP/M-68k (\$750), XENIX (\$750).

TARGETS: MS-DOS, CP/M-86, Macintosh, CP/M-68k, CP/M-80, TRS-80 3 & 4, Apple II, Commodore C64, 8086/80x86 ROM, 68xxx ROM, 8080/8085/Z80 ROM, 65xx ROM.

The first TARGET is included in the price of the HOST system. Additional TARGETS are \$300 to \$500 (non VAX) or \$1000 (VAX).

Call Manx for information on cross development to the 68000, 65816, Amiga, C128, CP/M-68k, VRTX, and others.

CP/M, Radio Shack, 8080/8085/Z80 ROM

Manx Aztec CII

"I've had a lot of experience with different C compilers, but the Aztec C80 Compiler and Professional Development System is the best I've seen."

80-Micro, December, 1984, John B. Harrell III

Aztec C II-c (CP/M & ROM)	\$349
Aztec C II-d (CP/M)	\$199
C-tree database (source)	\$399
Aztec C80-c (TRS-80 3 & 4)	\$299
Aztec C80-d (TRS-80 3 & 4)	\$199

How To Become an Aztec C User

To become an Aztec C user call 1-800-221-0440 or call 1-800-832-9273 (800-TEC WARE). In NJ or outside the USA call 201-530-7997. Orders can also be teleaxed to 4995812.

Payment can be by check, COO, American Express, VISA, Master Card, or Net 30 to qualified customers.

Orders can also be mailed to Manx Software Systems, Box 55, Shrewsbury, NJ 07701.

How To Get More Information

To get more information on Manx Aztec C and related products, call 1-800-221-0440, or 201-530-7997, or write to Manx Software Systems.

30 Day Guarantee

Any Manx Aztec C development system can be returned within 30 days for a refund if it fails to meet your needs. The only restrictions are that the original purchase must be directly from Manx, shipped within the USA, and the package must be in resalable condition. Returned items must be received by Manx within 30 days. A small restocking fee may be required.

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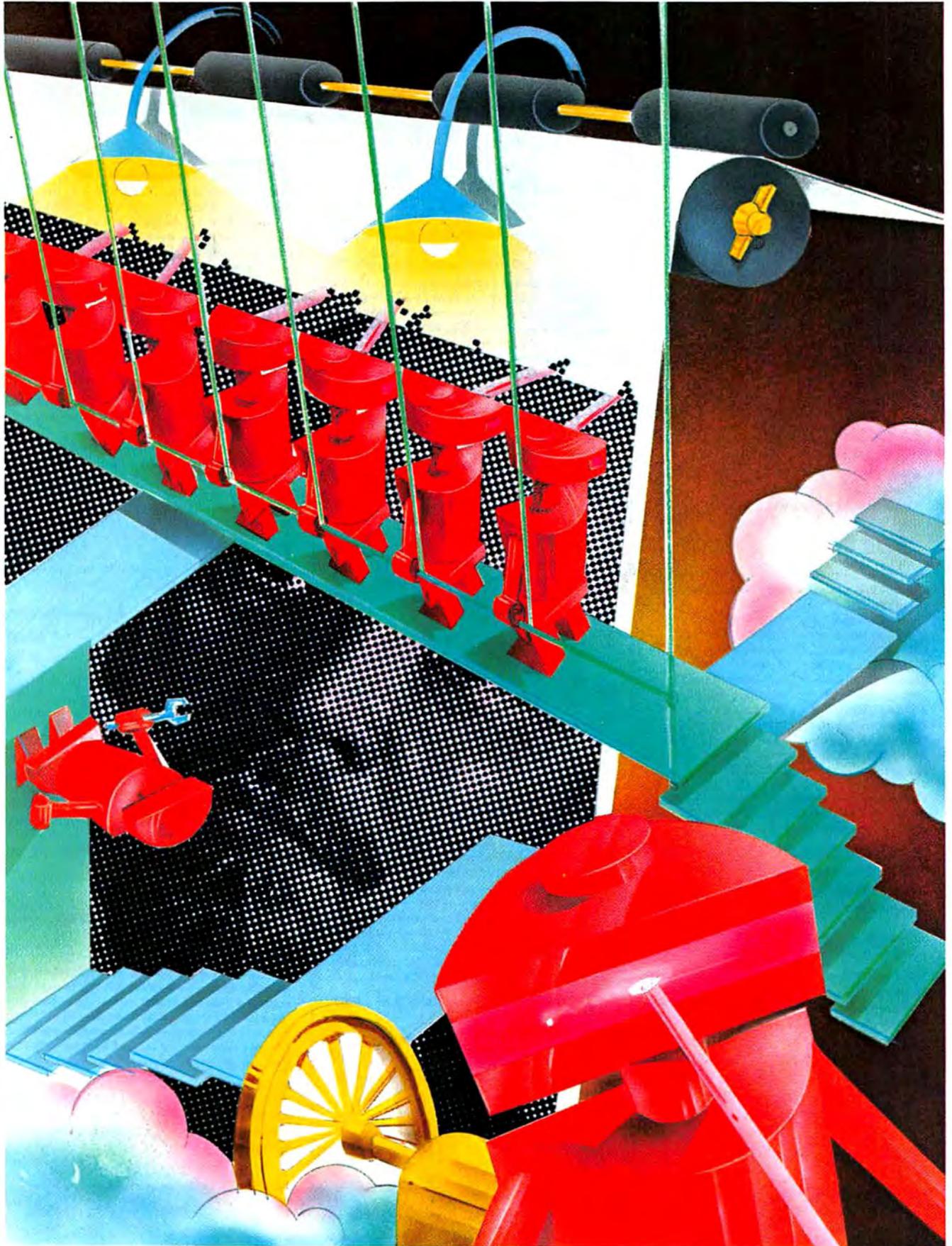
There are special discounts available to professors, students, and consultants. A discount is also available on a "trade in" basis for users of competing systems. Call for information.

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Looking Like Lasers

Canon caught the world off guard with its cheap laser printer engine, but now a swarm of second-generation Japanese photoelectric printers brandishing a variety of new technologies threatens to muscle in on Canon's turf. When the brawl begins in earnest, state of the art printing may become available at bargain-basement prices.

Ted Nace

■■■■ The year was 1969, and Gary Starkweather had a thorny assignment. Xerox Corporation, which a decade earlier had introduced the first office copier, wanted to adapt that technology to a new application—printing. In a nutshell, the idea was to design a machine that would use a laser beam to “write” a pattern of tiny charged spots on a photosensitive copier drum, expose this electrostatic image to oppositely charged toner particles, and transfer the image onto paper to produce a printed page. (For more information see “Laser Printers,” *PCW*, Vol. 2, No. 10.)

But Starkweather and his engineering team had to overcome more than a technological hurdle. Lasers

had just graduated from the status of laboratory curiosities and were still wildly expensive, as were the other precision components required by the printer. For a laser printer to be feasible—much less marketable—the cost of modulators, polygonal mirrors, and other components would have to be reduced by a factor of 50.

By 1977 Starkweather had accomplished this imposing job, and Xerox introduced its 9700 laser printer. Not only had innovative design lowered costs, the performance of the 9700 was stunning. The new printer could produce more than 7000 lines per minute while maintaining the exacting tolerances necessary to create images with 300-dot-per-inch (dpi) density.

Nevertheless, in the realm of high technology, climbing one peak inevitably reveals more formidable heights to scale. The introduction of the Xerox 9700 (priced at a then-reasonable \$350,000) merely set off the starting gun for a new race—mostly among the Japanese electronics giants—to drive the cost of laser printers down to previously unimaginable levels.

Two years ago, Canon broke ahead of the pack with its LBP-CX laser printer engine. Selling for \$1000 in quantity, the engine, built with components adapted from Canon's popular photocopiers, created a market for under-\$7000 laser printers virtually overnight. In short order, companies such as Hewlett-Packard, Corona, and Apple were incorporating LBP-CX engines into their own laser printer offerings.

But Canon's hegemony may be coming to an end. Eager Japanese manufacturers are about to flood the market with their own photoelectric printers—

some using far humbler technologies. For companies like Ricoh, NEC, Casio, and Epson, the stakes and the potential profits are high. Business document production in the United States alone is running at approximately 2.5 trillion pages per year; businesses have an incentive to do much of their own printing, and laser printers are the key to in-house publishing. Moreover, with their swift, quiet operation, laser printers are already elbowing clanky daisy wheel printers off the shelf. Currently, the Hewlett-Packard LaserJet generates more revenue than any other printer, laser or otherwise, on the market. And the market prognosticators at Future Computing predict

that by 1990, sales of laser printers will reach \$2.2 billion a year—nearly 25 percent of all printer and plotter sales.

■ LEDs Rising

Once relegated to calculators and wristwatches, the light-emitting diode, or LED, figures prominently in the inappropriately named LC-08 Laser Printer from the Nippon Electric Company (NEC). As might be expected, NEC studied its competition and came up with some revisions to Canon's design.

The major departure was creating a device with laser printer attributes that doesn't rely on a laser. Replacing the Canon engine with one built around the LED was a natural choice for NEC, according to product manager Mike McGee. "NEC does not make photocopiers, so we had a free hand to design this printer completely from scratch." Starting from scratch, of course, has its penalties. Canon's ability to piggyback its laser printer on its inexpensive copier was the key reason for the low cost of the LBP-CX.

But designing a "laser" printer from the ground up allows the machine to be matched closely to the durability or "higher duty cycle" of a printer rather than to that of a photocopier. The Canon engine, for example, uses a \$90 drum and toner cartridge that is expected to last for 3000 pages. The single-cartridge design is convenient, but it boosts the printer's operating costs, asserts McGee—particularly for those who print graphics. Graphics consume toner much faster than text does, forcing users to replace cartridges long before the drum inside is worn-out.

NEC's approach is to separate its \$15 toner cartridge, which also lasts for about 3000 copies, from other replaceable components. A separate photosensitive drum costs about \$95 and lasts for 5000 pages.

NEC's engine is up on the rack much less frequently as well. The Canon engine requires an \$800 overhaul every 100,000 copies; the NEC, only a new \$90 developer cartridge every 100,000 copies. Different wrinkles in engine design also make laser-style printing more efficient. The Canon input paper tray holds 100 sheets and its output tray 20; each tray on the NEC printer accommodates 250 sheets. Another welcome difference: sheets from the NEC printer emerge face down in the correct order.



The Kentek K-2: Powerful LED printing
Courtesy of Kentek



The NEC LC-08: laser quality printing without the laser
Courtesy of NEC

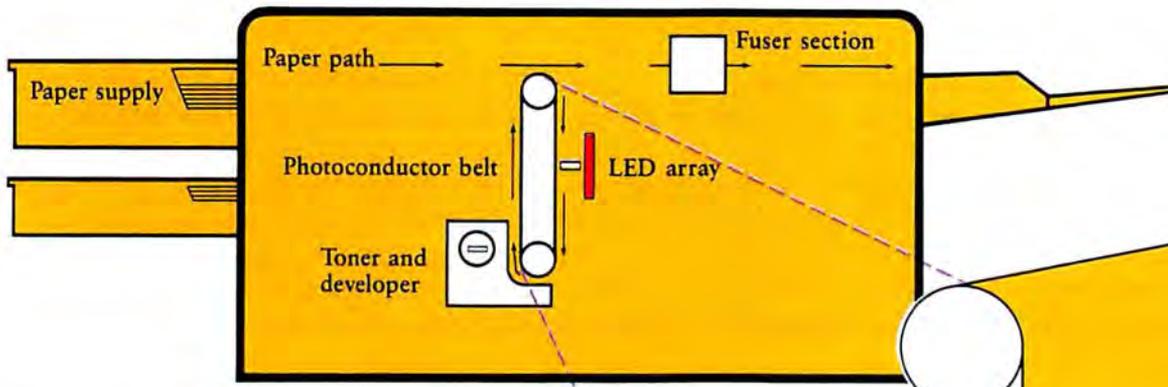


Figure 1: Imagine there's no laser ... Except for the light source, most photoelectric printers use the same technology. In this case, a bank or array of flashing LEDs imparts images to a coated belt or drum, which are then baked onto the printed page.

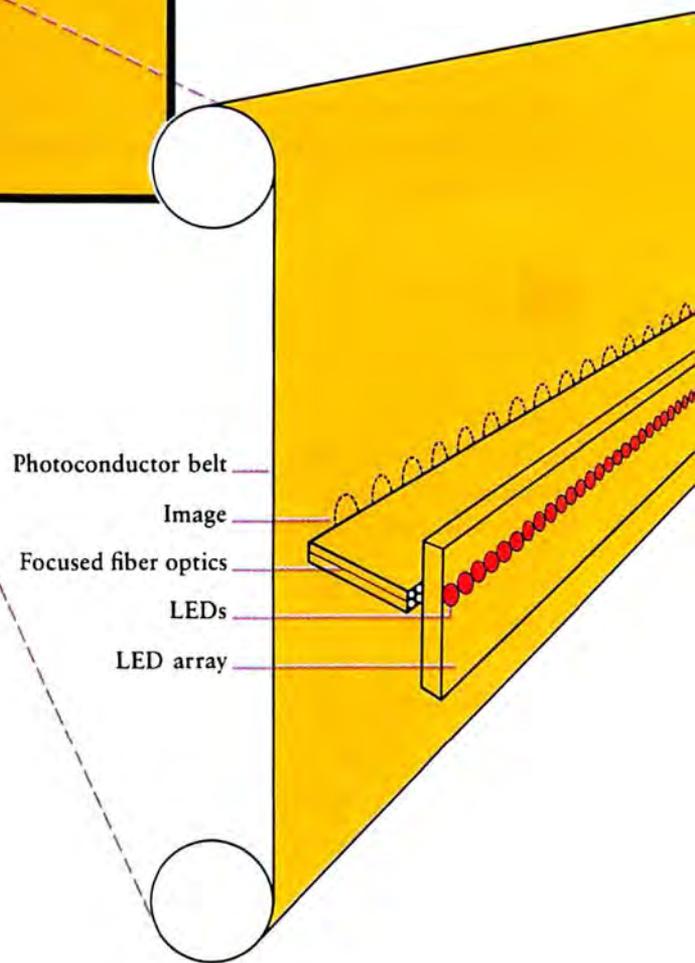
Courtesy of Kentek

Shedding New Light

Inside the LC-08 is an oblong array of 2432 miniature LEDs—300 per inch—each independently wired to the printer's controller board. As the light-sensitive drum rotates next to this 8-inch-wide, 1-dot-high array, each LED turns on and off 26,000 times per minute. The array forms a line of light, which is filtered and focused onto the printer's photosensitive drum; a charge is generated wherever light strikes. Powdered toner with the opposite charge is attracted to these charged areas, passed from the drum to the paper, and fused into place with heat. The drum is scraped clean and the cycle begins anew. Except for the LEDs, the process is essentially the same in a laser printer or any other photoelectric printer (see Figure 1).

Replacing the moving parts required by laser imaging with a fixed LED array makes for a sturdier machine. On the other hand, the fixed array gives rise to a new problem—streaking caused by LEDs that fail to shine brightly and quickly enough or to dim with the proper haste. Streaking is particularly noticeable in graphics output (see the sidebar “The Spot Market”). Consider too that when a single LED burns out, the entire array must be replaced. McGee notes, however, that replacing a malfunctioning LED array is only a matter of removing four screws. LED users can simply insert a new array; the LC-08 will perform the necessary alignment.

The NEC LC-08 uses plug-in ROM font cartridges like the HP LaserJet but provides two cartridge slots instead of one. The printer also features



three built-in Courier fonts, plus underline, bold, and shadow styles. In total, the LC-08 houses as many as 12 fonts at once—4 more than the LaserJet. NEC expects to release 30 to 35 fonts by year's end.

In the final analysis, performance and cost make the competitive difference. The LC-08 is aimed squarely at Canon-based machines—and apparently will hit the bull's-eye. It can match their 8-page-per-minute output and 300-dpi resolution while likely undercutting current laser printer prices. NEC's printer, like the Canon engine, will initially be sold by other vendors rather than under the NEC label. The LC-08 is expected to cost approximately \$3000.

McGee notes that NEC will add two more machines to the LC-08 family by mid-1986. While the LC-08 is expected to compete against the LaserJet and Corona printers, a lower-performance machine rated at 3 to 4 pages per minute and costing under \$2000 is intended to make the daisy wheel printer a fond, if noisy, memory. For high rollers, a faster LED printer with greater capabilities will be positioned opposite Apple's \$7000 LaserWriter.

■ Making and Selling Light

Hot on NEC's heels are other Japanese manufacturers, including Kentek, Casio, Ricoh, Epson, Konica, Minolta, and Konishiroku, plus the Dutch company Philips Peripherals, bent on getting their slice of the growing laser printer pie. Not surprisingly, the imaging technologies chosen reflect the electronics orientation of each firm.

Kentek, a New Jersey-based firm that makes photocopiers and printers, has reportedly inked a deal to supply IBM with its powerful K-2 LED printer. As LED—or laser—printers go, the K-2 is a heavy hitter. The \$9000 unit provides fast, laser-quality printing for local area networks. The printer packs a Motorola 68000 microprocessor, 256K (expandable to 1.2MB), a floppy disk drive, and one PC-compatible expansion slot. The 68000, coupled with the printer's resident UNIX V operating system, allows the K-2 to print bit-mapped graphics, mix and match images and text within documents, and utilize nearly 30 different fonts (see Figure 2). The K-2 can apparently stand up to the rough and tumble American office: The unit can print 24,000 pages (at 12 pages per minute) before requiring service.

Casio, the world's largest producer of liquid crystals for watches, calculators, and computer displays, is building a printer that uses an array of liquid crystals that act like shutters. A liquid crystal shutter (LCS) is either transparent or opaque, depending upon the supplied electrical current. Place a light

The Spot Market

The arrival of alternative photoelectric printers is generating arguments over which imaging technique produces the best results. Ultimately, the debate boils down to the shape of the spot—that tiny deposit of toner approximately $\frac{1}{3000}$ of an inch in diameter—that makes up one piece of the immense mosaic of a printed image.

The shape of the spot differs from one manufacturer's printer to the next. Spots may be circular, oblong, square, or splotchy. Obviously, a spot that resembles a dropped egg is undesirable. But a perfectly square or rectangular spot may not be optimal either. For example, for printing a diagonal line or the

curved edge of a character, crisp square spots may create a jagged appearance. The amount of spot overlap varies; some printers are "write white," printing the areas that are not activated by the imaging device.

So if a salesperson tries to sell you a photoelectric printer based on the assumption that the best-looking spot produces the best results, don't be taken in. Judge the printer by how its output appears to the naked eye—not to the ant strolling across the page.

source like a tungsten lamp behind the array, “shutter” the thousands of LCSs, and you have the functional equivalent of laser imaging. Like an LED array, Casio’s LCS printer eliminates many of the moving parts found in a laser printer. As with LEDs, individual liquid crystals may perform erratically.

Underdog Technologies

The proliferation of new imaging technologies doesn’t end with the LED and the LCS. Philips Peripherals’ Elpho 20 printer eschews both the array and the laser in favor of a single-line cathode ray tube (CRT). An electron beam flashes across the CRT, illuminating pinpoints of blue light, which in turn impart images to a revolving print drum. Since the printer’s selenium print drum is most receptive to blue light, less light is needed to form an image and drum life is prolonged. In addition, the CRT solution allows you to vary printing resolution from 200 to 300 dpi.

Unfortunately CRT prices remain stratospheric. The Philips’ unit costs second-party vendors approximately \$12,500. Imaging experts also question the CRT’s ability to match the quality of laser output. Because magnetic fields generated by the printer can affect the electron beam inside the CRT, the dots that make up images may stray from their appointed destinations.

Price Wars

But technological issues seldom influence the purchase of a printer. As Gary Starkweather points out, “The customer couldn’t care less whether you use a laser or something else.” Indeed, as NEC has shown, a company can call its machine a laser printer even if it lacks a laser. What does interest customers is the prospect of print quality increasing and printer prices declining.

Printer price is a function of basic manufacturing costs and the intensity of competition among original manufacturers and those who enhance—and sell—their products. Earlier this year, Tim Riggins of

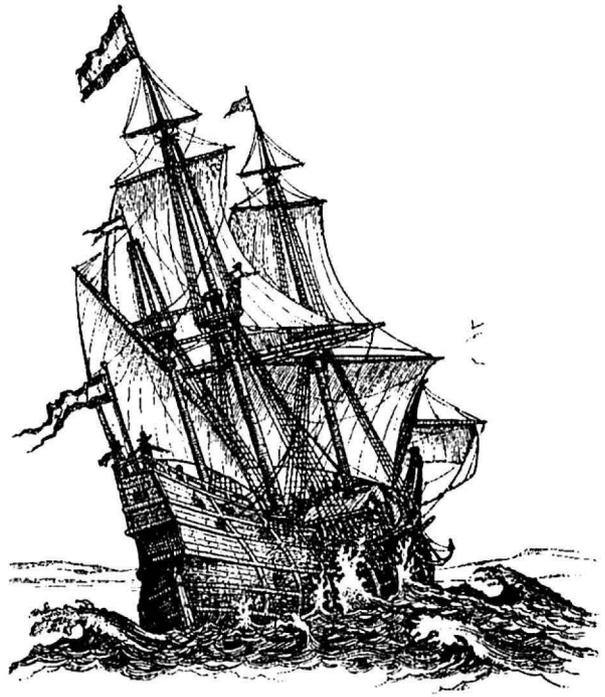


Figure 2: How you make a dot makes a difference. The K-2 LED printer offers 240-dpi resolution—but easily matches laser quality.

Courtesy of Kentek

Future Computing predicted that retail laser printer prices would fall to \$1000 by 1990. He now acknowledges that this prediction may have been too cautious. “It looks like we might get there even sooner,” he says.

Even without any further advances in technology, Riggins’ revelation seems reasonable given the driving forces of mass production and heated competition. Canon’s LBP-CX laser engine currently costs only about \$500 to manufacture—\$150 for the laser imaging device and \$350 for the photocopier mechanism. As contending imaging technologies hit the market, making laser devices will likely become cheaper.

As for the cost of the photocopier mechanism, the never-ending competition in the multibillion-dollar photocopier market should continue to spawn innovation. Even though the basic technologies are 30 years old, Xerox’s Starkweather says that opportunities for refinement are as plentiful as ever. “Electrostatics is a nasty physics,” he notes. “We’re still learning more about the behavior of the basic technology under a variety of conditions.”

But the biggest opportunity for lowering the cost of photoelectric printers may lie in their controller boards. Controller boards are composed primarily of microprocessors and RAM chips, and both components are plentiful and correspondingly cheap. Ubiquitous microprocessors such as the Intel 8088 and the Motorola 68000 cost under \$20 apiece in limited quantities; 256K-bit memory chip prices have skidded from \$18 to \$3 in a single year. That means more powerful printing for less and major savings in

the manufacturing of high-end printers such as the Apple LaserWriter—which owes its near-typeset quality output in part to its 1.5MB of RAM.

How soon prices will drop is unknown. Apple is reportedly selling LaserWriters hand over fist at the original \$6990 retail price. At the same time, Hewlett-Packard has introduced a version of the LaserJet called LaserJet Plus (see the sidebar “LaserJet With a Plus”). Echoing Adam Smith’s familiar dictum, Riggins says, “You won’t see prices drop until the supply really catches up with the demand.”

LaserJet With a Plus

Fast, quiet, and easy to use, Hewlett-Packard’s LaserJet has earned its popularity as a rugged, general-purpose letter quality printer. Now HP is challenging the Apple LaserWriter for the hearts and pocketbooks of those who want to create high-quality graphics, use a variety of fonts on a single page, and store predesigned forms.

The challenger is the HP LaserJet Plus, an enhanced version of the LaserJet that easily justifies its \$3995 price tag. Aside from boosting printer memory (from 64K to 512K), the company has blessed the Plus with the ability to use downloadable fonts. The Plus can store as many as 32 different fonts in sizes ranging from 6 to 30 points and can use 16 on a page. In addition to downloaded fonts, graphics images such as forms and letterheads can also be stored in memory. At 300-dpi resolution, the LaserJet Plus can hold a half-page image; at 150-dpi, a full-page image.

Since the LaserJet Plus does not incorporate a powerful page-description language such as PostScript, you cannot rotate fonts or dynamically change point size.

Much of the LaserJet’s success has been based on the availability of third-party enhancement software packages and hardware devices. The Plus wisely maintains compatibility with its progenitor; at the same time, HP has released more than a dozen new programs that support enhanced features of the Plus. If you currently own a LaserJet and want to step up to more powerful printing, you need not buy a Plus. For \$1495 (\$1995 after December 31, 1985) authorized HP dealers can elevate your LaserJet to Plus status.

■ Triple Tiers

Riggins sees the under-\$10,000 photoelectric printer market stratifying into three levels. At the high end will be powerful printers like the Apple LaserWriter and Kentek K-2 that incorporate full-page memory buffers and page-description languages, such as Adobe's PostScript or Xerox's Interpress. The text and graphics processing capabilities of these printers will allow them to serve as low-end phototypesetters.

The middle tier will be occupied by printers such as the HP LaserJet and the NEC LC-08. These printers will suit most business users and serve in local area networks. The price of these printers is expected to hover near \$2000.

Not yet in existence, but soon to enter stage left, are the \$1000 photoelectric printers. Sounding the death knell for daisy wheel and high-performance dot matrix printers, these inexpensive photoelectric devices will probably follow NEC's lead in curbing functionality—limiting fonts and speed to avoid competing with their more expensive brethren.

■ Future Lights

The evolutionary path trod by the computer, from mainframe to PC, is being retraced double time. In the space of 15 years, the laser printer and its minions have been transformed from gargantuan laboratory curiosities to PC peripherals. Like an enterprising social climber, the photoelectric printer has coasted on the coattails of other technologies: xerography, lasers, LEDs, LCSs, and memory chips. It looks like the ride will continue—and consumers are going to clean up. ●

Ted Nace is a freelance writer in Berkeley, California.

LC-08

*NEC Information Systems, Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
617/264-8000*

*List price: to be announced
Requirements: parallel or serial port*

LaserJet

*LaserJet Plus
Hewlett-Packard
P.O. Box 15
11311 Chinden Blvd.
Boise, ID 83707
208/323-6000*

List price: LaserJet with one font cartridge \$2995, LaserJet Plus \$3995, extra cartridges \$99 each; LaserJet upgrade \$1495 before December 31, 1985, \$1995 thereafter

Requirements: serial port

*Corona LP-300 Laser Printer
Corona Data Systems
275 E. Hillcrest Dr.
Thousand Oaks, CA 91360
805/495-5800*

*List price: \$3395
Requirements: 256K (512K for graphics), long expansion slot*

K-2

*Kentek
Kentek Information Systems Inc.
Six Pearl Ct.
P.O. Box 78
Allendale, NJ 07401
201/825-8500*

*List price: \$8995
Requirements: serial port*

Escape From the Second Dimension

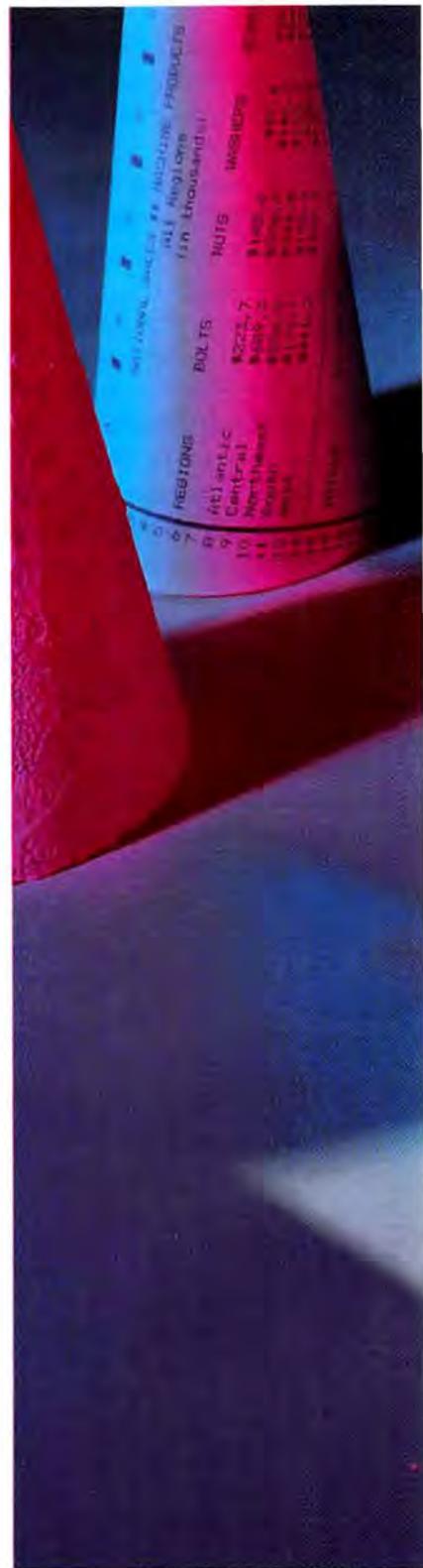
The need to perform increasingly complex analyses has added depth to traditionally flat spreadsheet programs. This third dimension aids consolidations and summaries—and provides an enlightening new slant on your calculations.

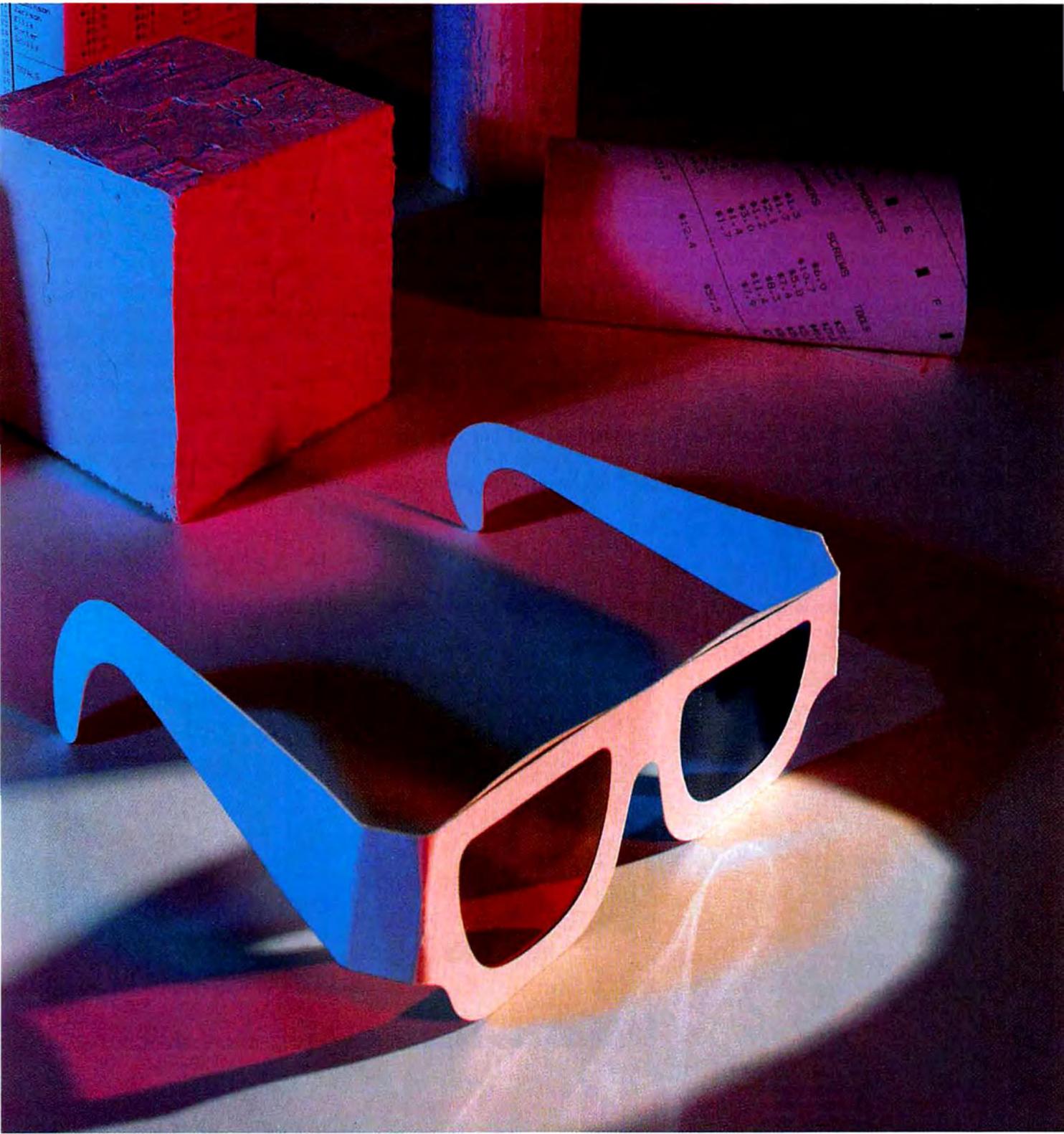
Jeff Angus

■■■■ In Edwin Abbott's geometry fairy tale, *Flatland*, the hero tries to describe life in three dimensions to the king of a two-dimensional land. The monarch is contemptuous, insisting that real space exists in two dimensions, not three, and infers that the hero is either a charlatan or insane. The king just can't make sense or use of what is to him an extra dimension.

Business spreadsheet users may soon find their imaginations similarly tested, as two-dimensional monarchs, led by 1-2-3, yield their thrones to three-dimensional spreadsheet programs. Will 1-2-3 and *Multiplan* fans find either sense or utility in these three-dimensional products? Why would anyone want one—what can be done with them?

■ **A Lever, a Fulcrum . . .**
Simply stated, a three-dimensional spreadsheet provides a much more convenient way to organize and consolidate data and reports. In a typical three-dimensional spreadsheet, a corporate income statement would consist of two-dimensional worksheets for each division, with rows holding revenue line items and columns containing monthly amounts for each line item. To consolidate the divisions into a corporate revenue report, a three-dimensional spreadsheet employs "pages," with





each department's revenue report constituting one page. The pages are stacked atop one another with either the top or bottom page representing the aggregate total (see Screen 1).

"The personal-computer-based three-dimensional spreadsheet arose from a real organizational need to consolidate similarly structured pieces of information from various levels within the organization," says Robert Carr, creator of *Framework* (which uses a two-dimensional spreadsheet). "Three-dimensional spreadsheets were created with financial analysts in mind, taking up where the two-dimensional sheets left off." So what brave new world does a three-dimensional orientation open up for those analysts?

"One of my clients is a perfect candidate for a multidimensional spreadsheet," says Jim Toole, a Seattle CPA and spreadsheet consultant whose clients are dispersed

throughout the country. "He's a midwestern retailer with five stores. I could have set him up with a traditional spreadsheet, but he really needed a three-dimensional one. When I got my hands on such a product, I increased accountability and presentation quality without affecting development and data entry time."

Toole's client required a cash flow projection and summary for each store, plus a companywide consolidation for the entire operation. Most people perform those chores with traditional two-dimensional spreadsheets like *1-2-3* and *Multiplan*. Because such programs compel users to put several work areas on a single page, data becomes tangled and difficult to address.

Whether analyzing multiple stores, the profitability of a set of product lines, or the performance

of a group of sales agents, most of today's spreadsheet users ultimately try to force three-dimensional tasks into two dimensions.

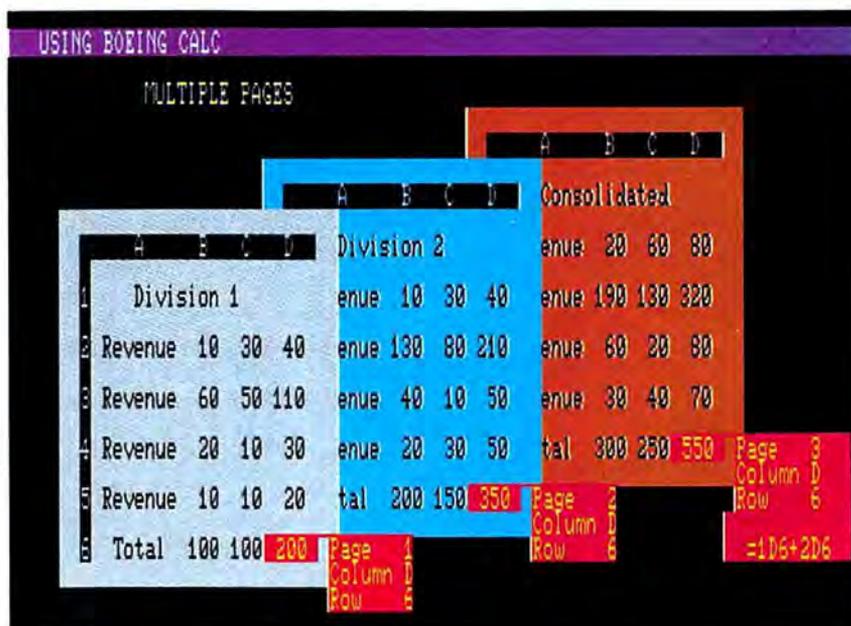
Electronic Ledger Book

If you attempted the retailer's analysis on paper, you'd need several identically formatted ledger pages, one for each store, and a summary sheet on top that totaled figures for the business.

The three-dimensional spreadsheet simply emulates this ledger book, holding a collection of identically formatted sheets. To use a three-dimensional spreadsheet, you scroll in two dimensions as our Flatlander does, but you also navigate through individual pages.

This mobility necessitates extending the naming system for cells. Where A1 and J9 sufficed for the two-dimensional sheet, the three-dimensional spreadsheet requires that you also address a cell with a page number, for example, 1A1 or 3J9 (for page, column, and

Screen 1: A three-dimensional spreadsheet conveniently consolidates the revenue reports from three divisions. Each division gets a page, as does the consolidation of totals.



row). A three-dimensional spreadsheet can store the same category, for example, January sales or Smith's orders, at the same coordinates on each page, or they can change a formula on all the pages at once. Seem like a lot of trouble? Perhaps, but certain applications—such as the one required by Toole's retailer client—beg for this kind of treatment.

Space and Time

Using 1-2-3 to set up a five-store cash flow analysis and consolidation, Toole would have two choices. He could use a separate file for each store—identical worksheets, each with one store's information. He would then set up a macro (a series of stored commands) to bring the files in one at a time and combine the results. For Toole, the problem with that approach would lie in dealing with six separate files; if any data was faulty, he'd have to load and examine each file individually—a costly proposition.

His second choice would involve a different set of pitfalls. He could place six identical worksheets in one 1-2-3 file. This would mean improved accountability and speed, but the user would need to scroll all over the worksheet. With this second approach, Toole says, "There would be no consistency to the areas' names, and worst of all, I would run out of memory long before everything was fed into the file. In short, I'd be trapped in the second dimension."

For Toole, the virtues of the three-dimensional solution are clear. Because all of the stores' worksheets are built on the same model, he needs to create only one template and extend the model six worksheets deep. The sheets aren't stored in different files, nor do they abut one another across a vast worksheet. They're all accessible and unified by the summary on top.

In addition to their clumsiness at tabulating large amounts of data, two-dimensional spreadsheets impose severe restraints on effective worksheet size. 1-2-3 provides a maximum worksheet size of 256 columns by 2048 rows, but holding those half a million cells

access the disk for parts of an active worksheet, thus circumventing the actual limits of memory.

Most three-dimensional spreadsheets don't require memory for blank cells residing between filled ones. Instead, they use a technique referred to as sparse matrix.

Many spreadsheet programs that aren't built around the sparse matrix principle (including version 1A of 1-2-3) keep track of data in worksheet cells by maintaining a table of pointers, one for each cell, in one area of memory and the actual data in another area. Each pointer points to the memory address in the data area that contains the first byte of data for that pointer's associated cell. The

Most of today's spreadsheet users try to force three-dimensional tasks into two dimensions.

would require megabytes of RAM. 1-2-3 (version 1A) also consumes memory for blank places in between the cells that contain data. Most three-dimensional products use virtual memory to increase maximum worksheet size.

Virtual memory is a scheme that entails swapping chunks of data between RAM and the disk. The PC fills RAM with as much data as it can hold. When you've pushed RAM to its limits but need to continue with a worksheet, the program writes an unused portion of the file from RAM to disk, thus giving you more elbow room.

Products that use virtual memory

problem is that to allocate memory for the lower right of the worksheet, the program must store a pointer for every cell starting at the upper left (A1); these pointers eat up memory.

Instead of tables, the sparse matrix method uses a linked list—that is, pointers that point to other pointers. While this method requires an extra step, it eliminates the need to have pointers for empty cells. Sparse matrix pointers are thus about 1.5 times as large as "traditional" pointers, but there are far fewer of them.

■ No Speed Demon

Comparing the speed of a new class of product like a three-dimensional spreadsheet with that of a less powerful two-dimensional program can be misleading. But users with medium-size two-dimensional applications may find the three-dimensional products slow, especially when creating new pages or scrolling. Table 1 presents some speed comparisons between a typical two-dimensional product (1-2-3) and the three-dimensional variety (*Boeing Calc*).

"Sometimes speed is relative," says Toole. "It may take about a minute to create six new pages with a three-dimensional sheet, but it's going to take at least that long to create six new 1-2-3 files and copy the original cells over to them."

■ Boards Give a Boost

There is, of course, a hardware solution for the problems that virtual memory and sparse matrix schemes are designed to address. Intel's AboveBoards for the PC and the AT use an addressing system developed by the manufacturer (in cooperation with Lotus and Microsoft) to expand the PC's RAM to 4MB (and the AT's to 8MB). The cost of raising a PC from its normal memory ceiling of 640K to about 2MB would be \$1295. While a hardware solution might help 1-2-3

users who need more than 640K, it doesn't resolve the confusion that results from a three-dimensional problem being forced into a two-dimensional model.

Since most three-dimensional spreadsheets can import 1-2-3 worksheet files and cost less than a third of our hypothetical RAM upgrade, three-dimensional products might be considered bargain specialty add-ons.

■ The Commercial Dimension

A spate of products that offer the benefits of three or more dimensions has hit the market. Each provides easier access to and handling of data sets larger than two-dimensional products can assimilate, easing any task that requires consolidation or summaries. In addition, these products are harbingers of analysis software to come: The spreadsheet is the "surface level" interface that belies a sophisticated data base structure beneath it.

■ Boeing Calc

To propel his retail client's analysis into the third dimension, Jim Toole used *Boeing Calc* from Boeing Computer Services, a division of the aviation company that brought the world the jumbo jet and the B-17.

"We sell primarily to Fortune 1000 companies," says Jamie Douglass, head of product development for *Boeing Calc*. "This three-dimensional spreadsheet can do useful things that established PC products can't. Because *Boeing*

Calc relies on a virtual memory model, one corporate user has been able to create a 7.5MB spreadsheet."

A product like *Boeing Calc* has immediate appeal for the major corporations that constitute Boeing Computer Services' client base. Most firms have divisions that generate financial data in parallel. Each division typically submits its data to a mainframe for consolidation.

"People are now trying to make connections between their flexible PC-based spreadsheets and powerful mainframe computers," Douglass explains. "One version of *Boeing Calc* runs on an IBM mainframe system—you enter the data on the PC and send it to the mainframe for both consolidation and number crunching."

Cognizant of the PC-based spreadsheet marketplace, the designers of *Boeing Calc* made it as 1-2-3 compatible as they could. The program's interface, commands, and functions resemble 1-2-3's, and the program can import 1-2-3 worksheets when the need for the third dimension arises. Indeed, Boeing sees that flexibility as the product's primary strength. The company is not out to replace the two-dimensional spreadsheet but to augment the traditional vehicle for commercial users who've outgrown its capabilities.

A few simple benchmarks convey the power of working in three dimensions. When *Boeing Calc* was pitted against 1-2-3 for model creation, recalculation, and formula alteration, the three-dimensional spreadsheet won going

Table 1: The Boeing Calc-1-2-3 face-off

	Boeing Calc	1-2-3 on one page	1-2-3 in seven files
Create model	58 seconds (on seven pages)	110 seconds	246 seconds
Recalculation			
one sheet	3 seconds	< 1 second	N/A
seven sheets	15 seconds	9 seconds	88 seconds
Change a formula in all work areas			
one sheet	6 seconds	15 seconds	N/A
seven sheets	9 seconds	57 seconds	98 seconds

away (see Table 1). Tests involved a PC equipped with 640K and a worksheet measuring 6 columns by 20 rows, which performed a basic break-even analysis. *Boeing Calc* used seven pages (six plus consolidation); *1-2-3* relied on seven identical worksheets on one page in a single disk file. In an alternative test, *1-2-3* created a separate file for each of the seven worksheets.

■ CalcIT

CalcIT, from aerospace giant Martin Marietta, both works by itself and integrates into the company's *IT* series of 11 programs (which encompass filing, communications, text processing, statistical analysis, electronic mail, and utility software). Where *Boeing Calc* allows a spacious maximum of 2000 rows and columns and up to 16,000 pages, *CalcIT* tops out at 255 rows and columns and 255 pages.

CalcIT includes EXEC, a BASIC-like programming facility, more powerful than macros, that enables you to build applications. Instead of executing instructions with *1-2-3*'s <Alt>-letter combination, you invoke commands that you've stored in files. EXEC can prompt you for specific information and then act on it. It also enables you to construct complex statistical and financial functions that aren't standard in most PC products.

When *CalcIT* is linked to *KeepIT*, Martin Marietta's filing program, the combination functions like a decision support system with a three-dimensional spreadsheet attached.

■ VP-Planner

Paperback Software's *VP-Planner* grew out of the decision support system tradition. Decision support software, which is used to build three-dimensional financial models, is a mainstay of the mainframe computer world. *VP-Planner* looks and acts like a spreadsheet but is fundamentally a data

manager. Assuming that your calculations occupy only a screen or two (but the actual numbers used in those calculations are plentiful), *VP-Planner* separates the data from the spreadsheet. Contemporary spreadsheets include some data management functions, but a decision support system is a true data manager fused with a functioning spreadsheet.

Rather than calling its product a three-dimensional spreadsheet, Paperback Software describes it as a data manager that works in five dimensions with a traditional two-dimensional spreadsheet built-in (see the sidebar "2-D + 3-D"). "Technologically, it's nothing new—we just married data base technology to spreadsheet technology," says one Paperback spokesperson. "The technicians understand data bases and the financial people understand spreadsheets, but there's been little crossover."

Jim Stephenson, developer of *VP-Planner*, explains why he connected data management and spreadsheet technology: "Most of the massive spreadsheets that are forcing people to buy more memory are symptomatic of bad planning," he says. "The spreadsheets are memory-intensive not because formulas and models are so big, but because users are putting massive amounts of data on the worksheet. Our program allows you to do a series of analyses, loading only the data you need for each analysis."

2-D + 3-D

Paperback Software's *VP-Planner* isn't strictly a three-dimensional spreadsheet, but it may be an alternative to that approach. Developer Jim Stephenson explains the fine points with this example: "Nabob Foods is a diversified Canadian company. The firm needs to compare budget versus actual income and expenses over time for many, many products and to monitor each product in each of the company's distribution regions."

The five axes in this problem, then, consist of time, income and expense line item, product, market area, and budget versus actual. *VP-Planner* queries you on the data set you're interested in and the axis on which you want to view the figures, and displays a worksheet with the specified information. If you want a different view or a full

summary, you simply enter your query. You want to see hot cocoa sales in Saskatchewan subtotaled for the first quarter, showing budget next to actual with variances? It's a straightforward query.

Entering information is a similar process. Once you've described the design of the data base, you enter your results much as you'd enter cells in a spreadsheet or bring in *dBASE* or *1-2-3* files with existing data.

Whether the five axes really constitute five dimensions is a question of semantics. People using paper-based systems can perform the same analyses, although no book-keeping equipment exists beyond the third dimension. Yet to accomplish Nabob's analyses with a three-dimensional product would require compressing those five axes into three dimensions—and might be as problematic as building the

three-dimensional model within a two-dimensional product. The budgeted product figures would need to be summarized on top. When all the products were built, another set of pages with the same breakout of actual figures would have to be assembled. You would then need to repeat the entire construction process for an equivalent set of pages holding the computed budget versus actual variances. After that, you'd still need to build pages to summarize information about each region, product, and so on, each time referencing the cell addresses of the relevant figures. Needless to say, the five axes are difficult to display in three dimensions.

The Bottom Line

The emergence of PC-based three-dimensional spreadsheet technology provides power heretofore rarely available outside the mainframe world. For certain tasks the additional dimension will redefine the entire approach to and use of PCs on the business desk top. On the other hand, for problems that truly exist only in two dimensions, the extra dimension can make data manipulation more confusing and the data itself less accessible.

Not all observers are excited about the potential of three-dimensional technology. Software developer Alan Cooper suggests that while three-dimensional spreadsheets are useful for consolidating information, the market for such models is severely limited by 1-2-3's popularity. Cooper favors the linking of separate spreadsheets or the development of a consolidation language as a better means of dealing with three-dimensional problems.

Says spreadsheet veteran Jim Toole, "The three-dimensional spreadsheet is a cleaner approach, but it's not ideal for every application I'm hired to build." Explains Toole, "Many of the problems I solve are two dimensional in nature: a break-even analysis for a single product, an annual balance sheet for a small business, a standard depreciation table."

Forefront's Robert Carr maintains that that market is now glutted with two-dimensional spreadsheets. Like Cooper, Carr doesn't

believe people will buy three-dimensional products merely to obtain better performance from their current applications. Still, this analysis ignores a significant fraction of business users. Who are they?

Toole recommends switching to a three-dimensional product if you must perform any kind of financial consolidation; compare or add multiple pages; or separate divisions, regions, or products.

Toole advises sticking to your traditional two-dimensional spreadsheet if you find thinking in three dimensions conceptually difficult, if you lack financial and spreadsheet experience and the patience necessary for building models, or if your application is small and quick execution time is essential.

Like *Flatland's* two-dimensional monarch, some people won't venture beyond the familiar. The third dimension represents confusion to some, but it's a new, exciting world to those who can see it clearly. ●

Jeff Angus is a systems analyst for Boeing Computer Services who has written documentation for Microsoft.

Boeing Calc

Boeing Computer Services

P.O. Box 24346

Mail Stop 7K-11

Seattle, WA 98124

List price: \$299

Requirements: 256K, two disk drives

CalcIT

Martin Marietta

P.O. Box 2392

Princeton, NJ 08540

800/222-0592, 609/799-7500

Price: \$400

Requirements: 128K, two disk drives

VP-Planner

Paperback Software

2612 Eighth St.

Berkeley, CA 94710

415/644-2116

List price: \$99.95

Requirements: 256K, one disk drive

AboveBoard

Personal Computer

Enhancement Operation

Intel Corp.

5200 N.E. Elam Young Pkwy.

Hillsboro, OR 97124-6497

503-629-7369

List price: AboveBoard/PC with

64K \$395, with 256K \$595;

AboveBoard/AT with 128K

\$595, with 512K \$995;

AboveBoard/AT Piggyback

Memory with 128K \$295, with

512K \$795

Project: ThinkTank

When a word processor isn't enough and a project management package is too much, an outline processor might be just the right tool. Here's how you might use Living Videotext's ThinkTank to organize fragments of ideas into manageable projects.

Reed McManus

Imagine that you've been plucked from your institutional-gray cubicle in R&D and called up to the walnut-paneled 30th-floor corner office of the company president and CEO. "People tell me you're good," the boss bellows. "We'll see how good. I'm putting you in charge of the Bigg Project. By the end of next month, I want a report about the Bigg Corporation's customers—what they do, what they eat, how often they call their mothers—everything. I don't care how you do it. Just get it done. And ... don't blow it."

As you stumble to the elevators in a daze, a thousand thoughts crash in your head. "My God, I've never done this before. Plan. Organize. I've got only a month. How many customers can we survey? Dates. Cost. Hire people. Who? How much? Got to find somebody who knows about data bases. Schedules. Mailing deadlines. Final reports ..."





Back in the calm of your cubicle, you wipe the sweat off your brow, pull out a legal-size note pad, and furiously begin to scribble notes. Wait. This won't work. There's no way to rearrange these things. There must be software designed to organize

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a mess like this. You start to pound at your word processor and soon get just as lost. It can handle text, but you need structure. A project manager? It's structured, but it doesn't help you think through a project from scratch, manipulating ideas instead of data. Project managers require specific, known tasks, dates, and costs to work effectively. Maybe what you need is an outline processor.

The Bigg Project is a complex organizational task that illustrates how a program like *ThinkTank* can help you structure a project from conceptual stages through implementation. *ThinkTank*'s user manual clearly presents the program's many functions for moving the cursor and outline headings around on a page, but it does not teach you how to use an outline to best effect. If your fourth-grade teacher was less than convincing, this example may show you how outlines, especially when backed by useful software, can help you organize your thoughts.

Ready. Set. Babble.

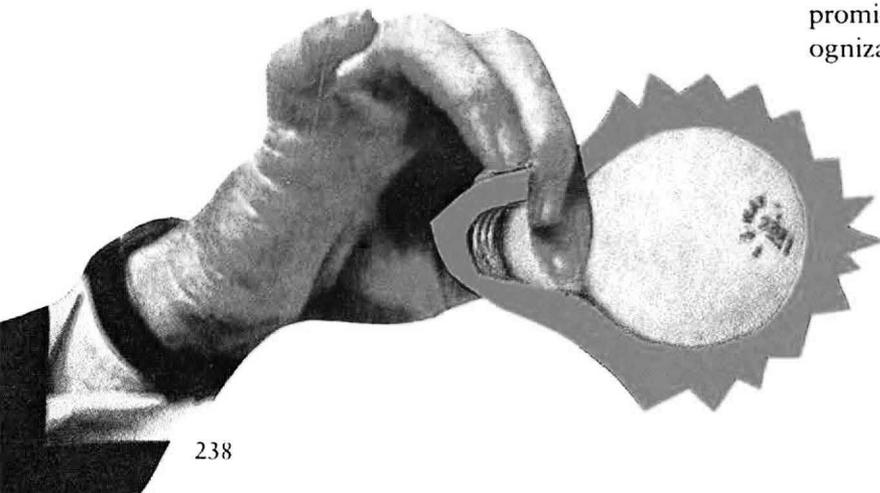
Brainstorming is *ThinkTank*'s milieu. It allows you to catch fleeting thoughts as they pop into your head, dump them onto a computer "page" as fast as you can, and worry about putting them in logical order later.

To begin, load *ThinkTank* and open an outline file called Bigg. Rename the Home line with an appropriate title (BIGG PROJECT—CUSTOMER SURVEY). Take a deep breath, press <Ins>, and type your first thought: Staff Needs. Press <Enter> and you're on the line directly below and at the same level of indentation as the entry above. Type every thought that comes to mind, pressing <Enter> after each one. Suddenly you're awash in all the implications of the Bigg Project. You'll need to hire temporary employees, get a budget, set a schedule, and organize countless other elements. Just keep typing and pressing <Enter> to get them all down.

If you've already thought through an idea or two, those can be entered with their logical subheads right from the start. To make an entry subordinate to the one above it, move the cursor with <CursorRight> before you type the new headline. The headline Survey, for instance, spawns subordinate thoughts on how many customers to survey, whether to contract out parts of the project, and how to write, print, collate, and summarize the survey forms.

A list simply can't do justice to some thoughts. If a headline inspires text, be it a paragraph, a poem, or a memo, you can press <F5> to enter the program's document editor.

Figure 1 shows how the initial panic-inspired list of ideas for the Bigg Project might look. A plus sign preceding a headline indicates that the item has subheads; a minus sign indicates that a headline has no subheads. The initial outline is extremely rough, with disparate project elements back-to-back and illogical and duplicate subheads. Some elements show promise of organization, while others are barely recognizable thoughts.



Now that you've got a kernel to start from, you can benefit from cooler reflection. Expand on and pare the outline, addressing each headline separately. New headlines can be inserted anywhere in the outline with the <Ins> key. Add subsidiary headlines or text to flesh out each idea that deserves attention, and press to delete the others.

Order Out of Chaos

Up to this point, you've simply collected thoughts—a task that can be performed easily enough with a word processor, a notepad program, or even a pad and pencil. Now you can call on *ThinkTank's* organizational skills to help put the Bigg Project in a workable order.

Scan the effects of your brainstorm. To focus on the broader picture, use *ThinkTank's* Collapse command. Collapsing an outline hides the subsidiary headlines and text, letting you focus on the relationships among headlines at the same outline level. Expanding the outline again lets you see all the topics under a single heading. At any headline press <F8> to expand or collapse the next level of subheads. (You can also press the plus key to expand or the minus key to collapse an outline.) Press the asterisk key to expand a complete range of subheads under a headline.

Now collect your headlines into logical groups. Some categories seem obvious from the beginning: The task seems to separate into administrative considerations, the survey itself, and the final report. The quickest way to move groups of headlines into proper order is with *ThinkTank's* Mark and Gather commands. Mark specifies the headlines you want to move, while Gather collects them under a new headline. The marked headlines can be copied, moved, or (in release 2.0) "cloned."

Cloning a headline creates a copy that remains linked to the original. The effect is like cell recalculation in a spreadsheet: A change in cloned text is instantly reflected in all of the copies. When you need to copy headlines that may change—a deadline for a task or the address of a footloose freelancer—it's best to clone them.

To gather scattered headlines for the Bigg Project's administration, move the cursor through the outline and press the <Tab> key at the headings Staff Needs and Money. Then move the cursor to the topmost headline and press G M (Gather Move) to collect the marked headlines. The headline will read 'gathered headlines'. Rename it ADMINISTRATION. Collect the other categories in a similar fashion (see Figure 2).

After you've gathered headlines into main topics, some thoughts still refuse to be pigeonholed. Keep a headline for random and unassigned thoughts called the Bone Pile. As you refine the outline, you'll find you can move items from the bone pile into the outline or delete them.

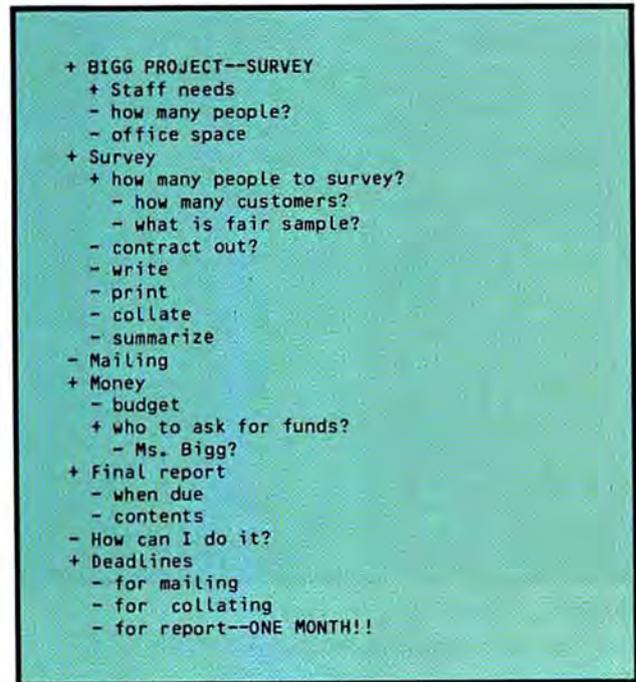


Figure 1: The effects of the brainstorm. Organizing and building on this skeleton will get the project moving.

```

+ BIGG PROJECT--SURVEY
+ ADMINISTRATION
+ Money
  - budget
+ who to ask for funds?
  - Ms. Bigg?
+ Staff needs
+ how many people?
  - to write survey
  - to collate results
  - to write report
  - contract out?
+ office space
+ THE SURVEY
+ How many people to survey?
  - how many customers?
  - what is fair sample?
+ How to get names of customers?
  - charge accounts
  - warranty cards
+ Write
  - need expertise in surveys
+ Print
  - typesetter?
  - laser printers
+ Mailing
  - mailing costs
  - deadline
  - enclose money to ensure response?
+ Collate
  + do collating outside?
    - look in yellow pages for possible companies
+ Deadlines
  - for mailing
  + for collating
    - find out from outside collators
  + for report--ONE MONTH!!
+ THE FINAL REPORT
  - When due
  + Contents
    + economics
      - mean income
      - how much spent on Bigg products last year
    + social
      - how often do they call their mothers
      - graphs
      - conclusions
+ THE BONE PILE
  + How can I do it?
    - !!!!!!!

```

Figure 2: The second step is to flesh out and organize the rough outline. When related headlines are gathered, the project begins to take shape.

You can cull related headlines from the outline with *ThinkTank's* Keyword commands. Keyword Search (K S) and Keyword Xchange (K X) can be used to search for headlines that contain specified characters or to search for and replace those characters in the outline. Keyword Mark marks all headlines that contain specified characters. Using Keyword Mark with Gather provides an easy way to group related headlines, provided that you write your headlines with care, using consistent terminology in each allied headline.

Within each topic group you may want to organize the headings into the order in which they should be handled. To move a headline you press <F1> and position the headline with the cursor keys. You can promote or demote its level in the outline structure with the same command. Moving a headline also moves any of that headline's subheads or text.

ThinkTank's Alpha command comes in handy when you're compiling telephone numbers or employee lists or simply searching for a way to put thoughts in order. You can alphabetize entries under any headline by moving the cursor to that headline and pressing A.

Higher States of Organization

The many-layered Bigg Project outline began with a jumble of rough ideas and unanswered questions. After much entering, moving, cutting, and pasting, you've created a working structure for the project. But the outline's job is not complete. Now it can serve as a framework for carrying out the project.

Looking over the outline reveals that some topics need immediate attention, while others are less pressing. Glancing first at the heading Staff Needs, then around your cubicle, you decide to focus first on Office Space. Move the cursor to the headline and press the opening bracket key ([) to invoke the Hoist command (available in release 2.0). Using Hoist zeroes in on one headline and its related subheads, giving you extra room on screen and removing the distraction of surrounding topics. You can now concentrate on all the chores relating to Office Space.

Pressing <F5> activates *ThinkTank's* document editor. The editor will handle up to 16 pages of text under any headline. It includes the basic word processing features, letting you cut and paste, set

ThinkTank's document editor will handle up to 16 pages of text under any headline.

tabs, and search for and replace text—adequate for a memo to the office manager requesting more space (see Screen 1). The document editor uses *WordStar's* cursor commands.

After polishing the memo, you can print it from within *ThinkTank* using the Port command. With the cursor on the headline that titles the memo, press P P F (Port Printer Formatted). *ThinkTank* then prompts you for 17 formatting options, allowing you to control such features as margins and line spacing. To ensure that only the memo and not its headline is

printed, type 0 at option 7, indicating to what depth headlines should be printed. After the format options are set, press the <Space> bar to begin printing. If no printer is immediately available, you can port the memo to a text file for printing later.

You can treat each headline differently. Moving to the next order of business, getting the surveys in the mail, you return to *ThinkTank's* more structured mode. Enumerating the questions to be included in the survey calls for another brainstorming, organizing, adding, and paring session, this time within a smaller topic scope.

As the project progresses, use *ThinkTank's* Gather, Mark, Copy, and Clone commands to continually update the outline and organize the project. As tasks are finished and decisions made, delete reminders for tasks and add records of decisions made. The outline will evolve into a compendium of project statistics for your reference.

```
+ Office space
-- T -----
To: Mr. Wizard, Office Services
From: Bob Cubicle
Re: Office space for temporary workers on Bigg Project

During the upcoming Bigg Project I will need several extra cubicles for
temporary workers. I expect to be hiring 100 people for one month. Can you
help, Mr. Wizard?

-- T -----

Document Editor                                insert mode
arrow keys move flashing cursor
use F10 for edit command menu
Page 1
```

Screen 1: Hoisting clears the screen of all but the current headline and its related headlines and text, and *ThinkTank's* document editor formats a memo.

```

+ BIGG PROJECT--SURVEY
+ ADMINISTRATION
+ Costs
  & survey costs
  & report costs
+ Personnel
  & survey personnel
  & report personnel
+ Deadlines
  & survey deadlines
  & report deadlines
+ THE SURVEY
+ Contents
+ social habits
+ buying habits
+ family behavior
& Survey deadlines
- write survey deadline--August 20
- print survey deadline--August 22
- mail survey deadline--August 23
- begin collating deadline--September 1
- collate survey deadline--September 10
& Survey personnel
+ writers
+ collaters
& Survey costs
+ writing costs
+ mailing costs
+ printing costs
+ survey salary costs
+ THE FINAL REPORT
+ Contents
+ social
+ buying habits
+ family
+ conclusions
+ graphs
& Report deadlines
- begin writing deadline--September 10
- final report deadline--September 18
& Report personnel
+ Bob Bobson
+ John Johnson
+ Alice Alison
& Report costs
+ report salary costs

```

Figure 3: In a project's later stages, the outline evolves into a record of project statistics. Each headline includes essential information for each project branch. The ADMINISTRATION outline has evolved into a control panel, using clones of statistics from each project area to monitor the overall project.

Cloning Around

ThinkTank's cloning feature provides an easy way to monitor a dynamic project whose various elements are chronicled in several categories. Each section of the Bigg Project includes information on costs, personnel, and deadlines—statistics you will want to track within each task and for the project as a whole. With cloning, you can create a central control panel from which you can keep tabs on overall project statistics.

In Figure 3, the control panel is labeled ADMINISTRATION. To create it, you first execute a Keyword Mark for *costs*. *ThinkTank* marks the two headlines containing that word—subsidiary headlines are included automatically. Type G & to gather the headlines as clones (the leading character of a cloned headline changes from a plus or minus sign to an ampersand). Then rename the headline and move it into position. Use the same procedure to mark and clone *deadlines* and *personnel*. When statistics under these headlines change, editing one copy will change the clone.

Portable Outlines

For tasks that can be better handled by other software, *ThinkTank's* Port functions enable you to transfer outlines to those programs. The report that will finally land on the Bigg honcho's desk will be massive: too large to be handled well by *ThinkTank's* document editor. Developing the report outline within the larger project outline before you move to the word processor enables you to easily toss into the report structure any relevant ideas that emerge in other parts of the outline, but to create the text you'll want to port the outline to a heftier word processor.

ThinkTank's Port to Textfile function creates documents in ASCII format. After you type P T S (Port Textfile Send), *ThinkTank* gives you three options: Formatted, Wordprocessor, and Structured.

The Formatted option allows you to manipulate *ThinkTank's* 17 format settings to control the appearance of the text file. If you want to keep the outline's normal indentations and still use a word processor, you should use this option.

For tasks that can be better handled by other software, ThinkTank's Port functions enable you to transfer outlines to those programs.

Formatted outlines retain carriage returns at the end of each line. Wordprocessor converts the outline into word-wrapped, nonindented text. Documents created with the Structured option retain *ThinkTank* formatting commands. When they are ported back into *ThinkTank* (with another porting option), their outline structure remains intact.

How easily you can port numbers or dates from *ThinkTank* into a spreadsheet or project management software depends on the import capabilities of the receiving software. You can isolate numbers or dates with *ThinkTank's* Mark and Gather commands, edit the gathered text or headlines, and port them to an ASCII file, but your format options are limited to those discussed here. Most likely, you'll have to enter the necessary statistics into those packages by hand once you've hatched them with *ThinkTank*.

The Strong, Silent Type

At first, approaching a project through *ThinkTank* may be as intimidating as staring at a blank piece of paper; the program won't prompt you for dates, times, and numbers. Neither will it print out Gantt charts or calculate work loads and budgets. Those tasks belong to project management programs.

What *ThinkTank* can do is incubate your thoughts and gently shape them until they're strong enough to move to another, more specialized software package or ready to organize a task. No matter

how complex a project gets, you can keep its essence in a *ThinkTank* file, to which you can refer to check the relationship of the parts to the whole and remind yourself of parts still in progress. When you don't know where to start, *ThinkTank* may be the place. Any idea, be it logical or intuitive, can be recorded, organized, manipulated, reshaped, or ignored with *ThinkTank*. ●

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ThinkTank
Living VideoText, Inc.
2432 Charleston Rd.
Mountain View, CA 94043
415/964-6300
List price: \$195
Requirements: 256K, DOS 2.00
or later version, two disk drives
Copy protected



Designer Screens

With an appreciation of DOS screen design and control features, you can use the video display as a canvas for creative and informative prompts and menus.

*Burton L. Alperson,
Andrew Fluegelman,
and Lawrence J. Magid*

||||| Control over the video display constitutes far more than window dressing: The screen is the medium for supplying information to the user. A well-designed screen enhances not only the aesthetics but also the efficiency of program execution and information presentation. It helps locate the appropriate instructions and interpret program output. It can put the final polish on a system.

With DOS 2.00's display capabilities and screen control fea-

tures, you can use graphics characters, redesign the DOS prompt, and control parameters such as inverse video, cursor location, foreground and background colors, screen width, and screen mode. Prior to the introduction of DOS 2.00, the only access to many of these operations was through assembly language.

■ Creating Custom Menus

Some people go to the trouble of writing elaborate menu programs in BASIC or another language. We take a simpler approach. The menus shown with this article are nothing more than screen displays that indicate which keys will produce what actions. (The keyboard macros do all the work; the menus provide the visual cues.)

This system enables you to create visually exciting menus and to tailor and revise them as you expand your PC.

■ Extended Characters

The extended ASCII character set can help create custom menus. Notice that the menu displayed in Screen 1 includes characters that appear in the appendix of the BASIC manual but not in the standard ASCII character set. These include solid lines (ASCII 179, 180, 193, 194, 195, 196, and 197), single-line corners (ASCII 191, 192, 217, and 218), double lines (ASCII 185, 186, 202, 230, 204, 205, and 206), double-line corners (ASCII 187, 188, 200, and 201), and special graphics symbols such as the large dot (ASCII 249) and the right arrowhead (ASCII 16). These graphics symbols are among many available to you without your having to resort to programming in assembly language or BASIC.

If you hold down the <Alt> key while you type the desired ASCII number on the numeric keypad, you'll discover that you can access all the symbols above ASCII 127. The corresponding character appears as soon as you release the <Alt> key. (This technique does not work with the numbers on the top row of the

keyboard—you must use the numeric keypad. If you are using a keyboard macro processor like *ProKey*, you'll have to hold down both <Alt> and <Shift> while you press the keys on the numeric keypad.)

The characters available depend on the editing technique you use to create batch files. The COPY and EDLIN techniques described in "The Tailor-Made Editor" (*PCW*, Vol. 1, No. 4) and "The Fully Powered PC" (*PCW*, July 1985) provide access to ASCII codes 128 through 254. IBM's *Professional Editor* makes available ASCII codes 1 through 6, 11, 12, 14 through 31, and 127 through 254. *Microsoft Word* offers entrée to ASCII codes 1 through 6, 14 through 31, and 127 through 254. *WordStar* does not offer access to any of the codes. Any of these editors other than *WordStar*, then, makes available a large stock of graphics symbols with which to construct displays.



Several strategies can simplify menu construction. Screen 1 shows a typical menu for application programs. The menu was created as a simple text file. Initial layout was done with *Professional Editor* to take advantage of its what-you-see-is-what-you-get display and its rapid search-and-replace function capability.

When you're relying on such an editor, using the <Alt> key to enter a long series of extended ASCII codes can be extremely tedious. A long double line might require you to press and hold the <Alt> key, type 205, and release the <Alt> key 30 times. A better technique would be to type 30 asterisks and

then replace them with character 205 via the editor's global search and replace.

Professional Editor cannot, however, perform one necessary task. Many menus tend to be so large that you'll want to do what you can to avoid wasted lines on the screen. A DOS quirk causes many batch files to end with a double prompt, forcing the top line of the menu off the screen.

This anomaly can be prevented by making a Control Z the last character of the last line of the ASCII file. *Professional Editor*

cannot perform this operation, but EDLIN, the DOS line editor, can. The final step in creating the menu in Screen 1 required bringing it into EDLIN to add the terminating Control Z.

Once your menu is saved as a text file, you can write it to the screen at any time using the DOS TYPE command. If you call your menu MENU.DSP, for example, you can display it by including the commands CLS and TYPE MENU.DSP in a batch file.

■ Creating an ASCII Display

Suppose you have added your own function key assignments for <F1> and <F7> through <F10> to the DOS default assignments (see DOS Keyboard Usage in the *IBM Guide to Operations*) for <F2> through <F6>. <F2> through <F4> allow you to redisplay different segments of a previous command

With DOS 2.00's display capabilities and screen control features, you can use graphics characters, redesign the DOS prompt, and control foreground and background colors.

line. <F2> plus a character redisplay all characters of the previous command up to the first occurrence of the character you typed. You can also redisplay all remaining characters (<F3>), skip all characters up to a given character (<F4>), and enter the currently displayed command line without executing the command to edit it further (<F5>). The final DOS default (<F6>) types an

end-of-file character, or Control Z, which is displayed as ^Z. We will assume that you have added the following assignments to the remaining function keys: <F1> is COPY, <F7> is BASICA, <F8> is the main menu display, <F9> is A:, and <F10> is B:.

You can create a small ASCII display, like the one shown in Screen 2, to remind yourself of these assignments. This is a simple task, requiring nothing more than EDLIN.

The first step is to invoke the editor with a new file name, such as EDLIN FK.ASC. You can begin immediately by sending EDLIN the command II to insert text starting at the first line. You then type the ASCII code for a double-line upper left corner (<Alt>-201), followed by 37 asterisks, the ASCII code for a double-line upper right corner (<Alt>-187), and finally <Enter>.

You begin the next line with the double-line border (<Alt>-186), then the text (F1 COPY), 15 spaces, the text (F2 Type to char), the double-line border (<Alt>-186), and <Enter>. Enter the remaining lines containing text in the same way. The final line includes a bottom left double-line corner (<Alt>-200), 37 asterisks, and a bottom right double-line corner (<Alt>-188). After entering the last line, press <Ctrl>-<Break> to exit EDLIN's insert mode.

The only task remaining before saving the display to a disk file is to change all the asterisks to the horizontal double-line character to finish framing the display. This is easily accomplished with the EDLIN command 1,8R* <Ctrl>-Z<Alt>-205. Typing E <Enter> saves the display, and it is ready for use.

Any time you wish to display the function key reminder on screen, just issue the command TYPE FK.ASC. You might, for example, include the command as the last line of any batch file that returns to DOS after running an application program. It could also be included as the last line in your AUTOEXEC.BAT file.

■ Harnessing the Power of the Prompt

DOS 2.00's PROMPT command provides additional screen control. Its simplest use involves changing a prompt. You can invoke it with the syntax PROMPT [*prompt-text*] from either the keyboard or a batch file. *Prompt-text* can consist of any of 13 arguments plus any text you want to insert into the prompt. Each argument must begin with a dollar sign. You can include the date (\$d), time (\$t), default drive (\$n), path (\$p), greater-than symbol (\$g), less-than symbol (\$l), DOS version number (\$v), vertical bar (\$b), double horizontal line (\$q), dollar sign (\$\$), a carriage-return/line-feed sequence (\$_), a backspace and erase (\$h), and an Escape character (\$e).

Anything on the command line other than these arguments will be printed as part of the prompt. The

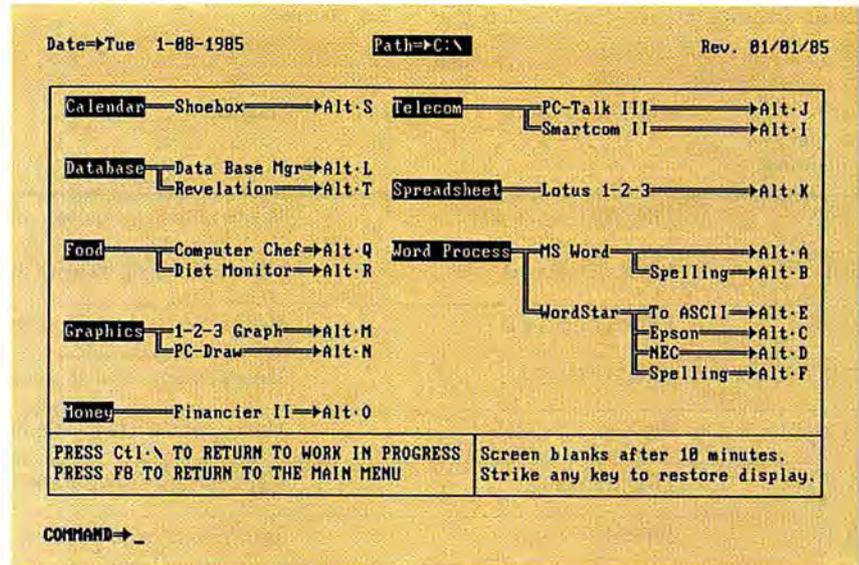
command PROMPT \$n\$g (or just PROMPT), typed from the keyboard or included in a batch file, will produce the normal DOS prompt. But if you use the command PROMPT \$d \$n\$g, the date will be included in the prompt, and it will appear, for example, as 'Thu 8-14-85 A>'.

A more useful application would have the prompt report the current path (including the drive specifier) after you issue the command PROMPT \$p\$g. If you are in the \EDISK directory of drive C:, for example, this command will produce the prompt 'C:\EDISK>'.

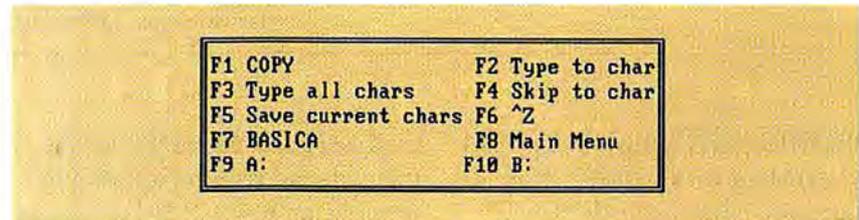
You can include any text in the prompt command. The command PROMPT Charlie's DOS, Current Directory: \$p\$g would produce the prompt 'Charlie's DOS, Current Directory: C:\EDISK>'.

Gateway to a Driver

Although controlling the prompt is useful, the PROMPT command's most important function may well be providing a gateway to an extremely powerful display driver called ANSISYS. ANSISYS lets you manipulate display functions precisely. You can control cursor position (in a fashion similar to using BASIC's LOCATE, PRINT, and CLS commands) and foreground and background colors and inverse video (similar to using BASIC's COLOR and SCREEN commands). ANSISYS also reports on current cursor location (like BASIC's CSRLIN and POS commands) and offers several functions not available in BASIC. (ANSISYS also enables you to redefine keys, although this capability is negligible compared to that of such macro



Screen 1: A sample menu created with DOS and a text editor



Screen 2: An ASCII function key reminder display

processors as *ProKey*, *SuperKey*, and *Keyworks*).

In order for DOS to install the ANSISYS driver, the ANSISYS file must be copied from the original DOS disk to your system start-up disk. The system start-up disk must also contain a file called CONFIG.SYS, and this file must contain the line DEVICE = ANSISYS.

Each call to an ANSISYS function begins with an Escape code.

Since PROMPT allows you to send an Escape code to DOS (\$e), this command provides access to the ANSISYS commands. The syntax of ANSISYS (modified to make use of the PROMPT command) and its functions are shown in Table 1. The visual effects of various Set Graphics Rendition (SGR) function parameters are listed in Table 2.

When you combine the power of the ANSISYS display driver with the PROMPT command, you can turn your system prompt into a useful display. The batch file

Table 1: Selected ANSI.SYS/PROMPT functions

DOS manual mnemonic	Modified syntax	Purpose
CUP	PROMPT \$e{#;#H	Moves cursor to row #, column #
CUU	PROMPT \$e{#A	Moves cursor up # rows without changing column
CUD	PROMPT \$e{#B	Moves cursor down # rows without changing column
CUF	PROMPT \$e{#C	Moves cursor right # columns without changing row
CUB	PROMPT \$e{#D	Moves cursor left # columns without changing row
SCP	PROMPT \$e{s	Saves current cursor position so that it can be restored with RCP
RCP	PROMPT \$e{u	Returns cursor to position saved with SCP
ED	PROMPT \$e{2J	Clears screen and homes cursor
EL	PROMPT \$e{k	Erases from current cursor position to end of line
SGR	PROMPT \$e{#;...;#m	Sets character attributes for color, bold, underscore, blinking, and inverse video (see Table 2 for values of #)

PROMPT1.BAT shown in Listing 1 was created with EDLIN. It produces the informative display shown in Screen 3. Whenever you are in DOS, this prompt lets you see both the date and the path to the current directory. The prompt also shows the date the system was last revised and an indication that the system is waiting for a command.

The first parameter specified in the PROMPT command (\$e{s) saves the cursor position when a DOS command is invoked. The next parameter (\$e{1;1H) moves the cursor to row 1, column 1, ensuring that the current date, the path, and the date the system was last revised will appear at the top of the screen, regardless of where the cursor was when the command was initiated. The next cursor movement parameters

(\$e{1;33H and \$e{1;67H) locate the path and revision information properly on row 1. The last cursor movement parameter (\$e{u), which appears toward the end of the PROMPT command, returns the cursor to the position it was in before the DOS command was issued, at which point the system can begin writing the command prompt.

Controlling the cursor with this scheme produces intriguing and useful results. If the DOS command does not generate screen output, the date/path/revision line will appear immediately above the command prompt (see Screen 3). But any screen output, such as the menu shown in Screen 1, will appear between the date/path/revision line and the command prompt. This display scheme helps focus the user's attention appropriately during day-to-day activities with DOS.

The prompt also contains several ANSI.SYS commands that control video attributes to guide the eye efficiently to the desired information. The parameter \$e{36m makes the date appear in cyan. (This command has no effect on an IBM Monochrome Display.) The next parameter (\$e{K) erases to the end of row 1. Inverse video is then turned on (\$e{7m) for the path information, making it the most salient information in the display. The character attributes are returned to normal status for the revision information (\$e{0m), and high-intensity is turned on for the command prompt (\$e{1m). Finally, character attributes are returned to normal status (\$e{0m) at the end of the prompt.

The batch file example in Listing 1 illustrates several characteristics of the PROMPT/ANSI.SYS system. You can string together any number of parameters on the same command line to produce any desired effect. Your only limitation is the 127-character maximum length of the DOS command line. Cursor movement commands may be interspersed with video attribute commands to create eye-catching displays. Finally, the extended ASCII set is available. In Screen 1, for example, the double horizontal line (ASCII 205) was combined with a right arrowhead (ASCII 16) to produce a "pointer."

Controlling Color

The PROMPT/ANSI.SYS system also enables you to control foreground and background colors in DOS. This feat is easy in BASIC, but any changes made in BASIC are removed when you return to DOS. Prior to DOS 2.00, control of colors in DOS required programming in assembly language. Now the conditional logic available in batch files and the display control provided by ANSI.SYS and PROMPT have eliminated this problem.

Listing 2, a batch file called SCREEN1.BAT, gives you control over foreground and background colors while in DOS. You invoke the batch file with the syntax `SCREEN foreground background`. To produce white text on a blue screen, for example, you would type `SCREEN WHITE BLUE`. (Note that SCREEN1.BAT, and any program to control DOS screen colors, will not be effective if the DOS prompt contains color commands, as discussed in the previous section.)

Table 2: Set Graphics Rendition (SGR) function parameters

Effect	Command	Notes
Attributes		
Normal	PROMPT \$e[0m	All attributes off: white on black IBM monochrome only
High intensity	PROMPT \$e[1m	
Underscore	PROMPT \$e[4m	
Blinking	PROMPT \$e[5m	
Inverse video	PROMPT \$e[7m	
Invisible	PROMPT \$e[8m	
Foreground Color		
Black	PROMPT \$e[30m	Gray in high intensity Yellow in high intensity
Blue	PROMPT \$e[34m	
Green	PROMPT \$e[32m	
Cyan	PROMPT \$e[36m	
Red	PROMPT \$e[31m	
Magenta	PROMPT \$e[35m	
Brown	PROMPT \$e[33m	
White	PROMPT \$e[37m	
Background Color		
Black	PROMPT \$e[40m	
Blue	PROMPT \$e[44m	
Green	PROMPT \$e[42m	
Cyan	PROMPT \$e[46m	
Red	PROMPT \$e[41m	
Magenta	PROMPT \$e[45m	
Brown	PROMPT \$e[43m	
White	PROMPT \$e[47m	

```
ECHO OFF
PROMPT $e[Cs $e[1;1H$e[36mDate=>$d $e[K$e[7n$e[1;34HPath=>$p $e[1;67H$e[0mRev. 01
/01/85$e[Cu$e[1mCOMMAND=>$e[0m
```

Listing 1: The batch file PROMPT1.BAT, created with EDLIN, illustrates such salient PROMPT/ANSI.SYS system features as cursor movement commands and use of the extended ASCII set.

```
Date=>Wed 1-09-1985 Path=>A:\ Rev. 01/01/85
COMMAND->_
```

Screen 3: Screen output of PROMPT1.BAT

```

ECHO OFF
CLS
ECHO Wait ...
IF ZIP==%1ZIP GOTO BACK
IF BLACK==%1 GOTO FBLACK
IF black==%1 GOTO FBLACK
IF RED==%1 GOTO FRED
IF red==%1 GOTO FRED
IF GREEN==%1 GOTO FGREEN
IF green==%1 GOTO FGREEN
IF BROWN==%1 GOTO FBROWN
IF brown==%1 GOTO FBROWN
IF BLUE==%1 GOTO FBLUE
IF blue==%1 GOTO FBLUE
IF MAGENTA==%1 GOTO FMAGENTA
IF magenta==%1 GOTO FMAGENTA
IF CYAN==%1 GOTO FCYAN
IF cyan==%1 GOTO FCYAN
IF WHITE==%1 GOTO FWHITE
IF white==%1 GOTO FWHITE
:FBLACK
PROMPT $e[30m
GOTO BACK
:FRED
PROMPT $e[31m
GOTO BACK
:FGREEN
PROMPT $e[32m
GOTO BACK
:FBROWN
PROMPT $e[33m
GOTO BACK
:FBLUE
PROMPT $e[34m
GOTO BACK
:FMAGENTA
PROMPT $e[35m
GOTO BACK
:FCYAN
PROMPT $e[36m
GOTO BACK
:FWHITE
PROMPT $e[37m
GOTO BACK
:BACK
ECHO ON
ECHO OFF
CLS
ECHO Wait ...

IF ZIP==%2ZIP GOTO END
IF BLACK==%2 GOTO BBLACK
IF black==%2 GOTO BBLACK
IF RED==%2 GOTO BRED
IF red==%2 GOTO BRED
IF GREEN==%2 GOTO BGREEN
IF green==%2 GOTO BGREEN
IF BROWN==%2 GOTO BBROWN
IF brown==%2 GOTO BBROWN
IF BLUE==%2 GOTO BBLUE
IF blue==%2 GOTO BBLUE
IF MAGENTA==%2 GOTO BMAGENTA
IF magenta==%2 GOTO BMAGENTA
IF CYAN==%2 GOTO BCYAN
IF cyan==%2 GOTO BCYAN
IF WHITE==%2 GOTO BWHITE
IF white==%2 GOTO BWHITE
:BBLACK
PROMPT $n$g$e[40m
GOTO END
:BRED
PROMPT $n$g$e[41m
GOTO END
:BGREEN
PROMPT $n$g$e[42m
GOTO END
:BBROWN
PROMPT $n$g$e[43m
GOTO END
:BBLUE
PROMPT $n$g$e[44m
GOTO END
:BMAGENTA
PROMPT $n$g$e[45m
GOTO END
:BCYAN
PROMPT $n$g$e[46m
GOTO END
:BWHITE
PROMPT $n$g$e[47m
:END
ECHO ON
ECHO OFF
CLS

```

Listing 2: The batch file SCREEN1.BAT enables you to manipulate foreground and background colors while in DOS.

WHITE would be the value assigned to '%1' in SCREEN1.BAT, and the batch file would test this variable until it found a match on the line 'IF WHITE = = %1 GOTO FWHITE'. The conditional logic would send control to the label ':FWHITE', which would set the foreground color. (Note that the test must be performed for both uppercase and lowercase strings. DOS is normally insensitive to case, but the batch file conditional that tests for matching strings is case-sensitive. You are searching for an exact match with a string, and uppercase and lowercase representations of the same word are legitimately different string values.)

After setting the foreground color, an unconditional branch (GOTO BACK) sends control to the routine that sets the background color. A new test is performed on '%2', which would find a match at the line 'IF BLUE = = %2 GOTO BBLUE'. ':BBLUE' would then set the background color and send control to the exit routine ':END'. The two 'ECHO ON, ECHO OFF, CLS' sequences in this batch file are necessary to force each PROMPT/ANSI color change when 'ECHO' is off.

Notice the 'ECHO Wait ...' lines that appear twice in this batch file. These are not trivial or cosmetic additions to the program. At its worst, this batch file takes about 15 seconds to complete. In such a situation, providing an indication that something is actually going on is a sound idea.

Otherwise, someone using the batch file for the first time is likely to terminate it prematurely on the assumption that it's not working. Many operations have been brought to a grinding halt by the failure to include simple messages such as 'Wait ...'.

The sluggish execution of this batch file is troublesome. If you think about the logic of the problem, you'll realize that you're forcing the computer to do more work than necessary. It is clear that you need a branching strategy, but requiring as many as 31 IF string comparisons is probably not the best way to proceed. (Among longtime computer buffs, this kind of activity is known as "shoving beans up your nose." You're doing something that may give you temporary satisfaction, but in the long run it won't do much good.) All you really need to do is go directly to the appropriate foreground routine, then to the appropriate background routine.

Listing 3, SCREEN2.BAT, is a more efficient and elegant version of SCREEN1.BAT. It replaces the conditional IF logic with unconditional GOTO logic, eliminating the need for all but two of the tests of string values. Not only is this batch file both shorter and more emotionally satisfying than its precursor, it runs with a worst-case time of 6 seconds—an improvement of 9 seconds over its more cumbersome predecessor. Rethinking your logic after completing a program can frequently

```

ECHO OFF
CLS
ECHO Wait ...
IF ZIP==%1ZIP GOTO BACK
GOTO FX1
:FBLACK
PROMPT $e[30m
GOTO BACK
:FRED
PROMPT $e[31m
GOTO BACK
:FGREEN
PROMPT $e[32m
GOTO BACK
:FBROWN
PROMPT $e[33m
GOTO BACK
:FBLUE
PROMPT $e[34m
GOTO BACK
:FMAGENTA
PROMPT $e[35m
GOTO BACK
:FCYAN
PROMPT $e[36m
GOTO BACK
:FWHITE
PROMPT $e[37m
GOTO BACK
:BACK
ECHO ON
ECHO OFF
CLS
ECHO Wait ...

IF ZIP==%2GOTO END
GOTO BX2
:BBLACK
PROMPT $n$g$e[40m
GOTO END
:BRED
PROMPT $n$g$e[41m
GOTO END
:BGREEN
PROMPT $n$g$e[42m
GOTO END
:BBROWN
PROMPT $n$g$ e[43m
GOTO END
:BBLUE
PROMPT $n$g$e[44m
GOTO END
:BMAGENTA
PROMPT $n$g$e[45m
GOTO END
:BCYAN
PROMPT $n$g$e[46m
GOTO END
:BWHITE
PROMPT $n$g$e[47m
:END
ECHO ON
ECHO OFF
CLS

```

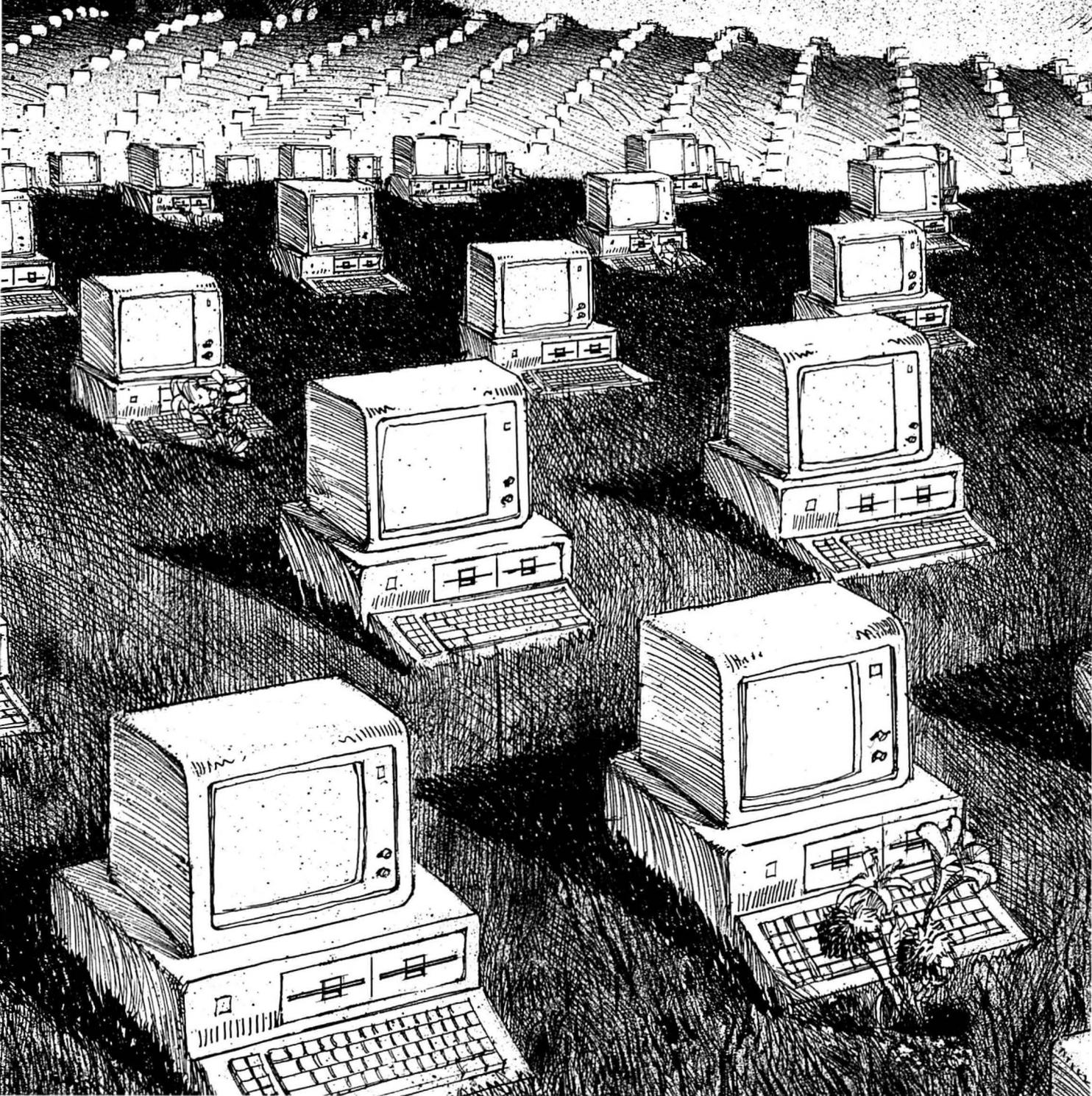
Listing 3: SCREEN2.BAT, an improved version of SCREEN1.BAT, which replaces conditional IF logic with unconditional GOTO logic

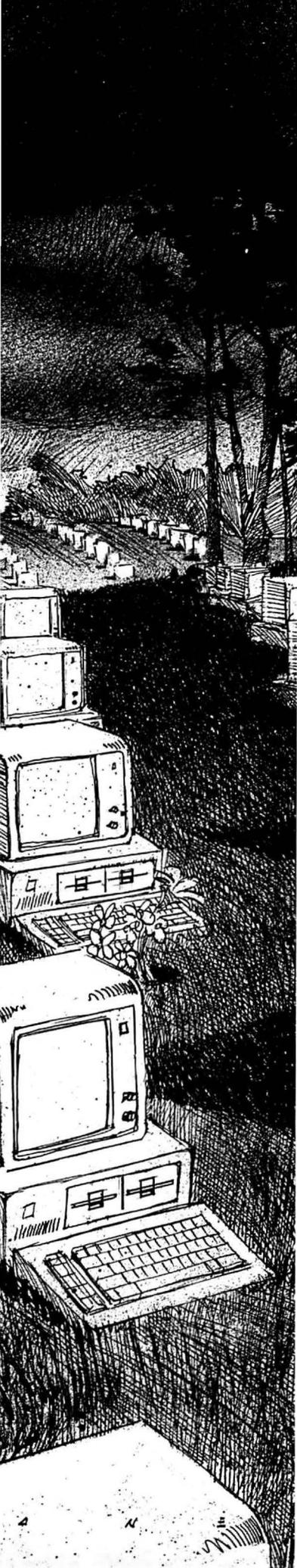
produce this kind of time savings, reaffirming the adage that no program is ever a total loss ... it can always be used as a bad example. ●

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Editor's note: The disk included in the book contains a program called MENU MAKER.BAS and its compiled equivalent MM.EXE; although the program listing is too lengthy to include here, either version makes creating designer screens even easier than the EDLIN or Professional Editor methods described here.

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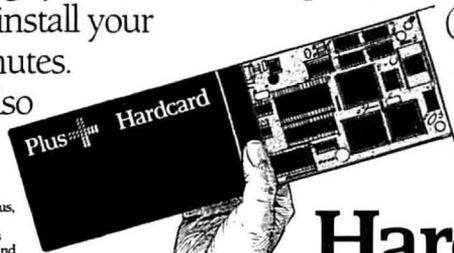
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C115



From the Software Shelf

PC World offers first impressions of recent software releases

This month: WordStar reborn, a PC paint program with a difference, and a bridge program with finesse

Edited by Robert Luhn

Polaris PrintMerge

On the day a sleek Hewlett-Packard LaserJet printer was uncrated at *PC World*, I was smiling on the outside but crying on the inside. I smiled because my technoid dreams had come true: Buck Rogers printing was finally at my beck and call. I would write—nay, craft—stunning memos that would make grown executives weep.

I knew that the LaserJet's proportionally spaced Times Roman typeface would, if nothing else, dramatically upgrade my credibility. We're all suckers for the typeset word, and I figured *PC World's* editors would mangle my splendid erudition a bit more respectfully.

But inside the tears still flowed. Why? Because the arrival of the LaserJet heralded the demise of my faithful *WordStar*. The near-typeset quality of the LaserJet's output is directed by strings of control characters prefaced by an escape code. Unfortunately, *WordStar* ignores any escape code found within a document (see "Dress Up Your Documents," *PCW*, September 1985). My overly patched copy of *WordStar* had met its maker.

But what of the thousands of *WordStar* users (legal and otherwise) who have spent years mastering this arcane program? How many billions of neural pathways have been dedicated to remembering the purpose of <Ctrl>-K N? Of course, some people switch effortlessly to new word processors. But at my age I want to save my few unclaimed pathways for learning Esperanto.

Luckily, you don't have to switch and fight. *Polaris PrintMerge* from Polaris Software is a nifty little utility that lets *WordStar* speak laser—perhaps not like a native, but well enough to use all the LaserJet's features, from proportionally spaced fonts and justified printing to superscripts and character graphics. *Polaris PrintMerge* circumvents escape code phobia by preempting *WordStar's* printing functions and redefining some control characters, extending some dot commands, and adding a few LaserJet-specific dot commands as well.

Under *Polaris PrintMerge's* aegis, for example, the control characters from Control P A to Control P H represent various LaserJet fonts, and the modified page-offset dot command .PO 10,15 directs the LaserJet to print alternating pages starting respectively at column 10 and at column 15. When it's time to print, you simply save the document, exit to DOS, and type PP filename. *Polaris PrintMerge* then asks a few questions, including the name of the font cartridge you wish to use. As it prints the document, the program sends the appropriate escape code sequence to the LaserJet.

Polaris PrintMerge also comes with a mail merge program that, among other things, permits *WordStar* to take advantage of the LaserJet's sideways fonts for printing envelopes. Neither utility slows the LaserJet's typically swift operation.

Of course, if you want to create long, complicated documents that require a number of font changes, I suggest you buckle down and burn

some new neural trails with a word processor designed with laser printers in mind. But if your documents aren't too demanding, check out *Polaris PrintMerge*. It proves the adage that old programs never die—they just gather new utilities.
—Ted Nace

Polaris PrintMerge

Polaris Software

310 Via Vera Cruz #205

San Marcos, CA 92069

619/471-0922

List price: copy protected \$99;

not copy protected \$124;

HP-150 version, not copy protected \$124

Requirements: 128K, DOS 2.00

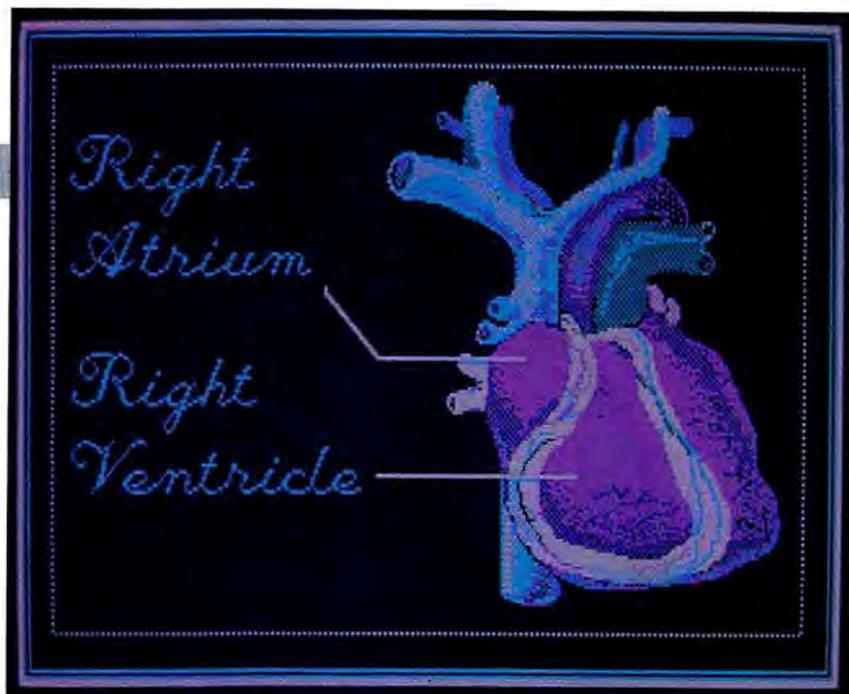
or later version, one disk drive,

Hewlett-Packard LaserJet

Printer

Digital Paintbrush System

Now that the novelty of PC painting programs has flaked off, it's hard to get excited about icons, pull-down menus, or mice. Yet not all painting programs generate ennui: *Digital Paintbrush System* from Jandel Scientific stands out from the crowd by taking a good idea, making it better, and concentrating on a specific audience—medical and engineering professionals with modest CAD (computer-aided design) needs. Jandel probably isn't expecting *Digital Paintbrush System* to be a runaway best-seller, but the program may



Screen 1: Heart by hand. This medical illustration was drawn and labeled in *Digital Paintbrush's* design mode.

Reprinted with permission of Jandel Scientific.

tap a bigger market than anticipated. For *Digital Paintbrush System* not only duplicates the painting and image-generation functions of *PC Paint* and captures and enhances other graphics à la *Graphix Partner*, it throws in some competent drafting tools as well.

Using a mouse with a paint program is akin to sketching with a block of wood—*Digital Paintbrush System* accepts input from an electronic stylus attached to the PC via a game control board (see photo). The stylus requires no special surface, although the program can only cope with an 8½- by 11-inch drawing area. (The company promises to expand this workspace in a future version.) An ink cartridge for the pen is also included so you can follow on paper what appears on screen.

Digital Paintbrush System software is divided into five modules: graphics design, measurement/estimate, graph/chart, presentation, and print. Each is accessible from the main menu, and data generated

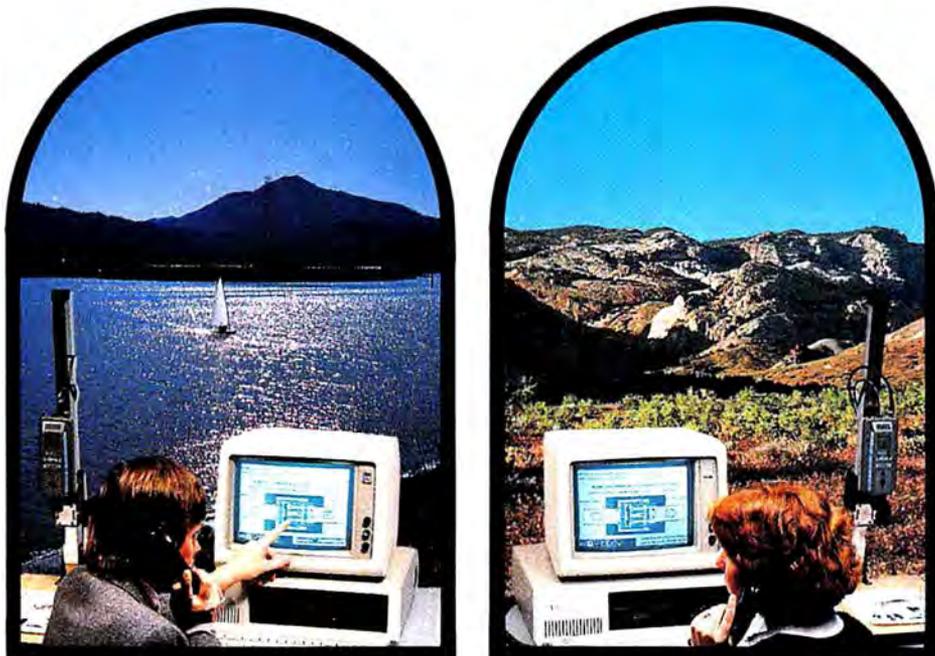
is interchangeable. You can make menu selections with the pen or from the keyboard.

The graphics design module is functionally reminiscent of *PC Paint* and *PC Paintbrush* (see "Icon Painting," *PCW*, June 1985). Painting tools (represented by icons), colors, patterns, and other program functions are selected from a vertical window on the right of the screen. As with other PC painting programs, you can draw freehand images, generate various geometrical figures, change patterns and colors, mold the shape and size of the brushstroke, select different background grids, and label images. A curve-fitting function allows you to plot a series of points, snake a line through them, and bend the line into any shape. It's a fast and flexible way to make subtle or major changes to an image (see Screen 1).

(continues)



An Interactive Digital Telecommunications System Sends Photos, Graphics, Text and Voice



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Easy to use PhotoMail is the system designed for organizations that must send complex information between offices or client facilities.

Applications abound in business, design and engineering, medicine, service and maintenance, insurance, security, access control, law enforcement, news and wire services.

PhotoMail is a complete hardware/software family of products that lets you send and receive pictures over ordinary phone lines to remote computers. Pictures of people, diagrams, text, houses, construction sites, property damage — anything you can capture with standard video equipment can be displayed and transmitted at resolutions up to 640 x 400 x 16 levels of gray. PhotoMail supports disk storage and hard copy printout and file conversion for "electronic mail" systems.

Simple to Use

1. Select a picture from disk file or capture it with a video camera.
2. Dial your party.
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Configure Your Own—You may already have some of the components . . .

	Component	PhotoMail Package	PhotoMail System	PhotoMail Workstation	Expansion Slots Used
REQUIRED	Computer (IBM PC, XT, AT)	User	User	•	—
	Monitor	User	•	•	—
	GA-1000 Graphics Adapter	•	•	•	1 Full
	PC-EYE Video Capture	•	•	•	1 Full
	PhotoMail Software	•	•	•	—
	Modem	User	•	•	•••
RECOMMENDED	Video Camera	User	•	•	—
	Pointing Device	•	•	•	1/2 Slot
	ScreenMaster	•	•	•	1/2 Slot
OPTIONAL	Camera Accessory Kit	User	•	•	—
	Expansion Chassis (8-Slot)	User	•	—	1 Full Slot in host for interface
	Printer	User	User	User	1 Slot for printer adapter

User - Supplied by user

• - Supplied with PhotoMail

••• - 1 full slot for plug-in board modem, 1/2 slot for external modems which connect to an asynchronous communications adapter board

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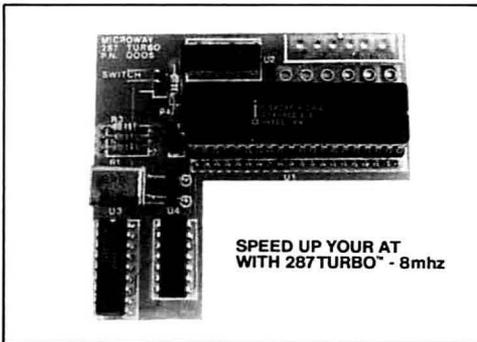
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For those who lack time or artistic flair, *Digital Paintbrush System* comes with a library of pictures—stock images, medical illustrations in the *Gray's Anatomy* vein, chemical and electrical symbols—that can be pasted onto any image. Once on screen, these pictures can be moved, reduced, enlarged, rotated, distorted, or inverted. The library also includes 23 text fonts.

The measurement/estimate module turns *Digital Paintbrush System* into an electronic planimeter. The screen is mostly reserved for drawing, with space set aside for a main menu window and a data window that displays on-line help and program prompts. (Both windows can be closed to liberate extra drawing

space.) Once you create an image—say, of a house—and define its scale, the program can automatically calculate and display the image's remaining dimensions, area, and x - y coordinates. In spite of these abundant features, program prompts at each step make the module easy to master.

However, generating a graph or chart with the program's graph/chart module is a fruitless endeavor. Instead of entering numbers and then creating a graph as you would with 1-2-3, you must manipulate a generic chart or graph supplied by the program. Once you confirm that a graph "looks right," the program calculates and displays the values. It's not the most efficient or accurate way of visualizing the health of your business.

Perhaps as a form of compensation, *Digital Paintbrush System* comes with Graph Grabber, a handy memory-resident utility that lifts graphs produced by other programs such as 1-2-3. Once captured from the PC's video buffer, these wayward images can be enhanced with the program's graphics tools. Another extra is the presentation module, which turns the PC into a slide projector. Saved images can be displayed in sequence automatically or manually.

Like any competent graphics package, *Digital Paintbrush System* supports a variety of black-and-white and color ink jet and dot matrix printers from over 50 vendors.

(continues)

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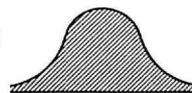
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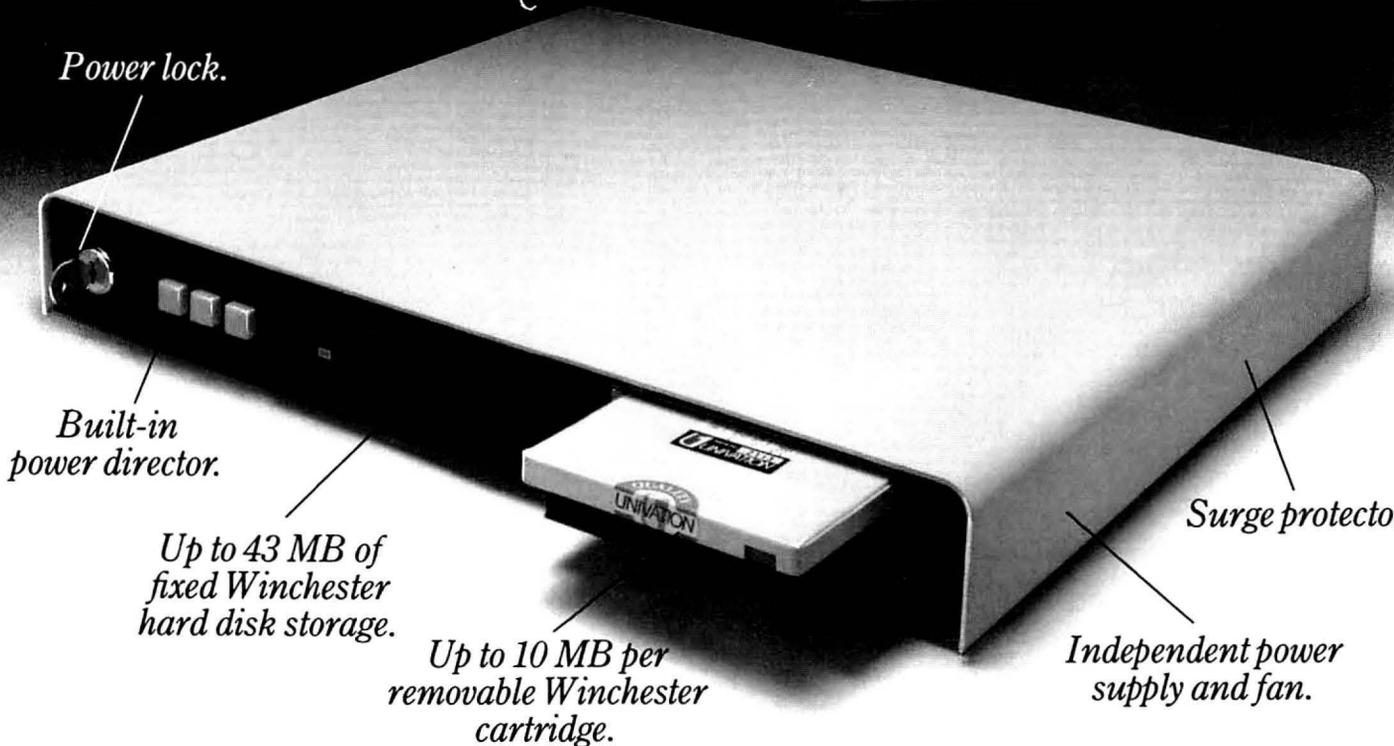


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Circle 661 on reader service card

Color plotters and laser printers have yet to join the roster—but Jandel is constantly expanding its list. Nestled unexpectedly within the program's print module lies the Stats menu, a source of statistical functions that can be applied to any image. The functions range from linear regressions and t-tests to nine mathematical transformations such as logarithms and square roots.

Digital Paintbrush System is a powerhouse low-end CAD system with a considerable range of sophisticated features. You can start using the system within half an hour, yet spend months discovering new capabilities. —Karen Dowell

Digital Paintbrush System
Jandel Scientific
2656 Bridgeway
Sausalito, CA 94965
415/331-3022
List price: \$450
Requirements: 256K, DOS 2.00 or later version, one disk drive, color graphics board, game control board, color monitor



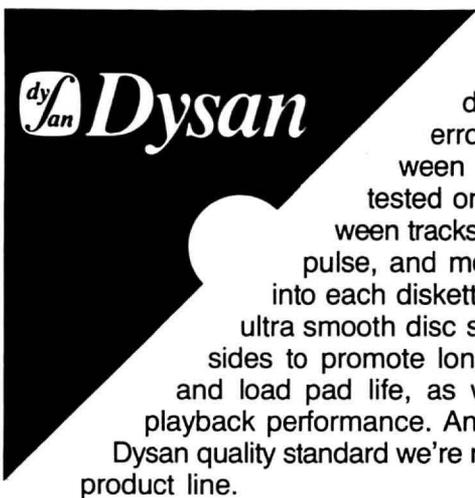
Bridge Parlor

In an unofficial but exhaustive poll, I found that inept bridge playing by one's spouse is a major cause of marital strife, narrowly beating out "won't let Snowball sleep in the bed" and "snores." The problem is

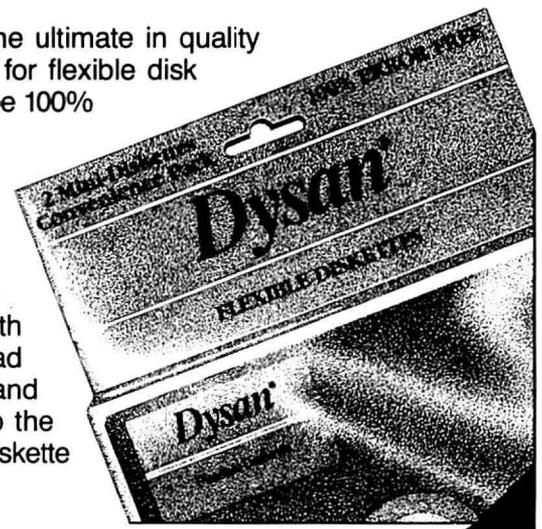
especially pronounced when a superior player has taught a blunderer. One visiting friend, infuriated by her husband's ill-advised finesse, snarled, flung her cards on the floor, and drove home without him. If you too know the exasperation of having your excellent advice routinely ignored or forgotten, consider giving your mate *Bridge Parlor*.

Bridge Parlor from Parlor Software is designed for beginning and intermediate players who need to polish their bridge-playing skills—although the program includes features, such as cue bidding and signals, for the advanced shuffler. The program's bidding system, based on Alfred Scheinwold's *Five Weeks to Winning Bridge*, corre-

(continues)



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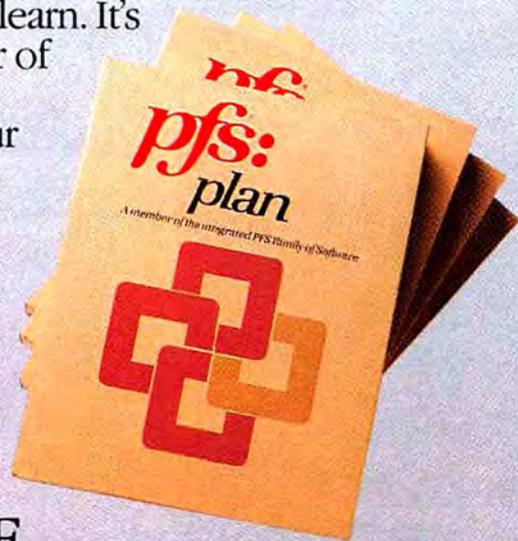
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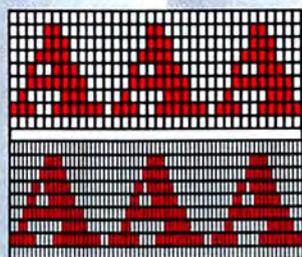
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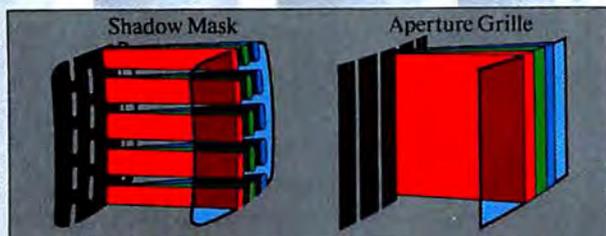
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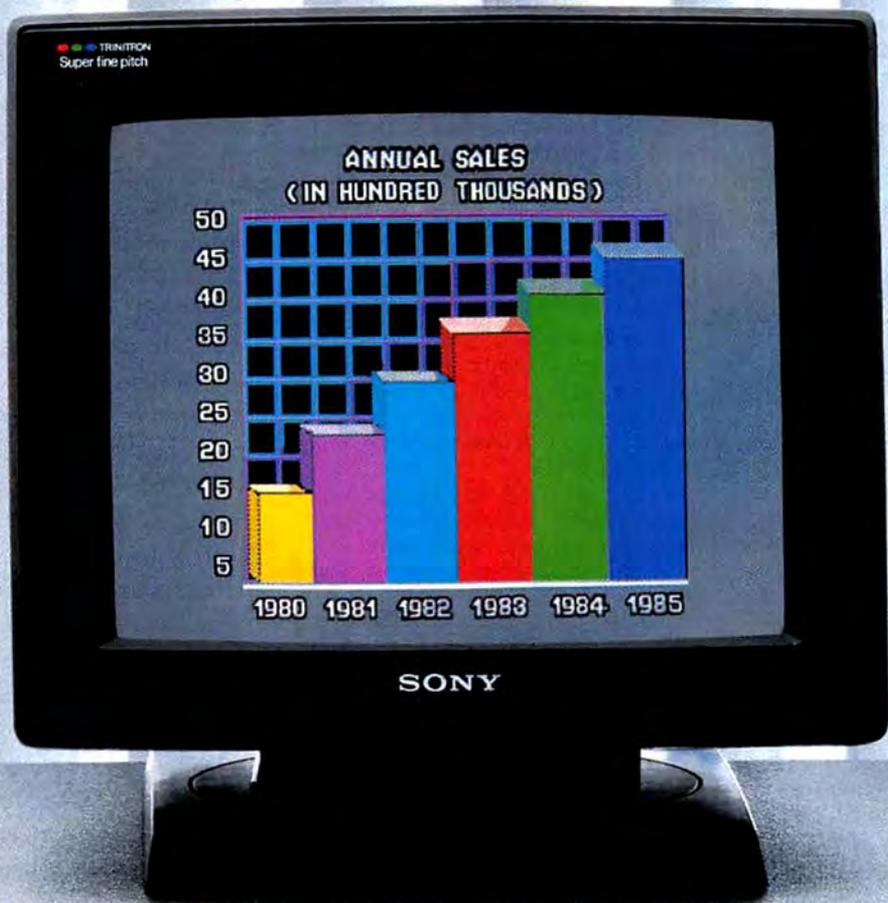
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sponds to the Goren/Standard American system most players are familiar with and follows the Blackwood, Gerber, and Stayman bidding conventions.

The program is packed with bidding, play, and scoring options. *Bridge Parlor* can generate a million different deals, or you can input your own—a useful way to review real-life games. *Bridge Parlor* shows only your hand, asks for your bid, and bids the other three hands. Bidding help is always available. In auto mode the program bids all four hands. Bidding history can be displayed at any time during the game.

The contract is displayed throughout play along with a count of each side's tricks. Cards played are shown center screen until you instruct *Bridge Parlor* to go on to the next trick. *Bridge Parlor* will suggest plays or merely flag those that it disagrees with, at which point you can try again, ask for help, or proceed stubbornly with your first choice. You have the option (also known as cheating) of viewing all four hands during play.

Having *Bridge Parlor* replay a hand is instructive—and at times comforting. Both *Bridge Parlor* and I went down one trick (namely, we lost) at six spades, proving that a contract can fail even when a hand is impeccably bid and played—something I've maintained for years. For those inclined to endlessly ruminate about lost opportunities, you can restart or cancel a hand at any time; review the last trick; practice offensive play, defensive play, or bidding only; and my favorite—play the strongest hand. Games are not stored, but you can print out a record of bids and play.

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(continues)

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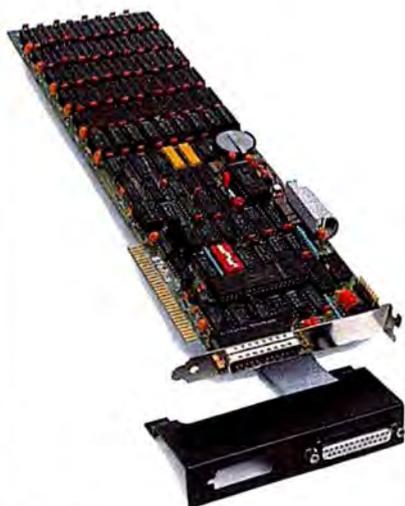


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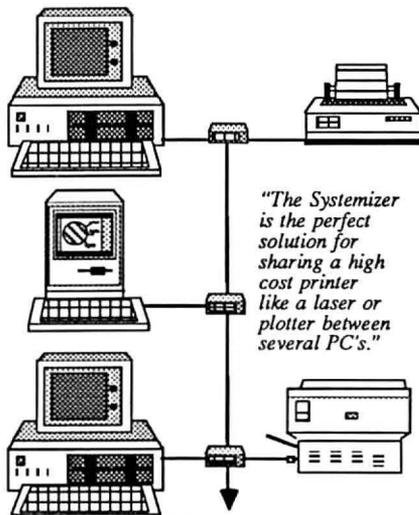
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"The Systemizer is all the network many PC users need."

Jim Seymour, PC Week

The Systemizer is indeed the best solution for sharing printers you'll find. That's a bold statement, so we suggest you get a copy of our article "The Wasted Buck Stops Here" and see if you don't agree.

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for the more experienced, a challenging opponent. The electronic sage often agreed with my plays, but it was far wiser in its choice of discards. I admired its foresight when it didn't automatically play low on a losing trick, cleverly unblocking dummy's diamonds in a no-trump contract and thus allowing the declarer to run the suit.

Unfortunately, in auto mode *Bridge Parlor* doesn't pause long enough between tricks. The only way to slow play down is to cancel auto mode after each trick, instruct the program to continue, then reactivate auto. My other complaint is the user manual. Program options controlled by the PC's function keys are explained clearly, but setting other options requires you to decipher three-letter codes displayed by the program. Thankfully, once you establish the desired configuration, it is saved to disk and used throughout the session. The configuration can be changed at any time during a hand.

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—Bonnie Monte

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Ted Nace is a personal publishing consultant and freelance writer based in Berkeley, California.

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THE MIRACLE ON PAGE 131A



On the First Day, Xanaro said to their technical writer: Let there be a demo for 500,000 *PC World* readers to see.



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From the Hardware Shelf

PC World offers first impressions of recent hardware releases

This month we answer these vital questions: Can Epson compete in the near letter quality sweepstakes? Is the FX-100 reborn? Will price-slasher Mannesmann Tally steal Epson's customers? Are faster modems better? Read on.

Edited by Robert Luhn

Epson LQ-1500

My trusty, squat Epson RX-80 dot matrix printer is like an old friend. Day in and day out, it works by my side without complaint or trips to the local computer internist.

Although I'm loyal to this old trouper, I sometimes have lustful thoughts about letter quality printers. When it's time to churn out a résumé or mail-merge professional-looking billets-doux, a letter quality printer is a must. So when *PC World* asked me to review the Epson LQ-1500, which offers both dot matrix and near letter quality (NLQ) modes, I jumped at the chance to be a printer bigamist for a few days.

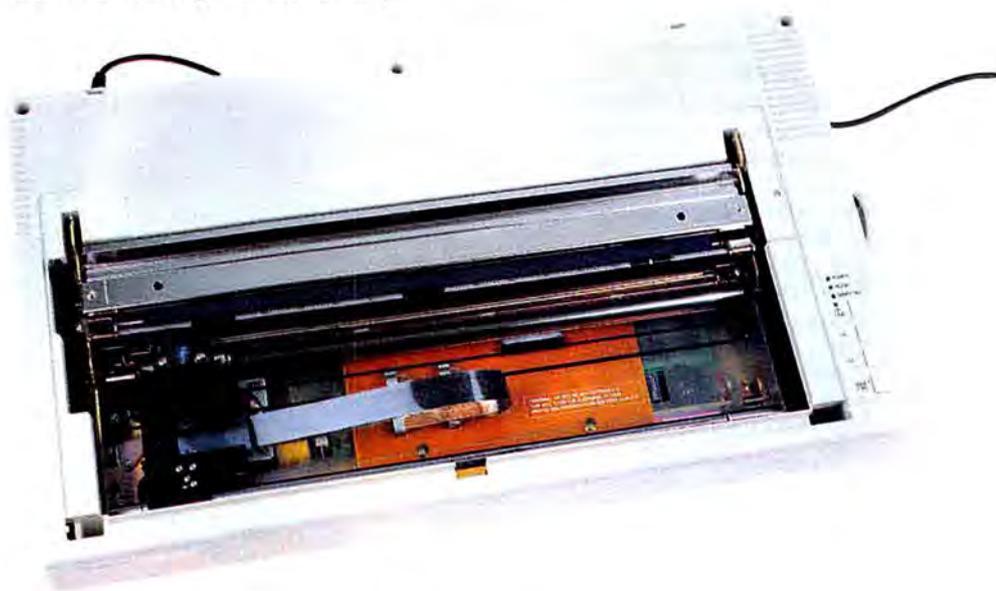
At first look, Epson had a great idea: Take the major features from its FX series—speed, ruggedness, graphics output, and a wide variety of print enhancements—throw in a 24-pin printhead capable of NLQ printing, and pack it all into a 14-inch-wide carriage. Unfortunately,

the printer doesn't always measure up to Epson's original concept—or its current price tag.

The LQ-1500 does a consistent job with some NLQ characters, such as *l*, *t*, *l*, and *N*, but the density of rounded characters is uneven. Os, for example, are often striated. Such characters look fuzzy, lacking the crisp edge you naturally expect from a true letter quality device.

But the LQ-1500 does not lack printing *savoir-faire*. You have a choice of compressed, emphasized, expanded, italic, double-strike, and underlined styles. In both NLQ and draft modes, these six styles, plus superscripts and subscripts, can be used singly or in combination within a document. Other options include proportional spacing (in NLQ mode) and regular and expanded pica and elite type sizes in both modes. Like other Epson printers, the LQ-1500 prints 11 different international character sets

(continues)



Too much, too late? Epson's LQ-1500 features fewer parts and near letter quality printing for a hefty \$1295.

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and has a 2K buffer that can store specially designed character sets. In the graphics realm, the LQ-1500 is on a par with its RX and FX siblings. Black-and-white images are sharp. However, don't expect the LQ-1500 to translate color images into distinct shades of gray.

The LQ-1500 is designed to keep up with the brutal pace of the modern office. Drafts roll out of the printer at 200 cps; NLQ documents, at a respectable 67 cps. Internally, the LQ-1500 is strikingly

different from previous Epson printers. It has fewer moving parts; areas sensitive to dust and hair—such as internal DIP switches and assorted circuitry—are shielded. Externally, the printer is sensible if not chic. The sleek cream-colored shell is made of tough, resilient plastic; DIP switches that set draft or NLQ printing modes are mounted at the back. The LQ-1500 will likely maintain Epson's reputation for low-maintenance machines.

Installing the printer is a matter of sliding a parallel or serial board into the unit and connecting it to its counterpart in the PC. The

printer accepts 14.3-inch-wide single sheets, tractor-fed paper ranging from 4 to 16 inches wide, and four-part carbonless paper. Along with the familiar on-line, form feed, and line feed functions, Epson has thrown in a sheet-load feature that automatically opens the paper bail and loads a piece of paper.

There are some caveats to consider before buying. Unlike the cheaper Mannesmann Tally MT86 (see the following review), the LQ-1500 does not give you access to print modes and styles via the

(continues)

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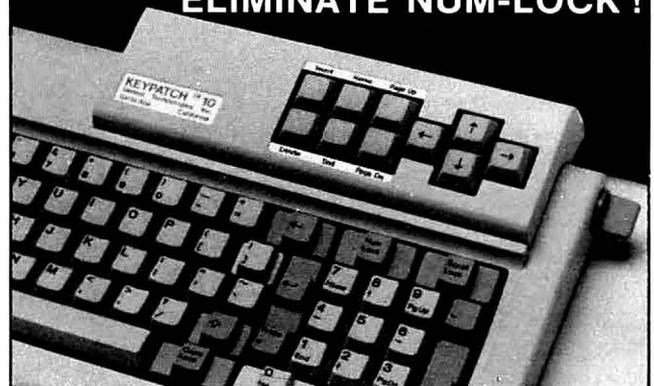


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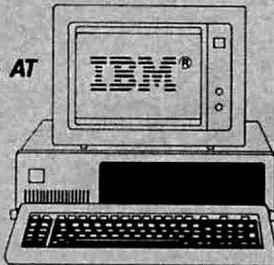
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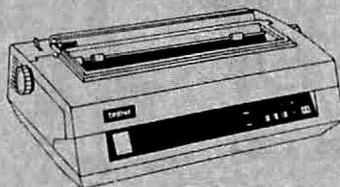
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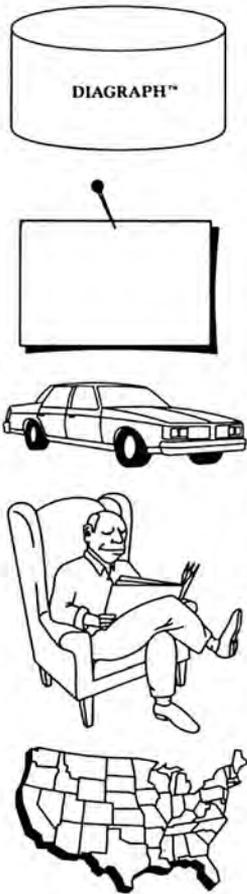


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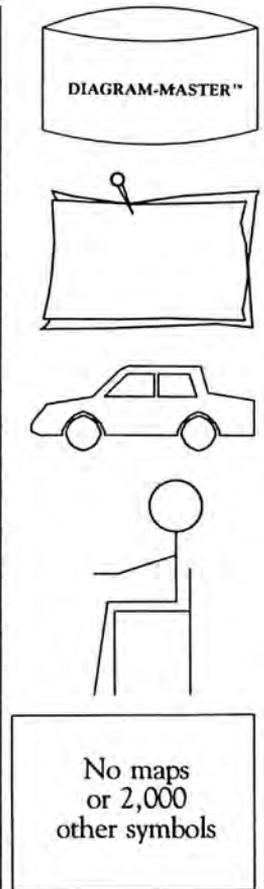
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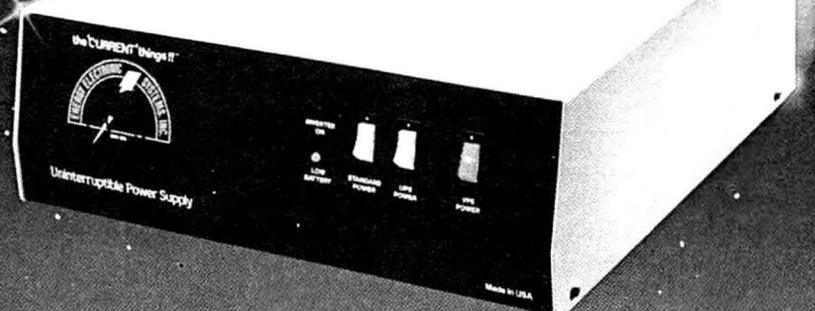
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control panel. Diagnostic indicators are also rather crude: The printer merely informs you that the power is on, the printer is on line and ready, and the paper is positioned correctly. The unit's flimsy plastic sheet-feed guide will probably be the first component you will have to replace.

The LQ-1500 has a bundle of features to recommend it—but not for \$1295. Printers at half the price offer superior NLQ printing and other time-saving features. If the quality of your company's presentations—letters, proposals, and so on—is crucial, think twice before you lay down the money for the LQ-1500. For a few hundred dollars more, you can buy both an inexpensive dot matrix graphics printer and a true letter quality printer—or at least an NLQ printer with the talent to pull off the masquerade. —Katie Seger

LQ-1500

Epson America, Inc.
3415 Kashiwa St.
Torrance, CA 90505
213/539-9140

List price: \$1295

Requirements: serial or parallel board

Mannesmann Tally MT86

The older I get, the more fashion-conscious I become. In the late 1960s, crinoline was my catnip and I gleefully thumbed my nose at the passing Pucci parade. But today, wearing yesterday's duds is a prescription for social and—dare I say?—financial disaster.

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Mannesmann Tally must have had my dilemma in mind, for the company recently revamped its entire printer line in an attempt to knock Epson on its keister. By my reckoning, it may do just that with the MT86, a thoughtfully designed, inexpensive dot matrix printer with an impressive array of modern features.

(continues)



No more DIP switches: Tally's MT86 allows you to select fonts and printing styles from the control panel.

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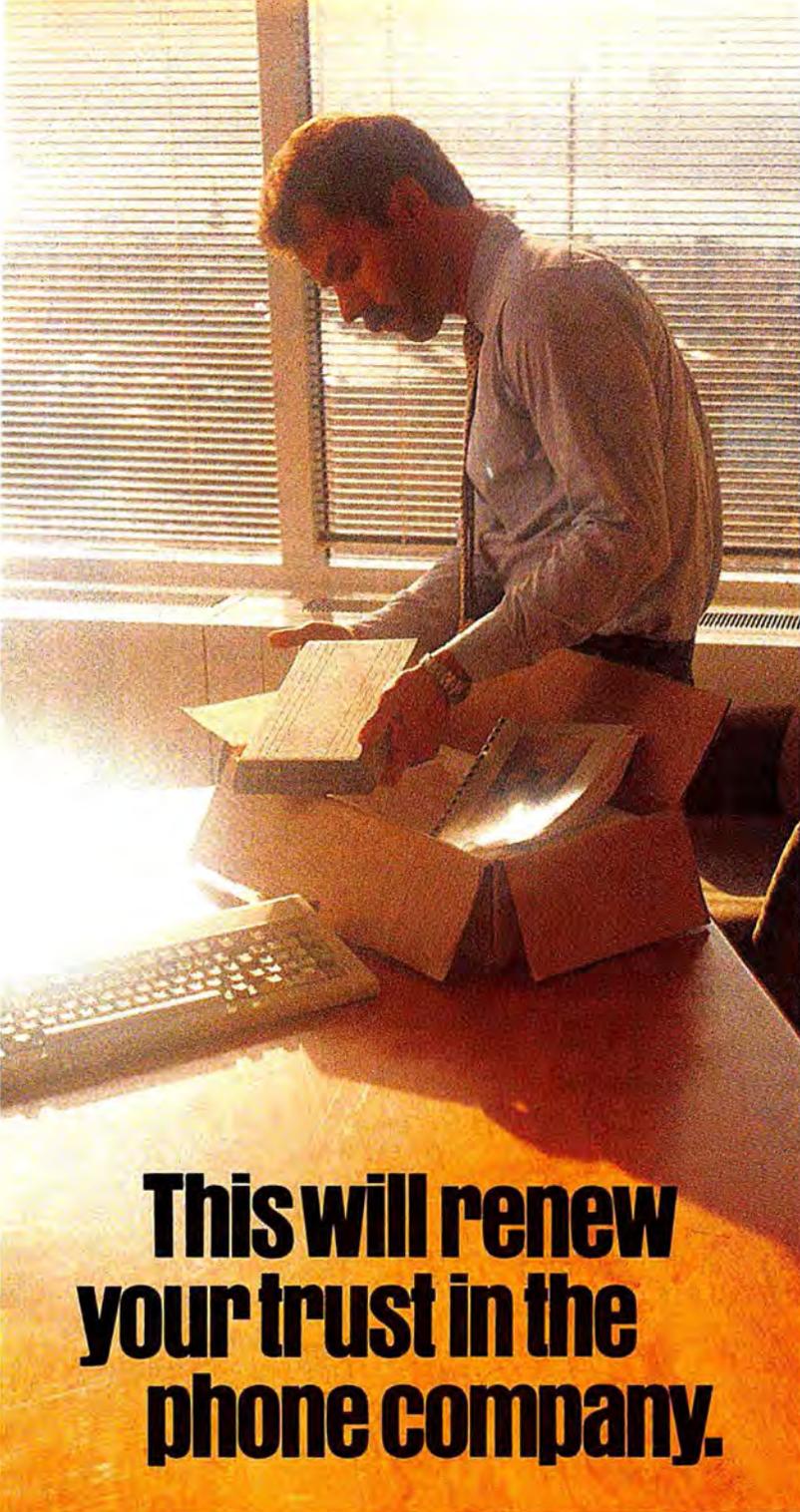
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 **MOTOROLA**

The MT86's 9-pin printhead pounds out drafts, graphics, and NLQ printouts with equal aplomb. At 180 cps, draft mode is perfect for budget reports, corporate forms, and spreadsheets. It even produces acceptable graphics. At 90 cps, enhanced mode generates denser, more readable characters. In NLQ mode, the MT86 pecks along at 45 cps, but the output is nearly indistinguishable from a \$1200 daisy wheel printer's. In short, few printers on the market do more and do it better, for less.

Like any dot matrix printer worth its pins, the MT86 fully emulates the Epson FX series and IBM Graphics printers. Both draft and NLQ modes use a standard Quadrata sans serif typeface; an italic version is available in the Epson mode. Printing styles include condensed, enlarged, enhanced, and double or single strike in elite and pica type sizes. Unlike its inexpensive contemporaries, the MT86 also uses font cartridges to provide Courier, Letter Gothic, and Script Italic fonts for NLQ printing. Each 96-character font can be sub- or superscripted; 5 to 17 characters per inch (cpi) proportional spacing is also supported. The MT86's 3K print buffer can also store two downloadable character sets in Epson mode.

Changing DIP switch settings to select print modes, styles, and fonts is accomplished solely with the four

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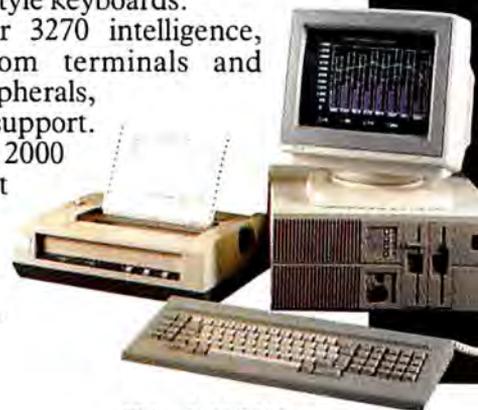
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buttons on the printer's control panel. Experiment until you arrive at the combination of settings that fit your needs. For example, I generate large 1-2-3 spreadsheets daily for managing the flow of *PC World* editorial copy, so I set one switch for the moderately fast enhanced print mode, another to print all zeroes with a slash, and a third for compressed printing. My only complaint is a minor one. The printer cover, which acts as a sound baffle, is not latched to the printer. Lifting the hood to advance the paper wrenches the cover off. A quiet printer is an emotional salve, but I'm not sure it's worth the nuisance. I have since stored the cover in my closet.

I used to rely on two printers—a dot matrix for printing 132-column spreadsheets and a letter quality for issuing letters—to get my work done. With the MT86, I've saved time, space, and some peace of mind. Value and innovation are never out of fashion. —Cindy Hamburger

MT86
Mannesmann Tally Corp.
8301 S. 180th St.
Kent, WA 98031
206/251-5500
List price: \$599, font cartridges
\$34.95 each
Requirements: serial or parallel
port

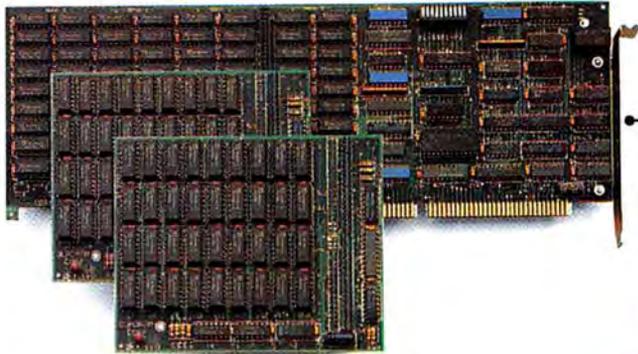
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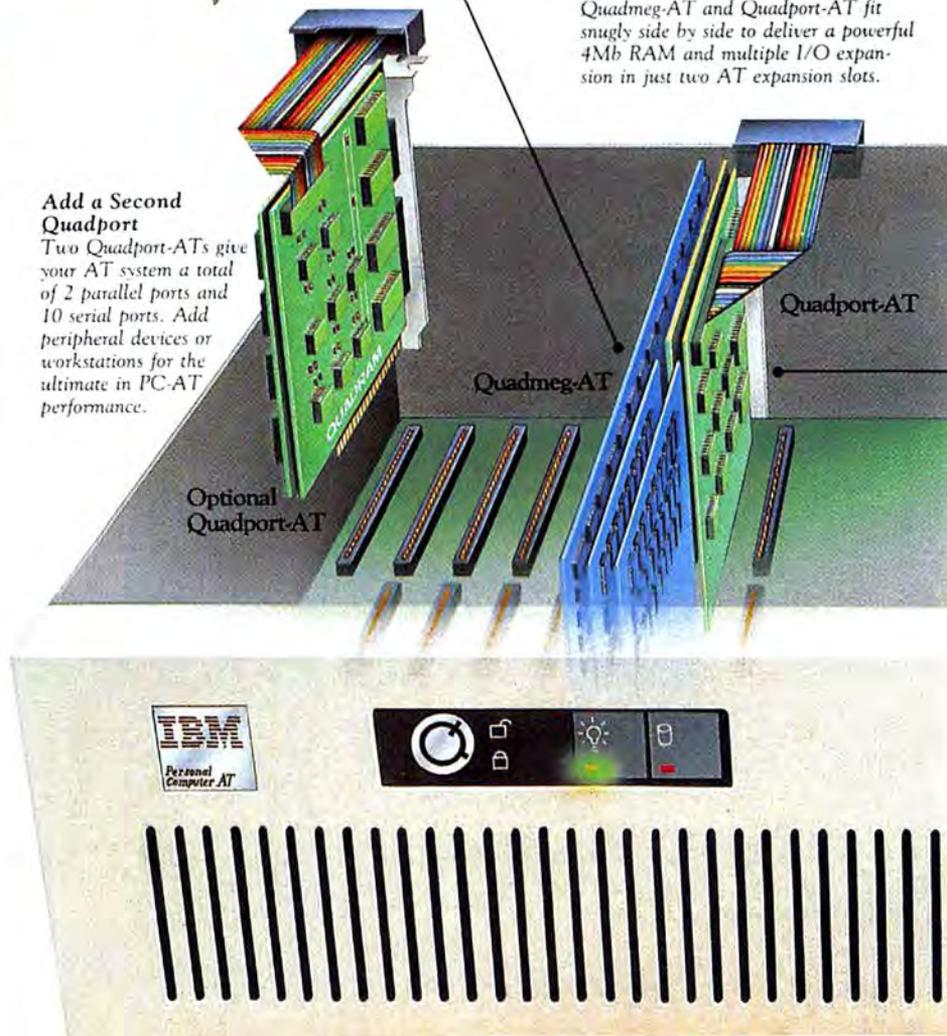
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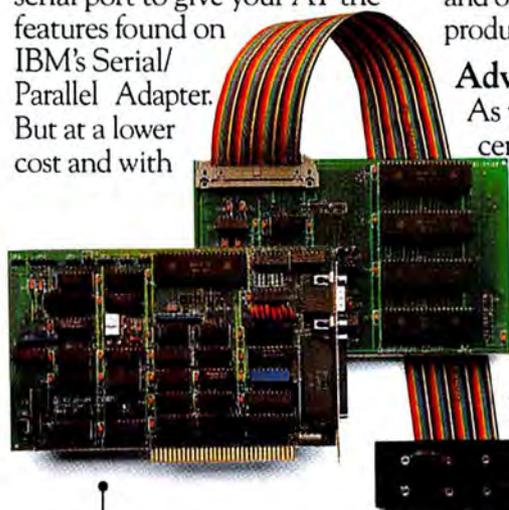
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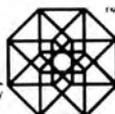
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Epson FX-185

Were it not for the label on the front, it would be hard to distinguish the Epson FX-185 dot matrix printer from its popular predecessor, the FX-100. The FX-185 matches the older model's draft printing speed (160 cps) and graphics output, features a similar 9-pin printhead, and even uses the same ribbons.

Closer examination reveals some notable differences. The FX-185 offers NLQ printing and access to printing enhancements from the control panel. But like the



Figure 1: Sample FX-185 print modes

LQ-1500, the FX-185's aspirations are only partly realized. The density of its two NLQ fonts (Roman and IBM) is uneven, and a cursory glance discloses the bricklike construction of printed characters that

results in wozy resolution. Quality improves in the enhanced mode; expanded, subscript, and superscript NLQ output are also more attractive (see Figure 1).

Printer operations have been greatly simplified. From the control

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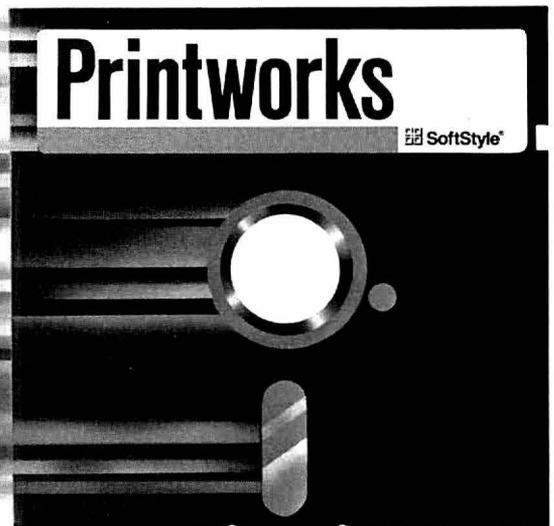
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panel you can quickly switch from draft to NLQ mode by tapping a few paper-feed buttons. Pica and elite type sizes, plus condensed, enhanced, italic, and other styles are similarly selected. This approach should be popular with those who would rather not wrangle with the mysteries of BASIC and escape codes just to operate their printers. For more adventuresome users, the printer can be controlled via software.

Epson has also corrected some past shortcomings in the FX line. The FX-185 features an expanded

8K print buffer that is always available, even when using as many as 200 downloadable characters.

The company has made some curious choices—particularly for a machine designed ostensibly with business users in mind. The unit emulates the IBM character set but fails to provide elite, condensed, proportional, and italic characters in the NLQ mode. Unfortunately, custom character sets cannot be created for NLQ printing—a crippling limitation given the printer's other blind spots. Anyone anxious to produce professional-looking business reports, academic studies,

and other complex documents may dismiss the printer based on these shortcomings.

Epson also claims the FX-185 prints 160 cps in draft mode and 32 cps in NLQ mode; however, in real use, performance is often slower. For example, a single-spaced, 600-word letter (about 3900 characters) requires 37 seconds to print in draft mode and 3½ minutes in NLQ mode—roughly 106 cps and 19 cps respectively. This is adequate but hardly stunning performance.

Epson's user manual is well written and amply illustrated. The volume includes BASIC listings that turn the complicated exercise of

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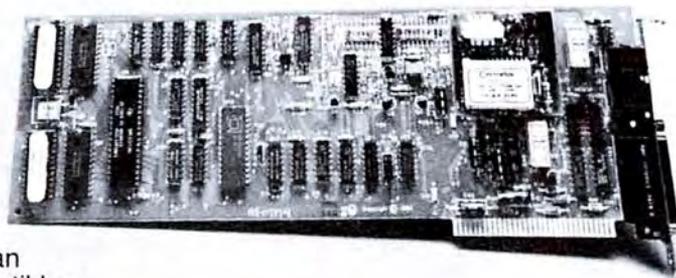
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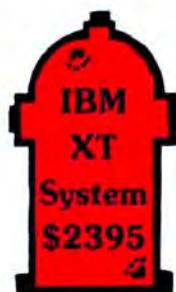
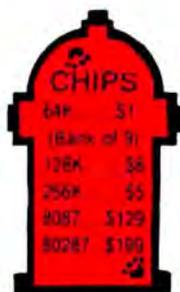
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downloading fonts into a prompt-driven process. Other listings streamline creation of characters and images. Like most of Epson's larger printers, the FX-185 uses both single sheets and tractor-fed paper. The tractor is removable; an optional sheet feeder is also available.

In the final analysis, the FX-185 appears to be neither fish nor fowl. As a workhorse dot matrix printer, it's somewhat overpriced; as an NLQ printer, it flies in the face of conventional market wisdom, which dictates that NLQ printers rely on printheads with 18 or 24 pins—not 9. If you're interested in replacing your current printer, you

may not want to jump on the Epson bandwagon. But if you're a current FX-100 owner, take note: Epson offers a \$100 upgrade kit (plus installation) that turns that discontinued unit into an NLQ printer, complete with an 8K buffer. Now that's a deal. —Ross A. Smith

*FX-185
Epson America, Inc.
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Requirements: parallel board*

UPTA 96

I don't believe in the tooth fairy, so when I saw a 9600-bits-per-second (bps) asynchronous modem advertised in a computer magazine for just \$895, I chuckled and flipped to the next page. But a nagging question kept playing ping-pong in my head: How much have I spent in the last year transmitting files between my office in New York and my clients in California? My muse dragged me back to the ad and compelled me to order two UPTA 96 modems from Electronic Vaults.

(continues)

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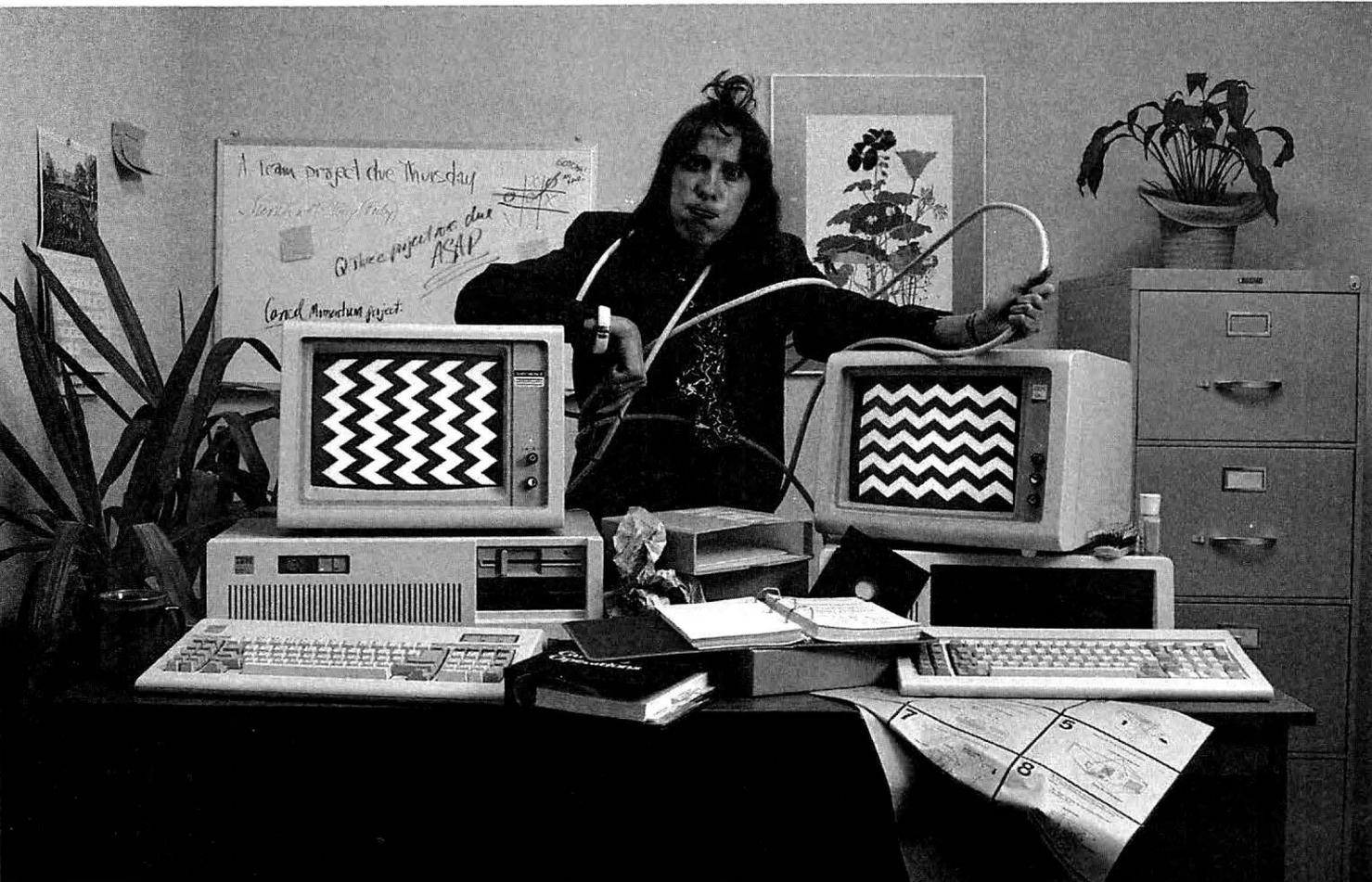
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My next long distance bill was surprisingly slim and my wallet correspondingly fatter. Tooth fairy, please forgive me.

The UPTA 96 is a half-duplex modem that comes in both internal and external versions. Since neither model includes a speaker, I found the external UPTA 96 with its Hayes-like LEDs easier to use. The UPTA 96 is compatible with most Hayes commands and communications software, such as *Crosstalk XVI* and *PC-Talk III*. Electronic Vaults utilizes some proprietary codes that let you switch the modem to 4800-, 7200-, and 9600-bps modes.

Be forewarned that trailblazers face certain obstacles. The UPTA 96 does not support 2400-bps and 1200-bps communications. Since hardware and software standards for 9600-bps communications have yet to emerge, the UPTA 96 also cannot work with other 9600-bps modems. These incompatibilities are not likely to change in the near future, so if you buy an UPTA 96 (or any 9600-bps device), hang on to your old modem.

But another question begs to be answered: Can a 9600-bps device work efficiently over public phone lines? In this case the answer is yes—because Electronic Vaults' proprietary 16-bit CRC (cyclic redundancy check) protocol ensures that data is transmitted error-free. I've

sent many megabytes of binary data between California and New York with the UPTA 96 without encountering a single data error.

Of course, error-checking schemes lower any modem's effective data transfer rate. A cross-country, UPTA-to-UPTA file transfer usually ranges between 6500 and 7000 bps. On one occasion, I even sent files from a cabin high in the Sierra Nevada mountains. Although the phone line was excessively noisy, the UPTA 96 averaged 5300 bps. Keep in mind that the UPTA always transmits at a set speed, such as 9600 bps, in spite of line noise. If errors are encountered, data is simply retransmitted.

(continues)



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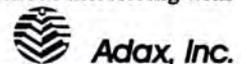
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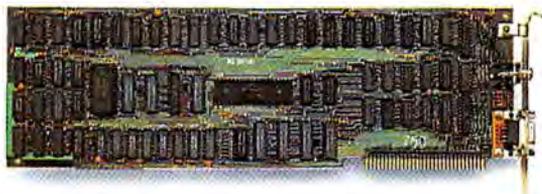
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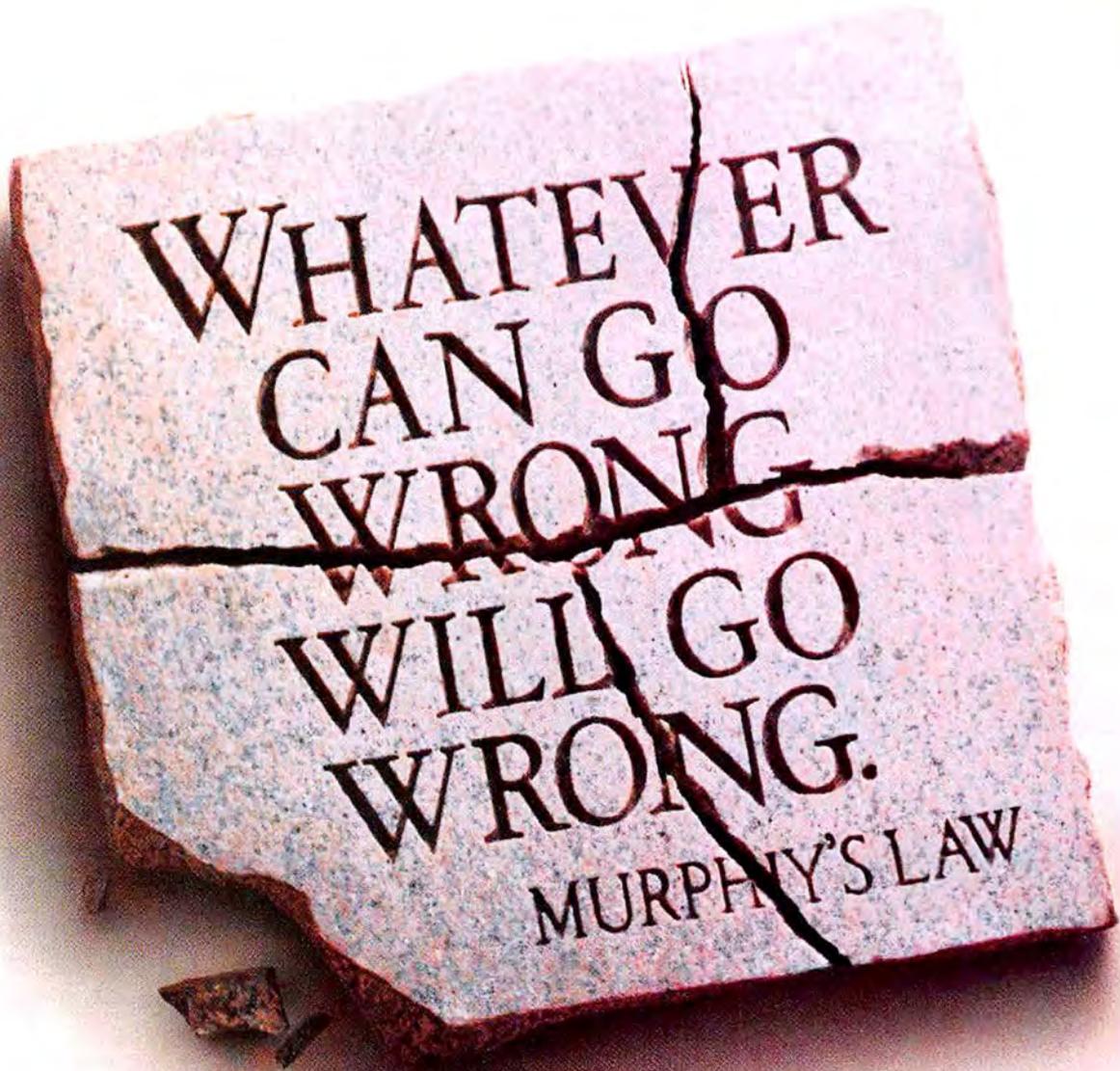
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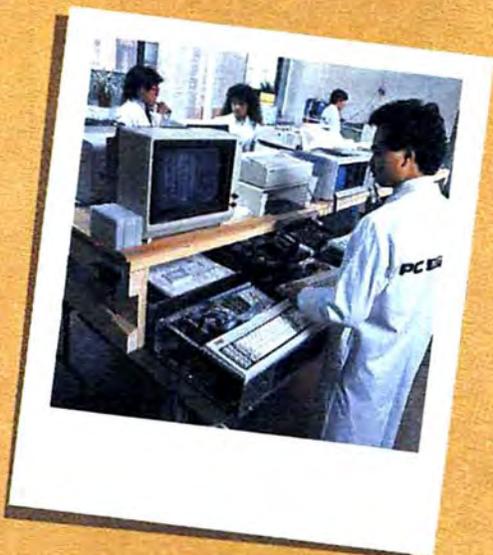
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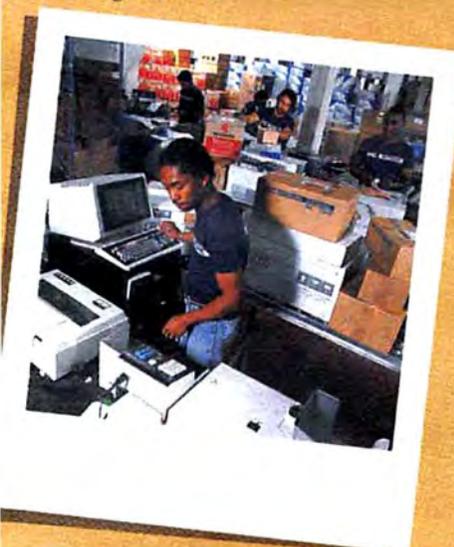
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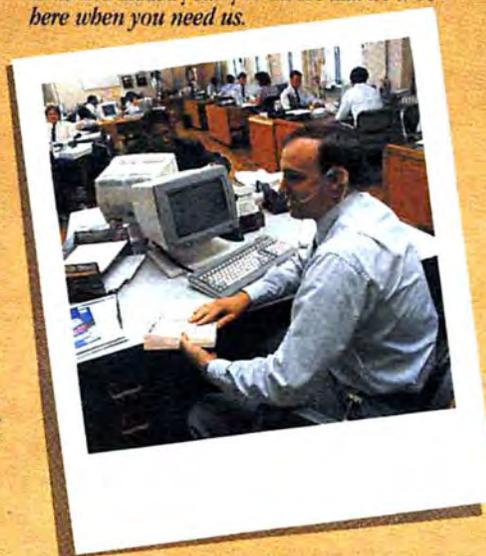


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Why, our ad manager asks, do we always go through a last minute price update frenzy, just seconds before our ad is due at the publisher, when we know that despite our heroic effort, ***many of these products will cost even less by the time you read this ad.***

How, she asks, can we get a crystal ball to forecast what fantastic promotions and specials our suppliers are going to offer from now to the date ***this ad gets to the newsstand over two months from today?***

Well, we decided that she has a good point. While we'll still keep getting our grey hairs and ulcers from last minute revisions, we will start publishing this notice and ask our readers to make a simple check. Look at any four back issues of this magazine (*yes we're in every one*) and track the prices on the most popular products. ***You will see that many drop with every issue.*** Most of these price changes were instituted well before the issue was printed and ***our members always pay the lower price.*** This should prove that this notice is much more than hype.

Given the current madness in the PC industry with its spur of the moment pricing and instant product introductions, ***you will find it always pays to call for our latest prices.*** You will be glad you did.



BUSINESS REPLY CARD

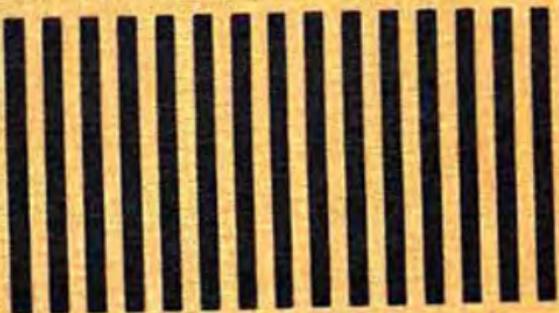
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PC NETWORK GOES TO THE

ORIENT DIRECT

How do you suppose most manufacturers of personal computer products get started?

They go to the Orient... taking either their designs or simply their ideas to one or more of the major electronics manufacturing concerns, getting bids for making these devices under contract to the creators. Multifunction Cards, Video Cards, Disk Controllers, Modems and I/O Boards all begin their life in this way.

This relationship between the manufacturing capabilities of the East and the design and marketing talents of the U.S. has resulted in the incredible selection of enhancement products for the IBM and Apple computer markets.

Well, with 100,000 members and growing strong, The Network sent its buyers east to visit some of these manufacturing

concerns to check out the feasibility of directly importing these products in the necessary volumes to *save our members money!* What they came back with was astounding.

Now, we always figured that there were some pretty substantial markups as these boards came into the country and got fancy boxes and marketing promotions under any one of a number of well known brand names in the peripheral add-on markets *but we had no idea they were so large!*

To prove our point, consider what they brought back. Each board is constructed to the same precise specifications, on exactly the same machinery as their name-brand duplicates. The difference? *As a Network member, you pay only 8% over our unusually low wholesale price... and you get our full 1 year warranty!*

Hercules' Smarter Brother

A Monochrome Graphics Card with Printer Port... 100% compatible with Hercules product...



Wholesale price...
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Graphics Printer Interface

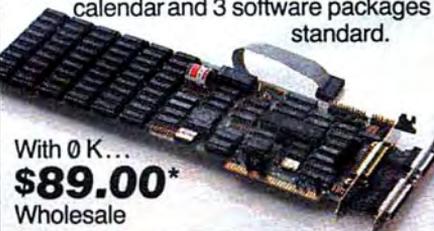
If all you want is a printer, this is the card for you. Supports all text and graphics printer features.

Wholesale price... **\$29.00***



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PC NETWORK

GET THE NETWORK ADVANTAGE!!!

A more efficient approach is to slow the transmission rate and thus reduce the errors. Electronic Vaults promises that a future release will detect noisy phone lines and automatically reduce the transmission rate until line conditions improve.

Though the UPTA 96 is a half-duplex modem, its clever bisynclike protocol allows it to simulate full-duplex operations. The UPTA 96 manages this feat by exchanging data in small packets and constantly "handshaking" with the other modem. The only problem I encountered was an occasional 4-second pause between transmitting characters and receiving the remote terminal's echo. If you use a full-screen editor or similar application

requiring immediate feedback, the UPTA 96 can be maddeningly slow.

The UPTA 96 is clearly not for everyone, but if you need to transfer large amounts of data, the savings can be significant. On a typical evening, I might transmit a 2.5MB graphics file to California. A 2400-bps modem using CRC takes 3½ hours; the UPTA 96, a little over an hour. The long distance savings for this session alone would be \$30—the UPTA can soon pay its own way.

If Electronic Vaults gives the UPTA 96 a speaker, 1200/2400-bps compatibility, and automatic speed fallback, it would be the ideal modem at the ideal price. Tooth fairy, are you listening? —David McCune

UPTA 96

*Electronic Vaults, Inc.
12347-E Sunrise Valley Dr.
Reston, VA 22091
703/620-3900*

*List price: internal \$895,
external \$995*

*Requirements: RS-232C port for
external modem*

Katie Seger is a San Francisco Bay Area freelance and technical writer specializing in computer topics. Ross A. Smith, a former IBM system engineer, is a private consultant based in Santa Rosa, California. David McCune is president of the Proteus Group, a consulting firm in Brooklyn, New York. ●

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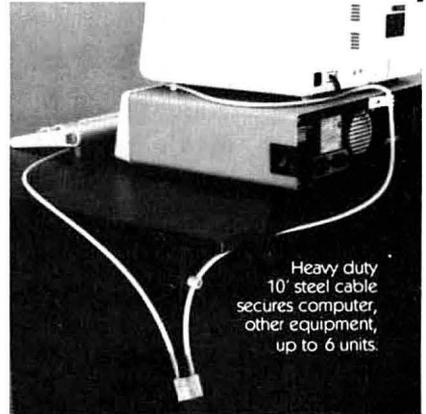
TERMS: Minimum 20 disks or \$35⁰⁰ — VISA or MasterCard accepted C.O.D. orders add 2% for special handling. **SHIPPING:** 3½" & 5¼" Diskettes: Add 3% for every 100 Diskettes or any fraction thereof. 8" Diskettes: Add 4% for every 100 Diskettes or any fraction thereof. We ship UPS; orders requiring other delivery methods add shipping, plus 2% of total order.

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Baseline schedules. Save them to compare with current schedules for schedule tracking. Actual, original plan, and current plan costs can be graphically compared for cost tracking.

Comprehensive report generator.

Simplify communications with management by synthesizing project information into presentation-quality hardcopy reports and graphs.

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The Project Scheduler Network provides the most advanced software technology available. Start with our mouse-controlled menus to select spreadsheet-style input templates to enter your project data.

Graphically build your dependency Network with only a "click of a button." Zoom to view the Network at selectable resolution levels. Now use the mouse to edit the Network to your satisfaction.

Select a Gantt chart and obtain schedules at any WBS level with a single click. Window resource graphs with the schedule to analyze resource allocations. And finally, select our integrated graphics to view color histograms, bar charts, and line plots of project resources and costs.

FEATURES

- Critical Path Method
- Network Analysis
- Gantt Chart
- Work Breakdown Structure (subtasks)
- Multiple Project Integration
- Tracking with Baseline Schedule and Complete Status
- Resource Scheduling
- Financial Planning and Tracking
- Presentation-quality Graphics

REQUIREMENTS

- IBM® PC, XT, or AT
- PC-DOS 2.0, 2.1, or 3.0
- Monitor plus IBM graphics adaptor
- IBM or Epson graphics printer
- 320K RAM (minimum)
- Mouse (Microsoft compatible)
- Two disk drives (one double-sided)
- IBM or HP plotter optional

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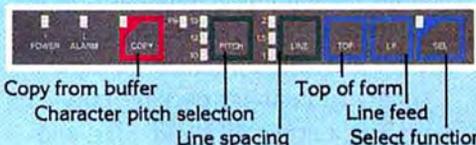
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Circle 106 on reader service card



The telecompaq—Compaq's early entry in the fledgling telecomputer marketplace

Also swimming with the bigger fish is Compaq, whose recent release of the Telecompaq line from its Dallas-based subsidiary may confer some needed credibility on the IVDT market. The Telecompaq is essentially an ungainly 8086-based Deskpro with a third floppy disk drive, a telephone, a modem, and a Z80 coprocessor. The Telecompaq is just as compatible as the Deskpro and also comes with homegrown communications software, including TTY, VT 100, and 3278 terminal emulation; a phone directory; and electronic mail. The third disk drive is dedicated strictly to a personal productivity package containing a notepad, a calendar, and assorted desktop management functions.

The Telecompaq requires two phone lines, one for voice, the other for data; the built-in 300/1200-bps Hayes modem controls the data line. Thanks to the

Z80 coprocessor, communications tasks can run in the background, enabling users to pop in and out of an application at the touch of a key.

"We're aiming the product at managers and executives within medium-size and large organizations—people who are always interrupted," says Compaq spokeswoman Gaynel Richie. "These are often people who've never used a computer before. The added efficiency is immeasurable."

While Rolm's Cedar demands the presence of a Rolm PBX, the Telecompaq operates with or without a variety of telephone switching computers. On release day, Compaq announced several agreements to develop PBX boards with PBX manufacturers, among them AT&T and Northern Telecom.

PBX makers are also in on the product's distribution—to the exclusion of retail dealers. PacTel Info Systems and Mitel were among the first to sign up. "The real difference with the Telecompaq," says Kevin Ellington, senior vice president of Compaq, "is that we're approaching that market

from the telecommunications end. The channels of distribution have not really matured. PBX companies can't sell computers, and computer stores can't sell switches. But at some point in time that's going to happen, and we'd like to be there."

Ellington is a proponent of patience and persistence, venerable values at Compaq. "If people are claiming that they'll sell 100,000 [IVDTs], I'd be skeptical," he says. "That's about the size of the total market. We don't have plans to conquer the world with the Telecompaq—but we believe we're getting in very early on what will be a strong, high-growth market."

—Ken Greenberg

*Telecompaq
Compaq Telecommunications
Corp.
15182 Marsh Ln.
Dallas, TX 75244
214/484-4200
List price: \$4195 for TC-2500-A
model with 384K, three disk
drives*

Networks

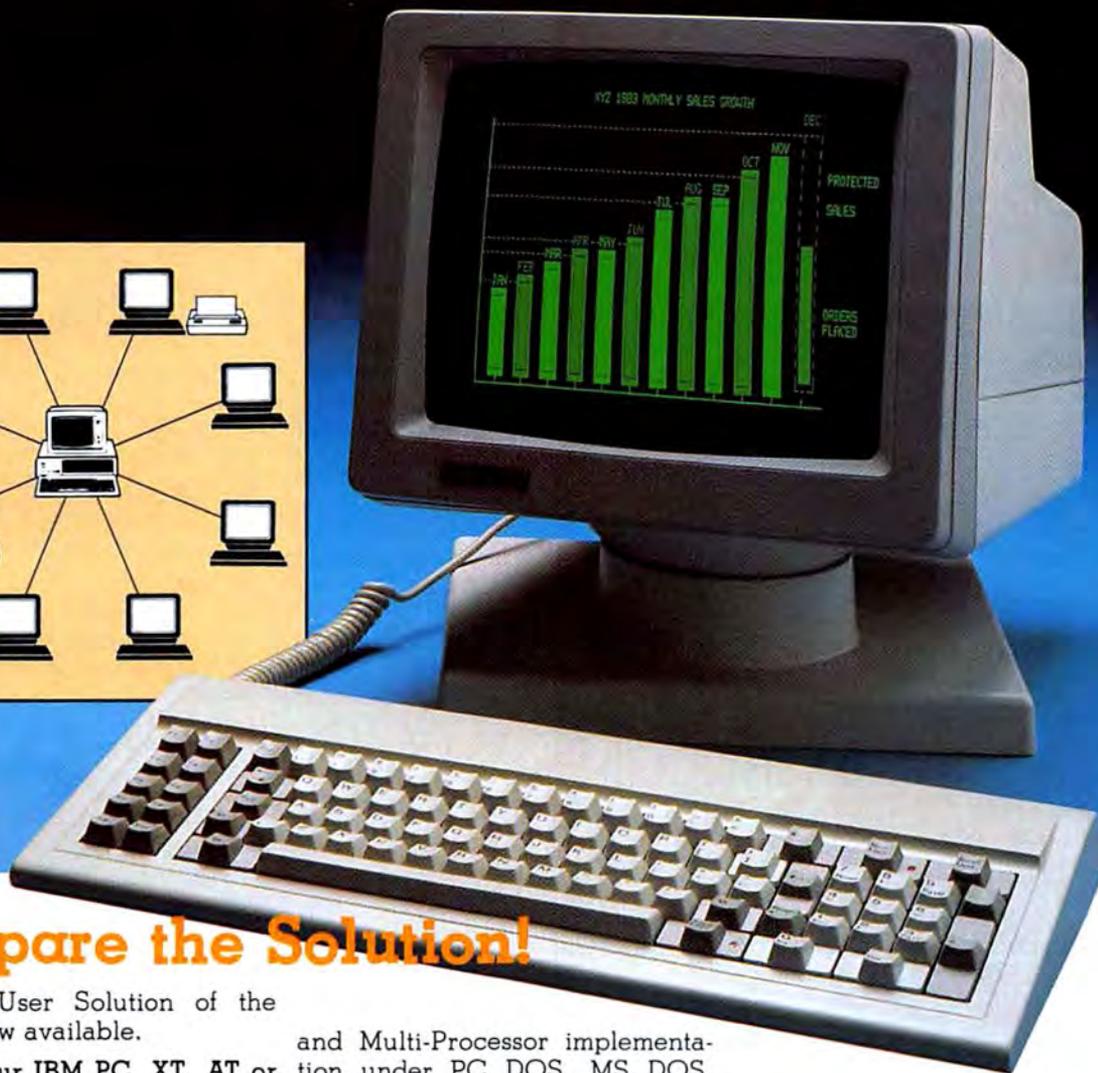
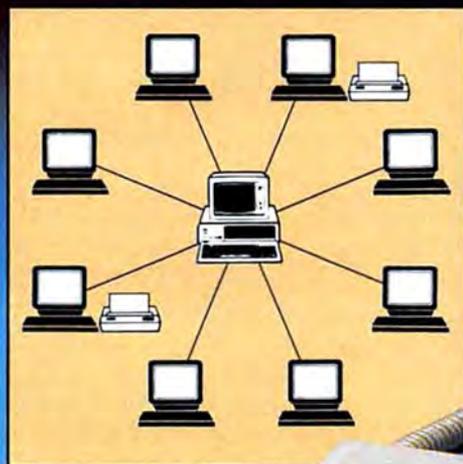
LAN Licensing Lags

This year the local area network (LAN) industry failed to erupt with the revolutionary fervor that many analysts had expected. Yet while most companies wait for standards to arrive from IBM, others have quietly gone about installing LANs to share access to

(continues)

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Circle 941 on reader service card

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Designed to take advantage of the AT, the system enables as many as eight terminals, connected to a single computer, to emulate IBM PCs having up to 420K RAM. Our PC-Shadow™ Workstation (shown left) even has an AT look-alike, as well as work-alike, keyboard, display, and serial printer port.

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99% of all PC-DOS software runs on the system. Lotus Symphony and 1-2-3, dBASE III, and WordStar are just a sampling of off-the-shelf software that can run under LANLink™.

A Constellation of Configurations. Although a number of configurations are possible, LANLink™ is most often set up as a "star," where up to eight satellites are connected to a single server. Larger networks can have multiple servers. Because the Server's not dedicated, a total of 73 or more network users can be supported.

In addition, dumb terminals can be used with LANLink™ simply by running MultiLink Advanced™ on a Satellite and connecting the desired number of terminals to it. This gives each terminal access to network disks, files, and programs.

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LANLink™



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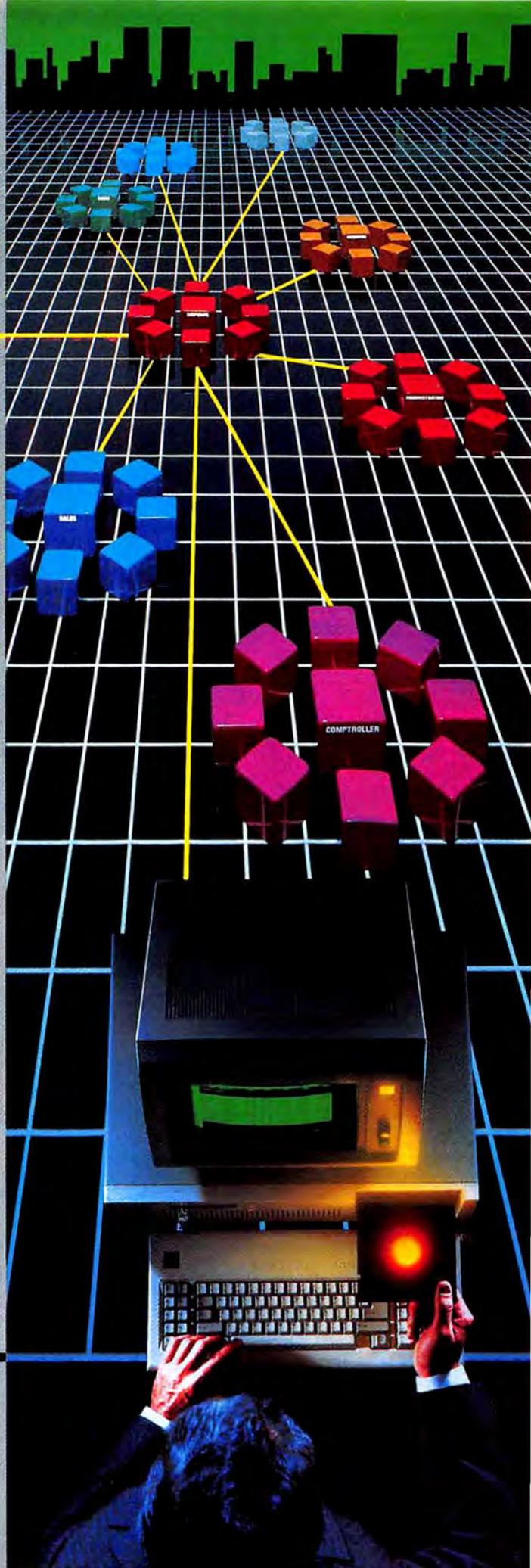
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Circle 526 on reader service card



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Circle 842 on reader service card

Password: Communicate

costly resources like hard disks and laser printers. Once LANs are installed and tuned, however, users ask the next logical question: Where's the software?

Unfortunately, most software in business libraries is strictly single user—by design and by law. Standard licensing agreements specify that software can be used by only one user on only one computer, and copy-protection methods enforce that rule. For example, if you want to run 1-2-3 or WordStar on a network, you must buy a copy for each workstation, each with its own licensing agreement and hefty price tag. While corporations wait for multiuser software, they also desire a more elegant (and inexpensive) solution for the single-user packages they want to use now. As networks nudge their way into the corporate world, software manufacturers are being challenged to find a more workable approach to multiuser licensing.

As a solution to this problem, a growing number of software companies offer site licenses for their products. Site licensing allows a firm to buy the right to use a software package on a prescribed number of its PCs, usually at a substantial discount per package, sometimes as much as 50 percent. Site licenses are offered to corporations for both LAN workstations and single-user PCs, but they are particularly attractive to network users.

An even more liberal policy is proffered by Fred Gibbons, president of Software Publishing. "We

permit and encourage our customers to put *pfs*: software on LAN servers," says Gibbons. Software Publishing is considering enclosing a multiuser licensing agreement with every program. The user would simply sign and return the license at no extra charge.

Under such broad licenses, sharing software on a network is no longer a legal problem, but technical roadblocks pose an even greater hurdle. The most formidable obstacle is that many single-user packages don't work on LANs. For example, if you put *dBASE III* on your file server, you could easily destroy all your files. To become truly useful, LANs require multiuser software with features like file and record locking, which forestall disasters that could result from simultaneous updates to the same file.

Ironically, although data base management systems have been touted as the kind of software that would be most appropriate in a LAN environment, word processing programs have been the first to come out with multiuser versions for PC LANs. Microsoft, MicroPro, Samna, Satellite Software, Lifetree Software, and Multimate have all either announced or begun shipping LAN-based versions of their word processing packages.

To address the needs of network users, Multimate International created multiuser versions

(continues)



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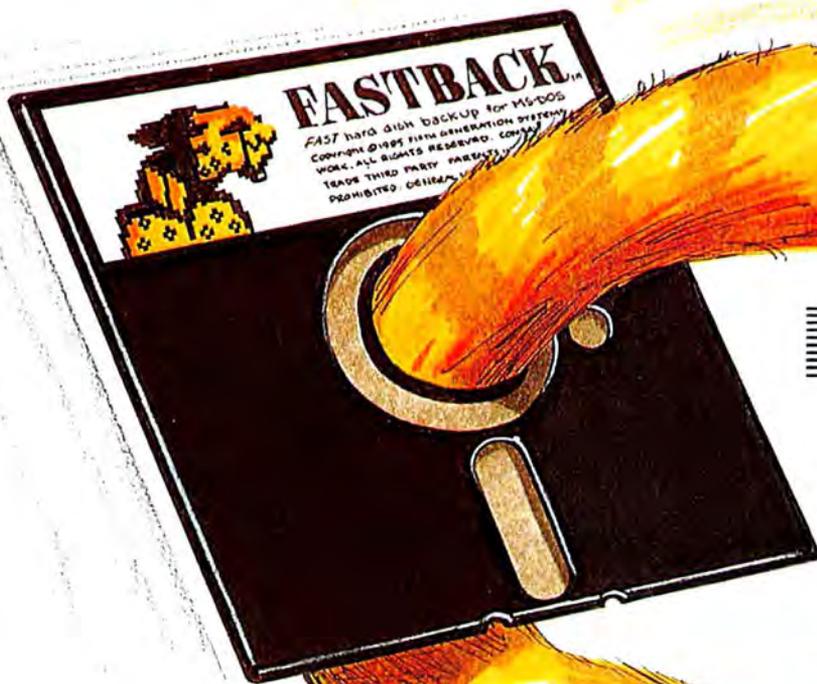
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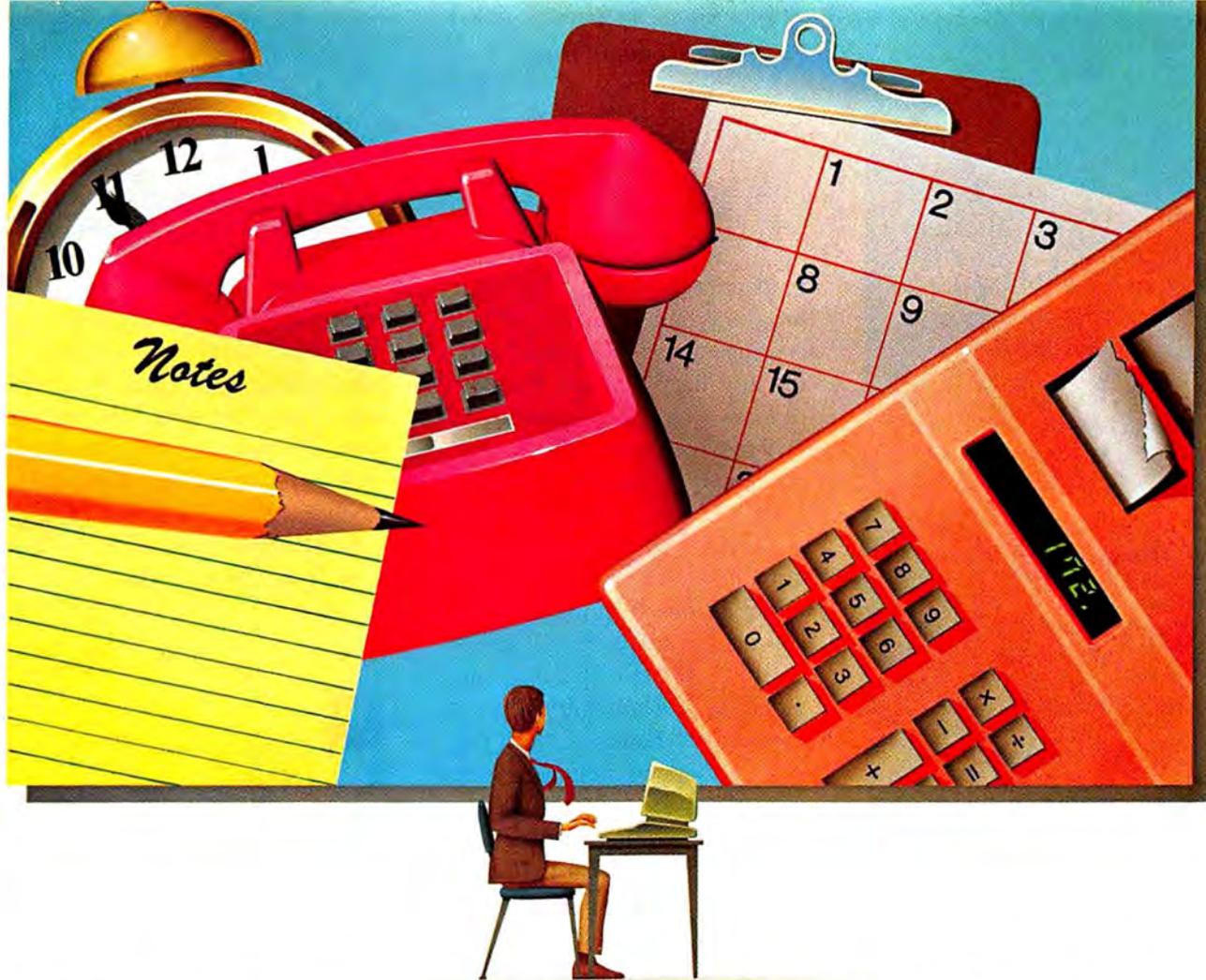
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Circle 427 on reader service card



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Ask about ZeroDisk to run copy-protected software from a hard disk without floppies.

of its popular word processing programs and debuted a LAN licensing agreement to match. Multimate's license follows the pattern of many single-user software site licenses; the buyer is charged according to the number of workstations that will use the program.

Most software companies are unwilling to trust their customers to police their own multiuser licenses. The software industry is working closely with LAN companies to develop multiuser copy-protection schemes on both the application level and the network operating system level. Novell's Netware operating system, for instance, includes a feature called MUSCLS, which restricts an application's use to the number of workstations specified by the vendor.

Software Connections recently decided to implement copy protection for *DATASTORE:lan*, its multiuser data management system. "We know piracy exists," explains the company's Gary Kwok, "because people who had initially bought four or five copies of the program were ordering just one update." Starting this fall, the company will begin to use a copy-protection method that ties the program's operation to a serial board in each workstation. Only computers with the specified serial boards will be able to access the program.

For now, LAN users must wait patiently while software developers unravel the technical knots surrounding file sharing and multiuser copy protection. Not until then will multiuser programs appear in significant numbers, and doubtless they will be as carefully controlled and licensed as single-user programs are today. —Darcy DiNucci

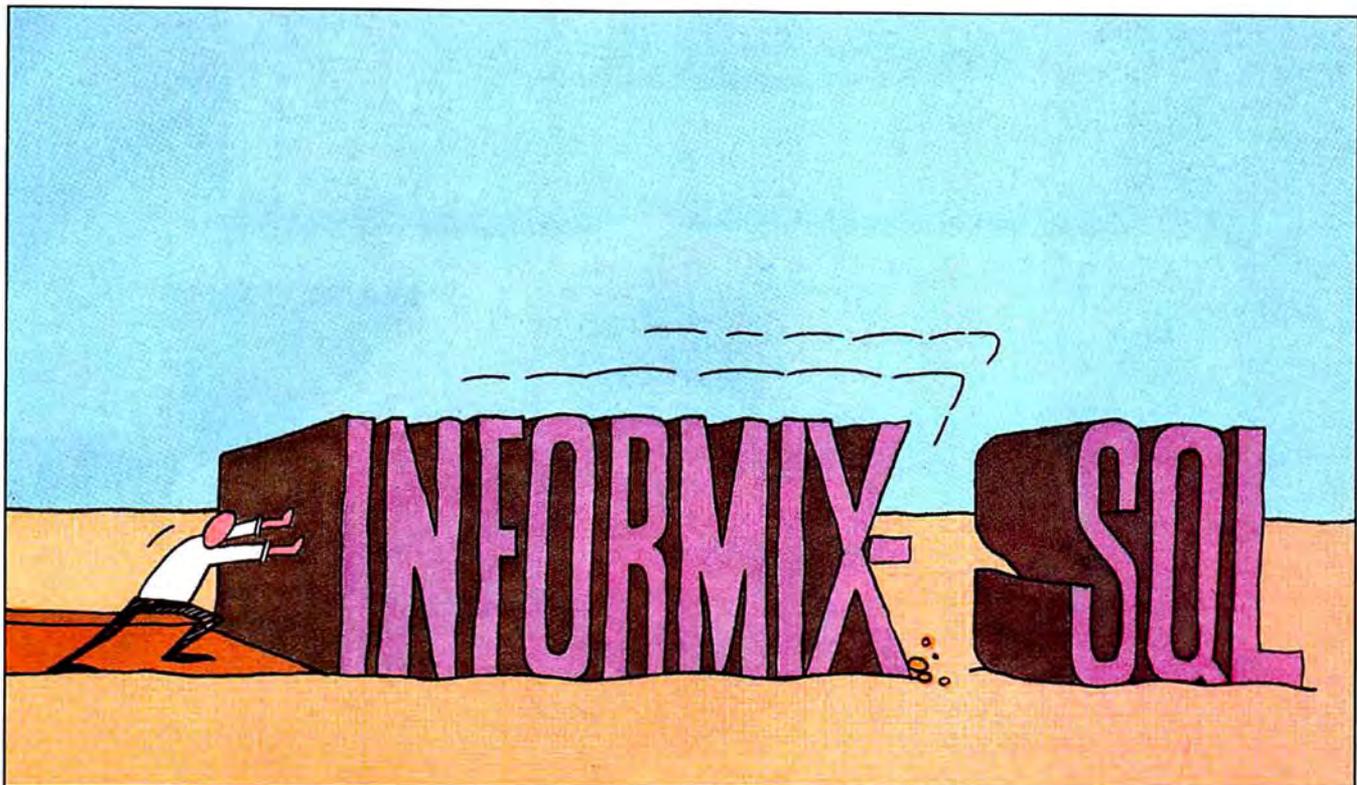
Start Bit

Fastlink at 10,000 Bits-per-Second

Even before the 2400-bps modem market has a chance to settle down, some modem manufacturers are attempting to break the 9600-bps speed barrier over standard, dial-up telephone lines. Although several 9600-bps modems for the PC have already arrived on the market (see this issue's "From the Hardware Shelf" for a look at the UPTA 96 modem), IRMA's Fastlink from Digital Communication Associates (DCA) stands out as the high-speed leader, both in technological sophistication and marketing moxie.

Developed as a joint venture with Telebit Corporation, the Fastlink modem can purportedly transmit data with another Fastlink modem at speeds approaching 10,000 bps, making it the fastest modem that operates on

(continues)



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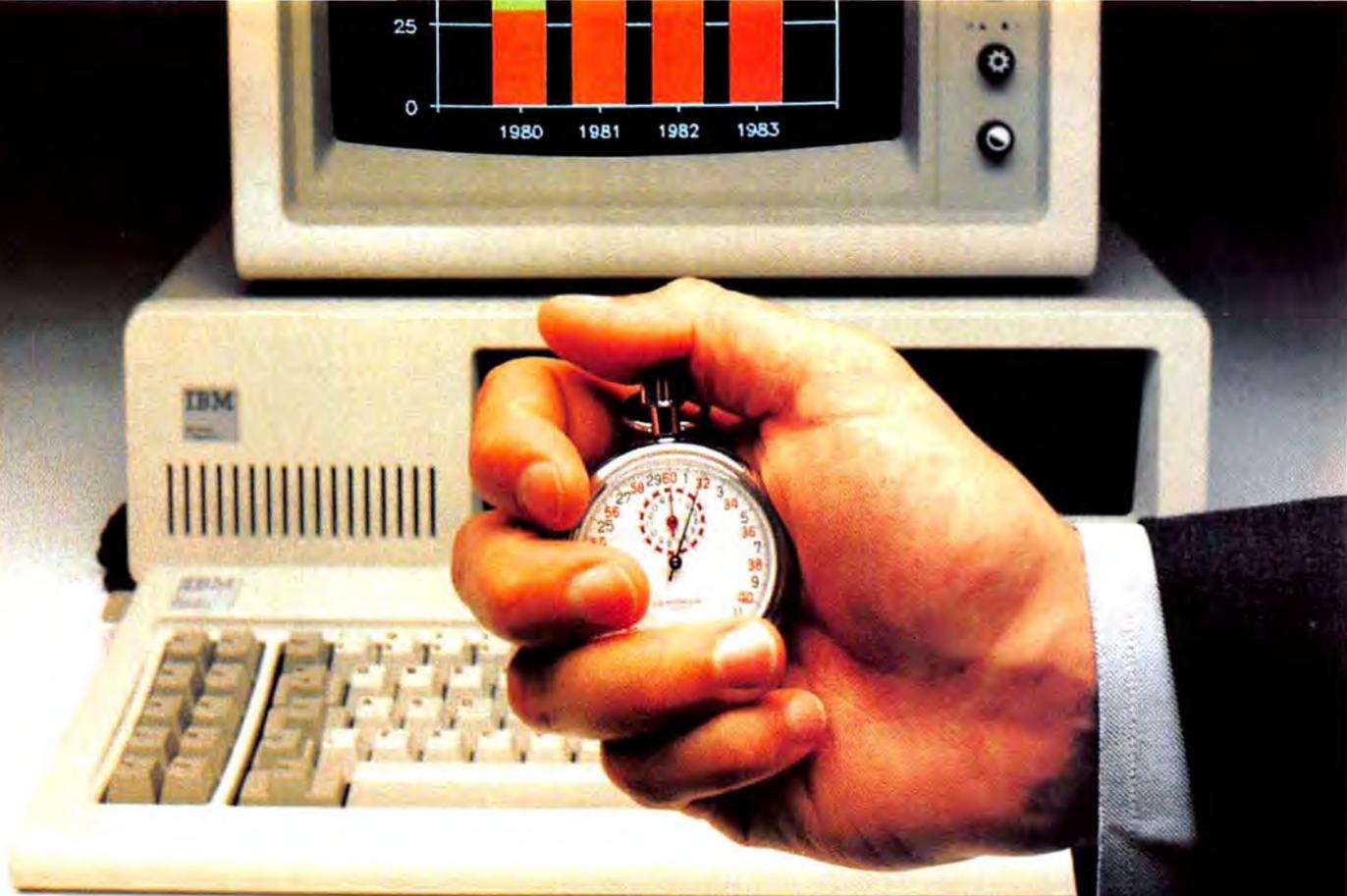
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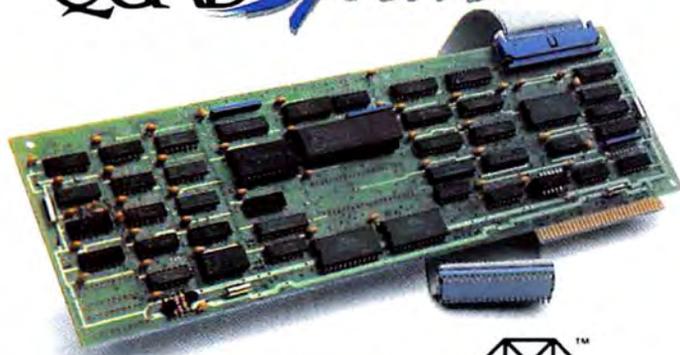
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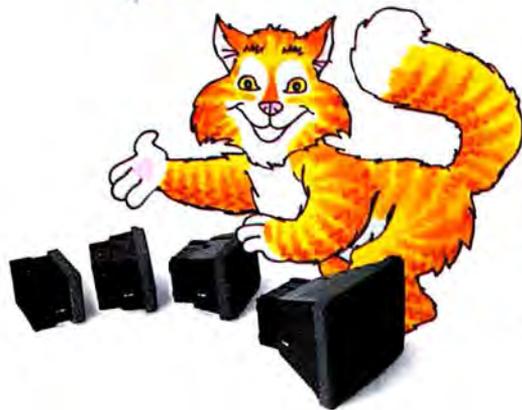
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standard voice lines. Fastlink can also communicate with other, slower modems (without error-checking) by detecting the speed difference and automatically downshifting to compensate.

The key to Fastlink's high-speed success is its proprietary multicarrier modulation technique, DAM-QAM, which allows the modem to use 50 percent more of the telephone bandwidth than other modems are able to use. Fastlink sends out signals over hundreds of frequencies and then tests each for signal-to-noise ratio. The higher the ratio (that is, the cleaner the channel), the more data is encoded for that frequency. Encoded data is then grouped into packets for transmission and tagged with a 16-bit CRC (cyclical redundancy check) error-checking code. If the remote modem detects an error, it requests a retransmission of the suspect block. Because the error-checking scheme is proprietary, it works only when both modems are Fastlinks.

The Fastlink can also "fall back" to lower speeds if line noise is encountered. Because each frequency is tested separately, transmission speed can be lowered incrementally, rather than in large steps.

Fastlink also speeds throughput with its adaptive duplex technique, which determines what system is sending the lion's share of data and allocates send and receive channels accordingly. For example, if a PC is primarily acting as a terminal that downloads data from a remote mainframe, the mainframe modem is assigned more send channels.

A souped-up version of Microstuf's *Crosstalk XVI*, called *Crosstalk Fast*, is included with the internal version of Fastlink, but DCA hopes that other communications programs will soon support the modem. Indeed, DCA, which manufactures the popular IRMA line of terminal emulation boards, may well create the standard for 9600-bps communications by dint of its dominance in the micro/mainframe world. However, the Fastlink is expensive by microcomputer standards, and cheaper, less sophisticated 9600-bps modems, such as the UPTA 96, may also find their market niches.

IRMA's Fastlink
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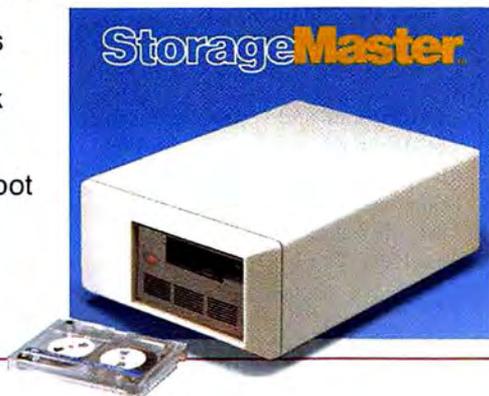
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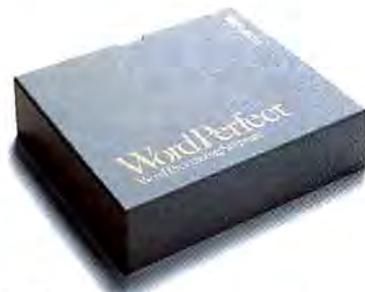
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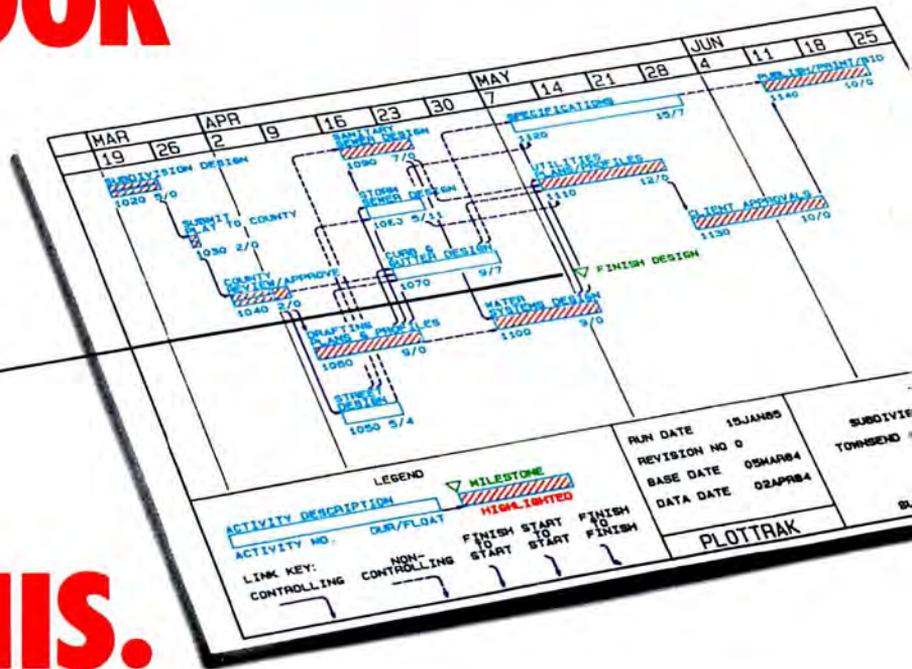
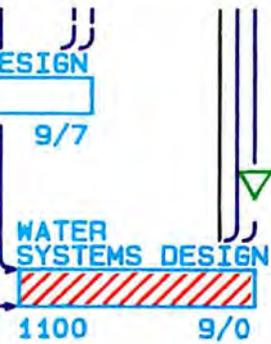
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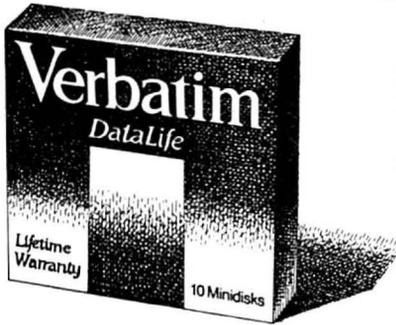
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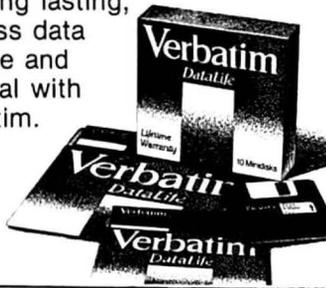
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Micro-to-Mainframe Cut-Rate Cluster Controllers

If your office PCs have been denied access to your company's IBM mainframe, the obstacle could likely be cluster controller sticker shock. IBM's 3274 cluster controller unit—a required part of IBM's cabling scheme—electronically routes access requests to a mainframe from terminals attached locally or remotely to the controller. In a typical setup, 32 terminals or PCs are lashed to the 3274 controller, which relays requests to the mainframe directly via cable or indirectly via a synchronous modem (see "From Here to Mainframe (and Back)," *PCW*, September 1985).

If your district office or company division harbors a rabble of PCs demanding mainframe access, the controller's \$6000 to \$10,000 price tag can be justified. However, if you need to connect just a few PCs, buying an IBM controller is costly overkill.

Recognizing this gap, AST and Emulex/Persyst have created expansion boards that enable a PC to emulate IBM's cluster controller—for less. While not matching the IBM unit feature for feature,

these controller work-alikes provide enough emulation to make your PCs mainframe-literate.

Up to four "slave" PCs can be attached to a master PC using the AST Cluster board, and three can be attached using Persyst's DCP-88. The DCP-88 board is equipped with an 8088 that speeds up requests from PCs attached to the master PC, and at the same time helps process incoming mainframe data. All slave PCs in the Persyst configuration must use the company's MCP board to link up to the DCP-88.

Both cluster controllers support synchronous communications: either IBM's bisynchronous (BSC) or synchronous data link control (SDLC) communication protocol. AST offers a separate board for each standard, whereas Persyst combines both standards on one device. In addition to emulating IBM's controller, both products enable the slave PCs to mimic the basic attributes of the IBM 3278/9 terminal and perform the necessary ASCII/EBCDIC conversions to permit simple text file transfers. However, neither supports high-resolution graphics. Additional conversion software is required to reformat mainframe data into Lotus, dBASE, and other appropriate file formats.

The two boards provide a "hotkey," or session hold, function that lets you switch instantly between a mainframe session and a

(continues)

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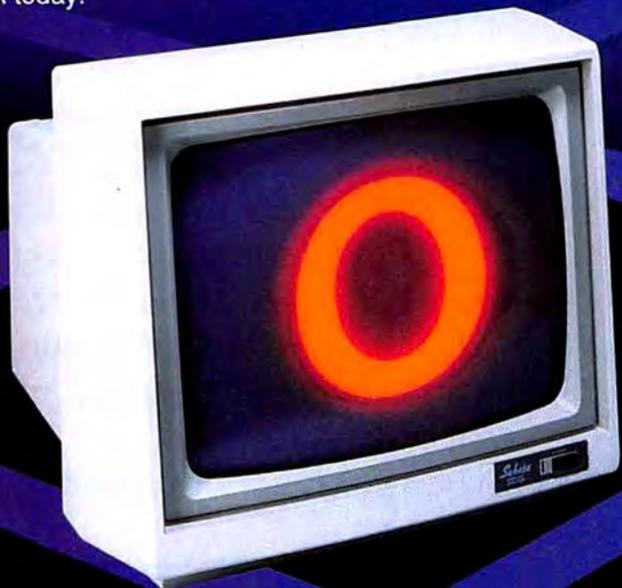
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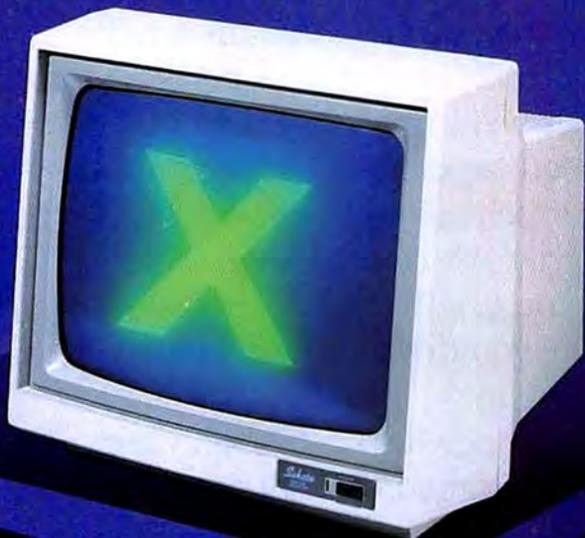
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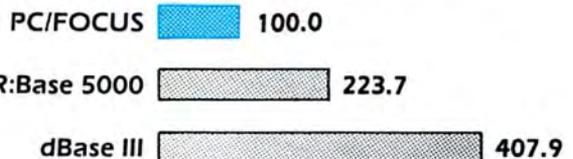
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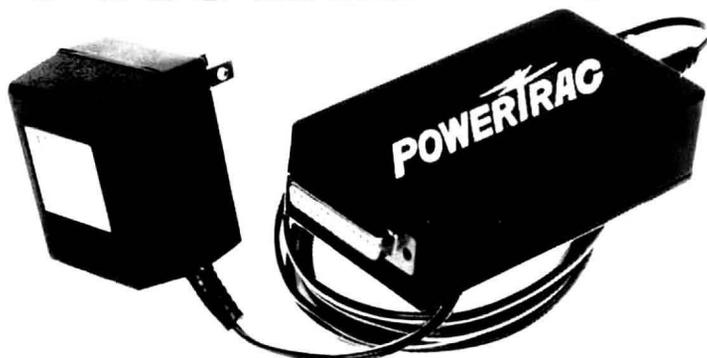
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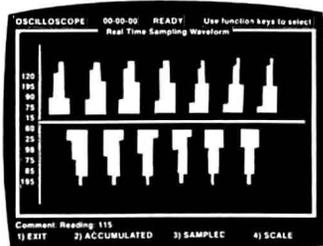
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DOS application. Printers attached to a PC look like IBM 3287 printers to a mainframe—and can thus print mainframe documents. In addition, the Persyst controller includes 3770 RJE (remote job entry) terminal emulation for remote batch processing. For PCs currently cohabiting in a local area network, AST offers a separate LAN-to-mainframe gateway product.

Although each product takes a slightly different approach to the same problem, both open the door to the ubiquitous world of IBM mainframes. For offices with a smattering of mainframe-hungry PCs, or large offices considering the purchase of a second cluster controller, these offerings can provide micro-to-mainframe communications at cut-rate costs. —Art Wilcox

AST-SNA/Cluster, AST-BSC/Cluster

AST Research

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Irvine, CA 92714

714/863-1333

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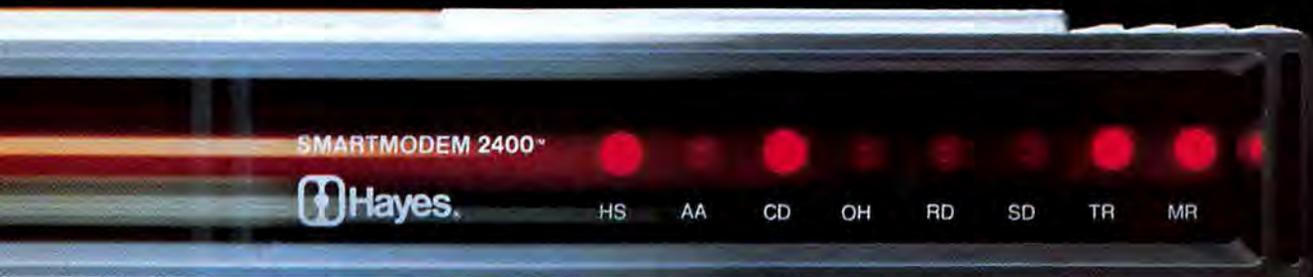
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Art Wilcox is a telecommunications consultant and freelance writer based in San Francisco.

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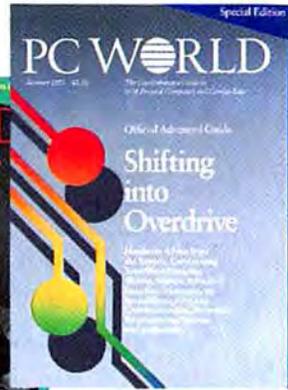
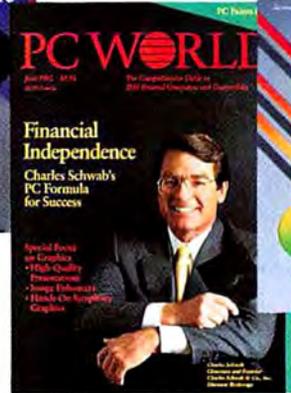
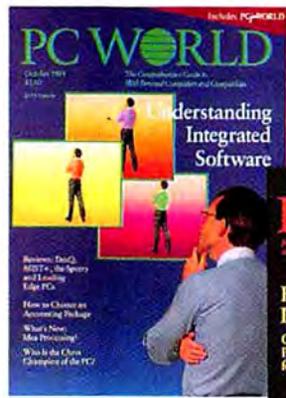
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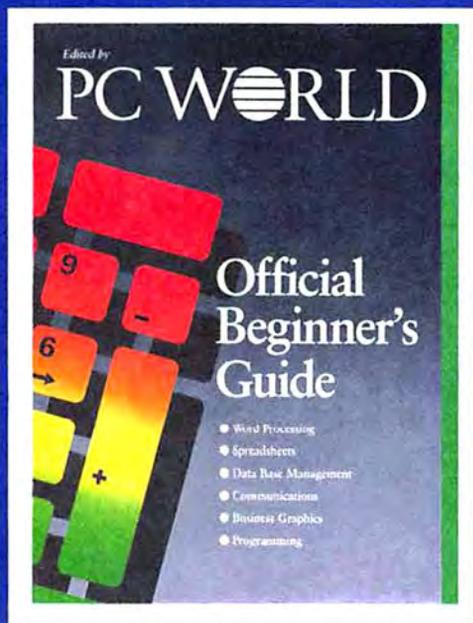
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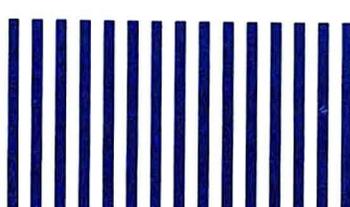
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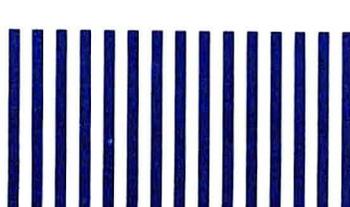
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Technical Bulletin

No. 2 in a series.



SUBJECT: Engineering a LAN for Maximum Flexibility.

Quantum Software Systems Ltd. proudly announces QNX 2.0 — the Ultimate Distributed Network Operating System. QNX 2.0 is now available for the IBM-PC, IBM-AT, PC compatibles, DEC Rainbow and TANDY 2000. If you have been waiting for a Real-time Multi-tasking Multi-user Operating system with fourth generation LAN support, then QNX 2.0 can offer you today what the competition can't even begin to promise for the future.

QNX 2.0 integrates the Local Area Network architecture right into the heart of the operating system, at the fundamental level of intertask communication allowing tasks to communicate transparently with other tasks across the whole network. This means that any task (program/application) may access ANY serial port, ANY printer or ANY disk on the network. There are no artificial restrictions. Every PC with a disk is a potential file server. PCs without disks will automatically BOOT over the network.

QNX on the IBM-PC AT:

QNX is the first Multi-tasking Multi-user Operating system available for the AT. It is available in both networked and single machine configurations. At about 2.5 times faster than the QNX 8088 PC based systems, and 10 times faster than other multi-tasking operating systems on the same processor, QNX is the ideal program development environment.

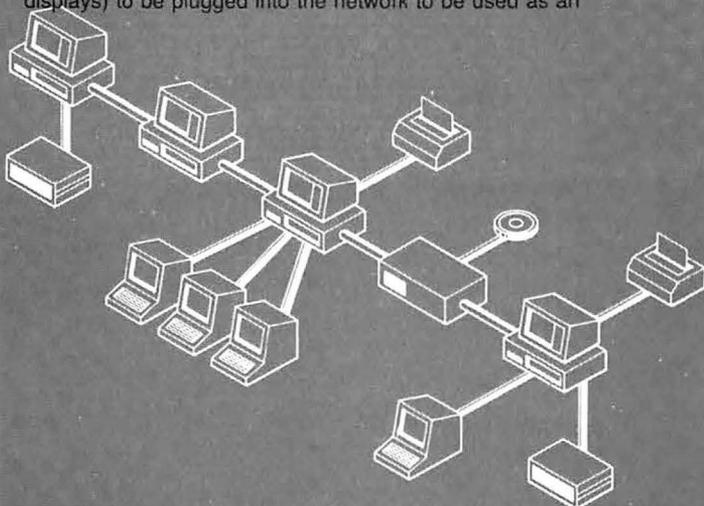
O/S	Computer	Processor	Measured time
QNX™	IBM-PC AT	80286	480 usec
XENIX™	Intel-286	80286	4,930 usec

File Security:

Designed with extensive file security features, QNX 2.0 provides login protection with network wide file permission checking based on 255 groups of 255 users. In addition, each PC user may control network access to devices attached locally to their machine.

Distributed Processing:

The QNX LAN supports distributed processing as well as distributed devices. Tasks may be executed on remote stations as easily as they may be executed on the local work station. This allows pure processing elements (PCs without keyboards or displays) to be plugged into the network to be used as an



un-committed processing resource. This is ideal for real-time, process control, data acquisition and data communication applications.

Global Communications:

QNX supports a full implementation of X.25 allowing connection to public networks such as Telenet and Datapac. This allows you to link geographically separate LANs together providing true global area networking.

Cost Effective Growth and Flexible Solutions:

QNX is affordable, and will work with the PCs you use today and those you will use tomorrow. You may mix and match different brand PCs on the same QNX network with absolute ease. Multi-user expansion may be accomplished by adding terminals to PCs or PCs to the network. You can start your multi-user application on a single PC with 1 to 10 attached terminals. Once your single processor starts to show signs of degradation, add another PC and connect terminals to the new processor. If the disk becomes the major bottleneck, you may add hard disks to other attached PCs to distribute the processing. Applications which are very CPU intensive may wish to limit a single user to each processor and expand the system with low cost diskless PCs used as work stations. QNX does offer a truly cost effective and flexible solution to your applications needs.

Portability:

QNX 2.0 is portable. The operating system is independent of the physical local area network. It is available in a form suitable for porting to other 8088/8086/80186/80286 computers in the consumer, educational and industrial market place. QNX is ROMable and can operate in as little as 128Kb RAM.

DOS Compatibility:

PC-DOS version 2.1 can run as a task under the QNX 1.2 or 2.0 operating systems. QNX will also allow transparent access to the DOS file system partition and floppies.

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Qbol (dibol) Compiler	Networking Board
Text Processor	OEM Customization Kit
Real Time Spelling Checker	(to port QNX)

Established:

Quantum sold over 10,000 copies of its operating system during 1984, into all business systems environments, to developers of real time applications, government and educational systems, to software developers/integrators, universities and research establishments.



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Star-Dot-Star

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This month we present tips for reclaiming wasted disk space, a utility to help you clean up cluttered disks, prime information for the mathematically inclined, and 114 new hues for your color display.

Edited by Steven Cook

130-Color Graphics

I read with interest the item on 16-color low-resolution graphics ["Secret Graphics Mode," *.* , PCW, April 1985]. I had previously read of such a capability, but this was my first look at the necessary programming information. Because my work involves displaying geophysical data from satellites, I was intrigued by the possibilities. Even so, I felt somewhat restricted by 16 colors and was prompted to do some experimenting.

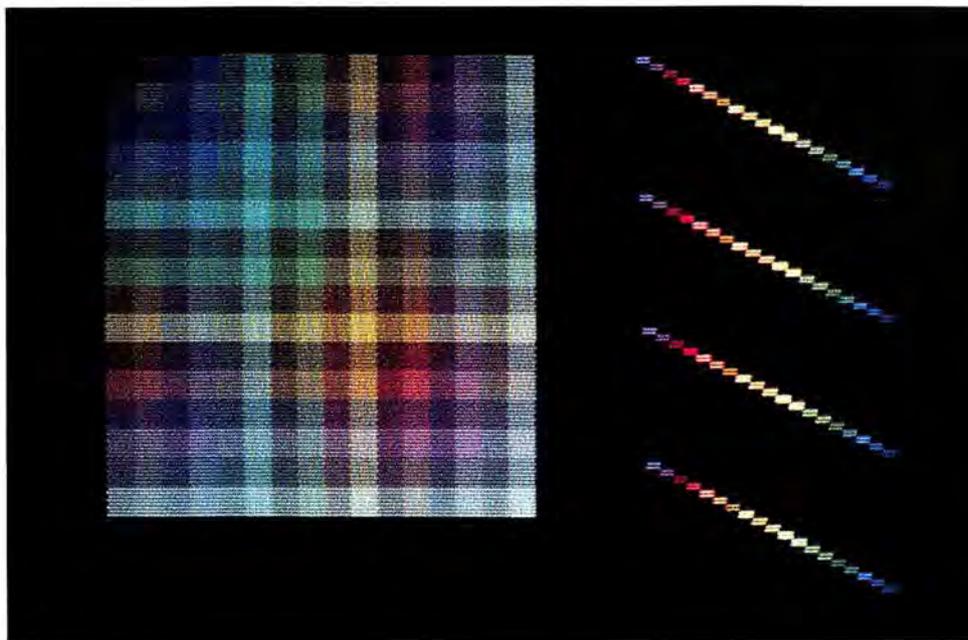
In looking over the PC's character set, I found the combinations offered by characters 176 to 178 particularly appealing. Images I created using characters 176 and 178 were interesting, but the results given by 177 were amazing. The screen was filled with 8000 characters, which I could color in any of 130 unique shades.

The explanation is that character 177 illuminates every other dot it occupies. When adjacent background and foreground dots are on, they appear to the eye as a

solid color. With 16 different foreground and background colors, 256 combinations are possible. However, 120 of them are exact duplicates, leaving 136. Six of those are 50-50 mixtures of primary colors, duplicating 6 of the original colors, so 130 unique colors are available. On some displays the colors look a little strange, but with plenty of good combinations to choose from, omitting a few should not cause any trouble.

The program 130COLOR.BAS demonstrates the effect. Lines 170 through 210 and 400 through 670, which set up the screen, are taken directly from the original LOWRES.BAS program. The statements in lines 260 through 300 generate the values for each of the 136 colors, and lines 330 and 340 simply select 19 of those colors in spectral order. Lines 370

(continues)



AW...

WHAT THE HECK

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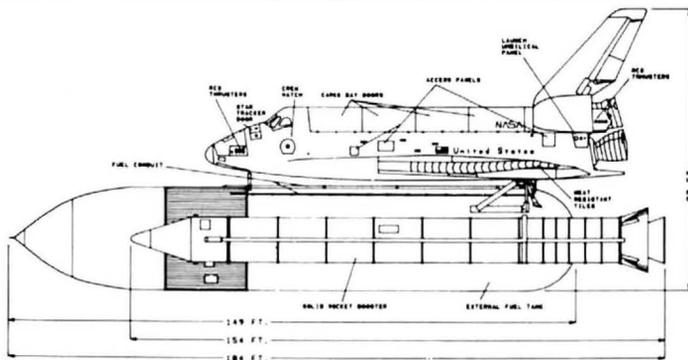
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We did market studies and calculations. We consulted with experts. We drew charts and graphs. We used the finest spreadsheet programs money could buy. When it came right down to it, we still didn't know what to sell ProDesign II for. \$2995? \$2495? \$1995? We even considered \$995.

Then, in the great American tradition, we said, "AW...WHAT! THE HECK! Let's see the other guys beat this price!" ProDesign II costs \$299. At that price, you can't go wrong!

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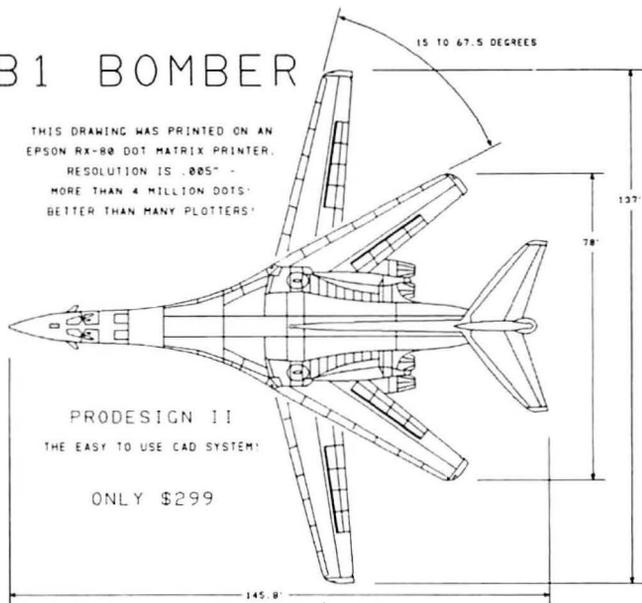
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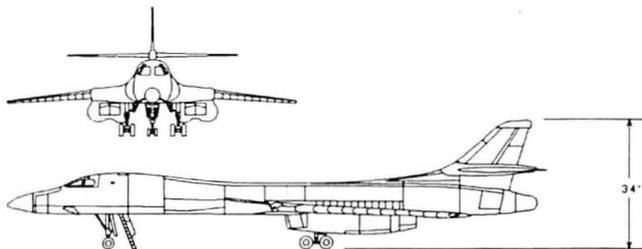
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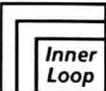
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```

100 '130 color graphics by Larry McMillin
110 'Derived from LOWRES.BAS [PC World, April 1985]
120 DEFINT A-Z:KEY OFF:CLS
130 DIM COLOUR(135,1),ORDER(15),CHOICE(19)
140 LOCATE 1,1:PRINT "130 Color Demonstration"
150 LOCATE 5,1,1:PRINT "Now assembling colors...";
160 '
170 'Color/Graphics Adapter definitions
180 MODEREG=&H3D8:COLORREG=&H3D9           'control registers
190 MODESAVE=&H465:COLORSAVE=&H466        'BIOS saves the regs here
200 CRTREG=&H3D4:CRTDATA=&H3D5            '6845 CRT controller regs
210 HIRES=1:VIDEO=8                       'Mode register bits
220 '
230 'Create a List of the 136 colors. This includes 6 colors that are
240 '50-50 mixtures of primary colors, but excludes foreground/background
250 'combinations that duplicate background/foreground combinations
260 C=0
270 FOR I=0 TO 255
280   BG=I\16:FG=I MOD 16:IF FG<BG THEN 300
290   COLOUR(C,0)=BG:COLOUR(C,1)=FG:C=C+1
300 NEXT
310 '
320 'Select 19 colors from the list for this demonstration
330 FOR I=1 TO 19:READ CHOICE(I):NEXT
340 DATA 1,16,24,17,2,10,39,119,133,89,68,128,81,87,126,58,4,19,20
350 '
360 'Build an index to organize the colors in the matrix
370 FOR I=0 TO 15:READ ORDER(I):NEXT
380 DATA 0,8,1,9,3,11,2,10,6,14,4,12,5,13,7,15
390 '
400 'Set up Color/Graphics Adapter for 80- by 100-block graphics
410 DEF SEG=0:MODE=0
420 POKE MODESAVE,MODE:OUT MODEREG,MODE
430 POKE COLORSAVE,0:OUT COLORREG,0
440 '
450 'Load new parameters into 6845 CRT controller
460 FOR REGISTER= 0 TO 11
470   READ REGDATA
480   OUT CRTREG,REGISTER:OUT CRTDATA,REGDATA
490 NEXT
500 '
510 'Initial data for 6845 (80 x 100 characters)
520 DATA 113      :'register 0 - horizontal total
530 DATA 80      :'register 1 - horizontal displayed
540 DATA 90      :'register 2 - horizontal sync position
550 DATA 10      :'register 3 - horizontal sync width
560 DATA 127     :'register 4 - vertical total
570 DATA 6       :'register 5 - vertical adjust
580 DATA 100     :'register 6 - vertical displayed
590 DATA 112     :'register 7 - vertical sync position
600 DATA 2       :'register 8 - interlace mode (non-interlace)
610 DATA 1       :'register 9 - maximum scan line address
620 DATA 32      :'register 10 - cursor start (disables cursor display)
630 DATA 0       :'register 11 - cursor end
640 '
650 'Set mode for 80 column color enable
660 MODE=HIRES+VIDEO
670 POKE MODESAVE,MODE:OUT MODEREG,MODE
680 '

```

(continues)

130COLOR.BAS: A program to display 130 colors on the standard IBM PC Color/Graphics Adapter

EXECUTIVE PRIVILEGE.

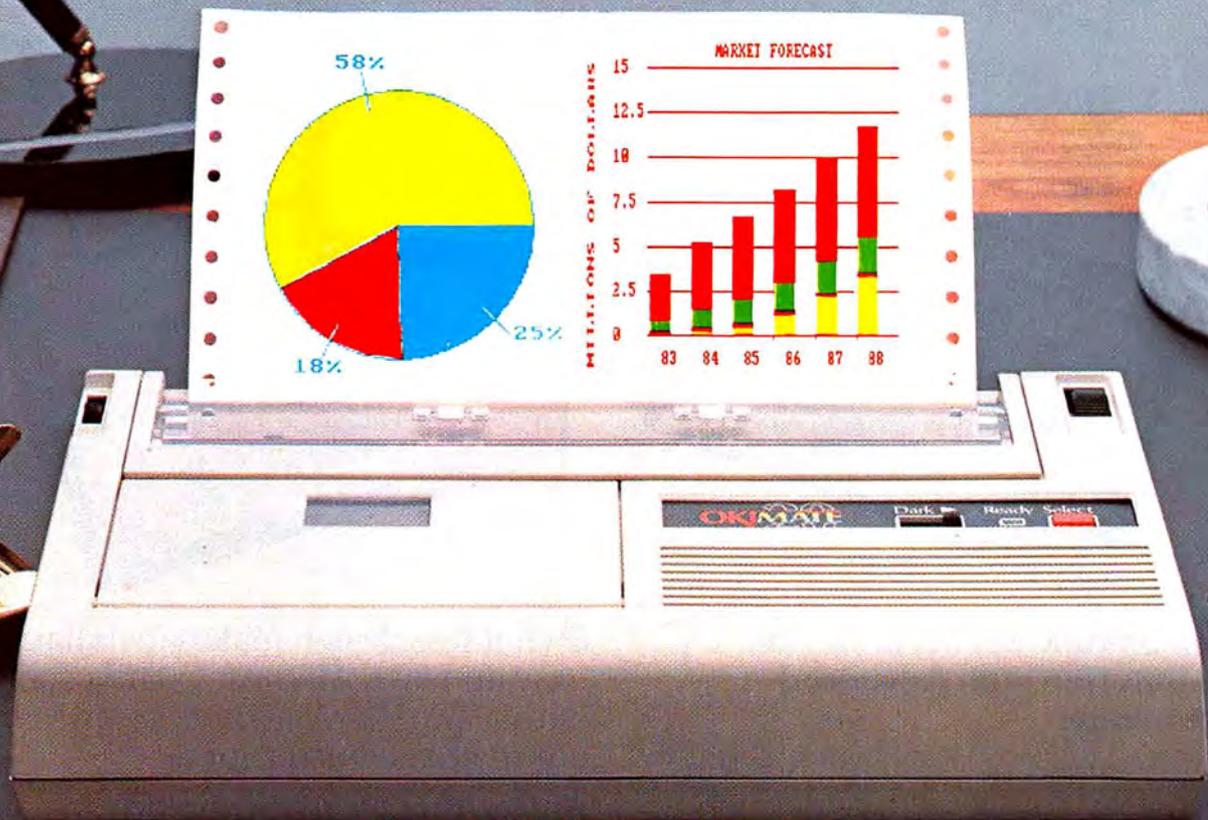
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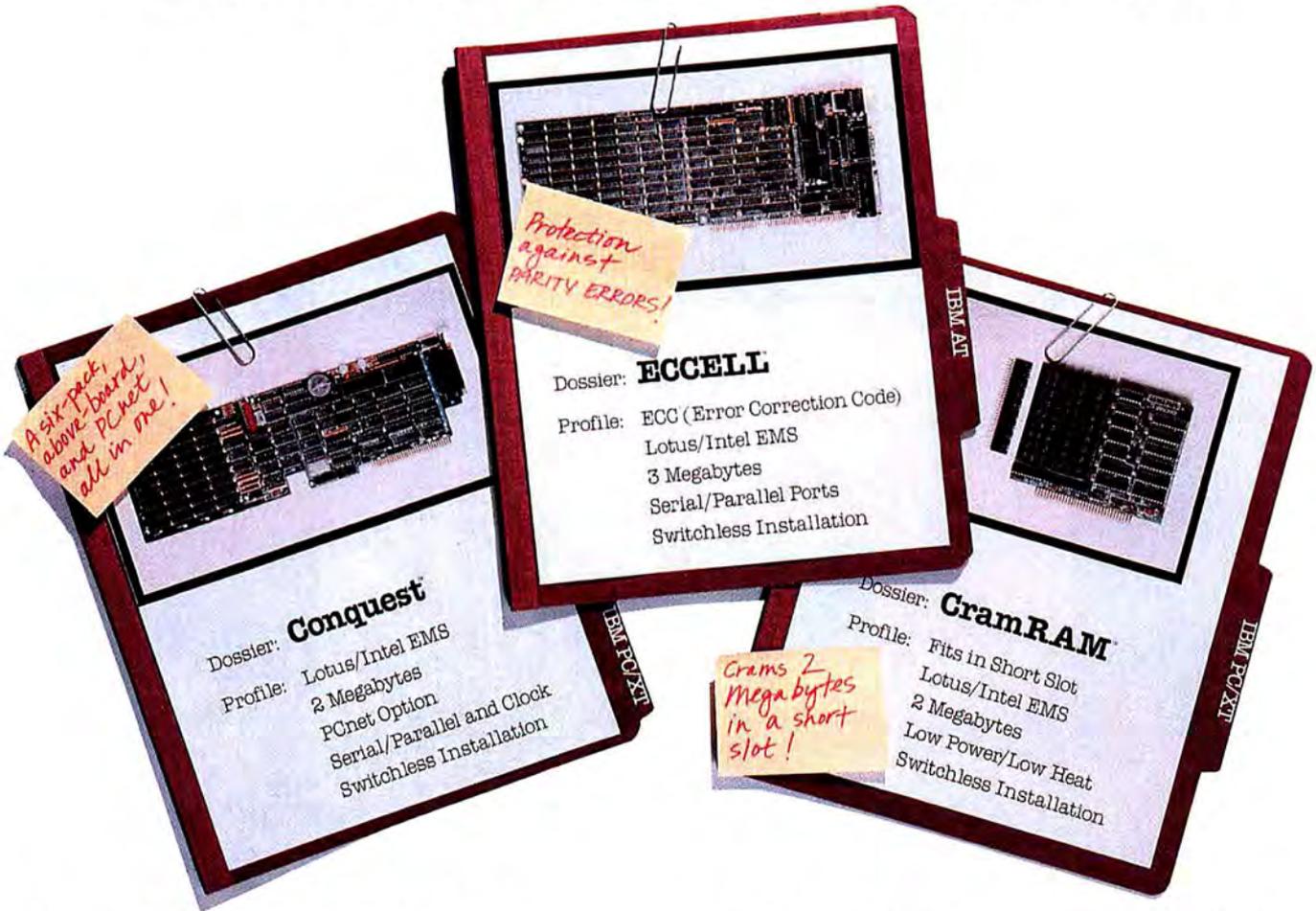
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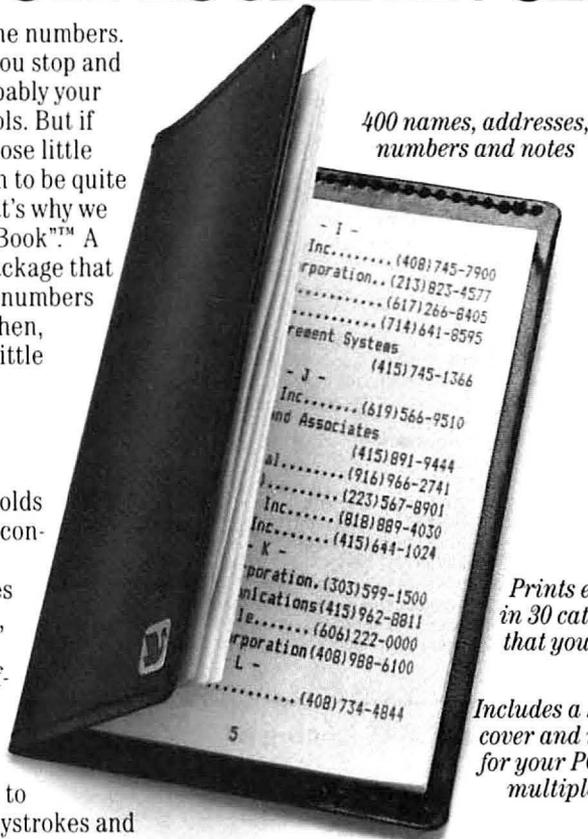
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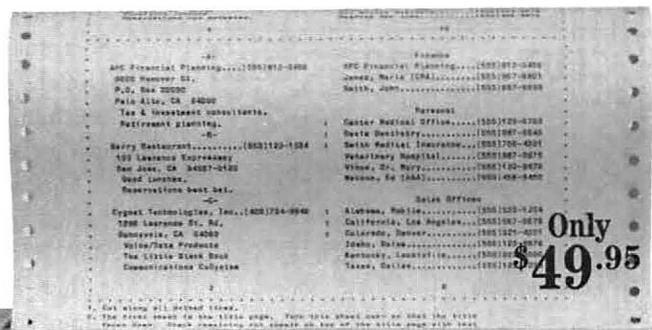


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```

690 'Clear screen; Set all characters to 177, attributes to 0
700 DEF SEG=&HB600
710 FOR ADDR=0 TO 16000 STEP 2:POKE ADDR,177:POKE ADDR+1,0:NEXT
720 '
730 'Draw a matrix of colors
740 FOR I=0 TO 31
750   FOR J=0 TO 63
760     X=I:Y=J
770     BG=ORDER(I\2 MOD 16)
780     FG=ORDER(J\4 MOD 16)
790     GOSUB 960
800   NEXT
810 NEXT
820 '
830 'Draw diagonal lines using selected colors
840 FOR I=0 TO 75
850   PICK=CHOICE(1+(I\1 MOD 19))
860   BG=COLOUR(PICK,0):FG=COLOUR(PICK,1)
870   X=40+I MOD 19:Y=I
880   GOSUB 960
890 NEXT
900 '
910 'Wait for keypress, restore text mode, end program
915 FOR I=0 TO 135:LPRINT I:"COLOUR(I,0);COLOUR(I,1),:NEXT
920 WHILE INKEY$="" :WEND
930 SCREEN 2:SCREEN 0,0:END
940 '=====
950 'Subroutine to plot PIXCOL at (X,Y)
960 PIXEL=2*X+(Y*160):PIXELADDR=(PIXEL AND &HFFF)+1
970 POKE PIXELADDR,BG*16+FG:RETURN

```

130COLOR.BAS (continued)

and 380 organize all the colors in a logical order for display on the left side of the screen. That makes selecting colors easier; when colors are separated it's difficult to judge how different they are.

To show how the technique can be applied, lines 840 through 890 plot the diagonal lines that appear on the right side of the screen, using the 19 colors selected earlier.

It's easy to improve on the program. You may want to add some BSAVE and BLOAD statements rather than create the image each time. You can add them after line

710 to clear the screen quickly. If it's done after line 890 you can save or reload the completed image.

Larry McMillin
Clinton, Maryland

*Editor's note: This program is truly amazing! I once heard a rumor that such a display was possible, but no one I knew had any idea how it might be accomplished. I'm very pleased to finally learn the answer and to see that it works so well. Anyone who translates the BASIC code to assembly language is encouraged to submit that work for publication in *.*.*

(continues)

SMART vs "STRONG"

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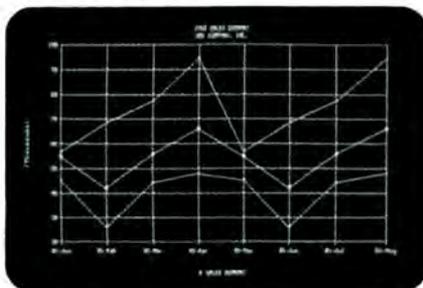
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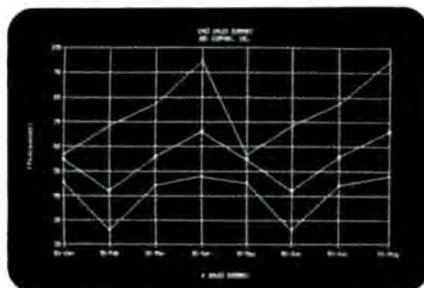
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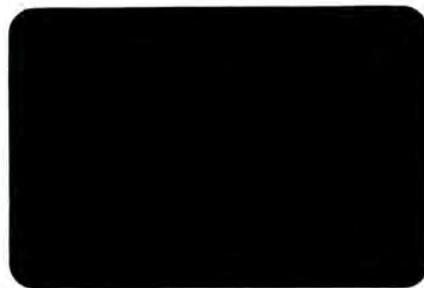
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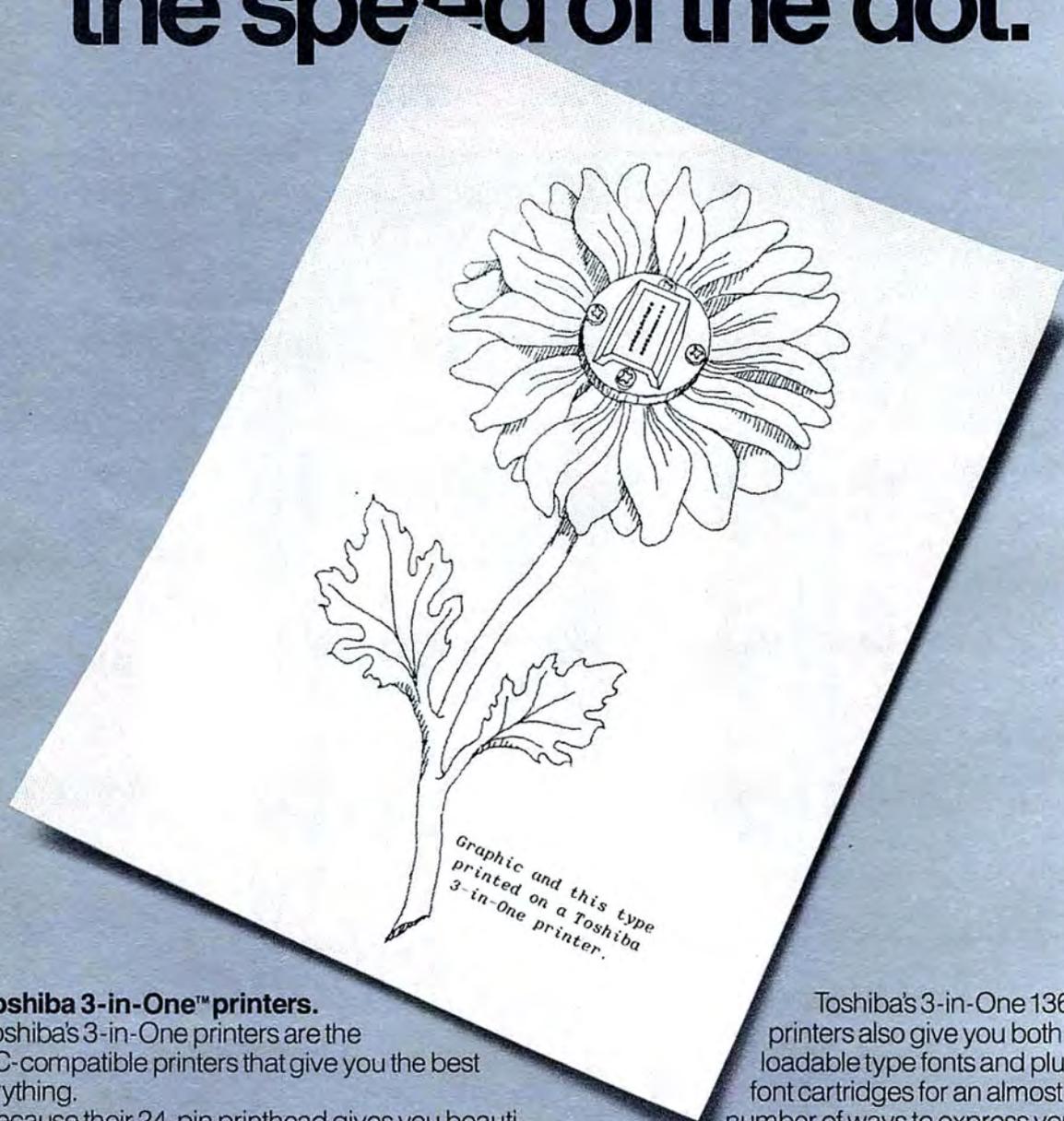
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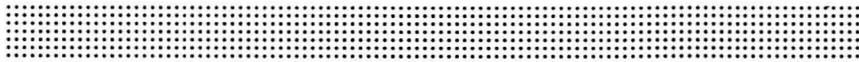


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```

100 DEFINT A-Z:DEFSNG T:KEY OFF:CLS:DIM PRIME(1000)
110 INPUT "Primes from 1 to ";LIMIT
120 T1$=TIMES$
130 FOR N=1 TO 3:Q=Q+1:PRIME(Q)=N:PRINT N;" ";:NEXT
140 FOR N=5 TO LIMIT-1 STEP 2
150   K=1
160   FOR Z=3 TO Q
170     T=N/PRIME(Z)
180     IF T=INT(T) THEN K=0:Z=Q
190     IF T<PRIME(Z) THEN Z=Q
200   NEXT
210   IF K THEN Q=Q+1:PRIME(Q)=N:PRINT N;" ";
220 NEXT
230 T2$=TIMES$
240 BEEP:PRINT:PRINT "There are the";Q;"prime numbers <";LIMIT
250 PRINT:PRINT "Started at: ";T1$:PRINT "Completed at: ";T2$
260 T$=T2$:GOSUB 280:TM=TI:T$=T1$:GOSUB 280:TM=TM-TI
270 PRINT "Elapsed time =";TM;"seconds.":END
280 TI=(VAL(LEFT$(T$,2))*3600) 'convert time to seconds
290 TI=TI+(VAL(MID$(T$,4,2))*60)
300 TI=TI+VAL(RIGHT$(T$,2)):RETURN

```

PRIMES.BAS: A fast algorithm for generating prime numbers

Prime Calculations

Your December article on the PC AT listed several speed trials clearly showing advances and advantages of the new machine ["AT: The PC's Powerful Partner," *PCW*, Vol. 2, No. 13]. I was surprised, however, to see such slow response times for *all* machines in generating the prime numbers less than 1000.

I use the program PRIMES.BAS to generate any given number of primes and also as a benchmark for comparing computers.

The speeds listed in the article were particularly surprising because with this program my Apple IIc can produce all primes less than 1000 in just 40 seconds. I doubt that the Apple IIc is four times faster than the PC AT, so it

must be that my program uses a more efficient algorithm. To achieve its speed, PRIMES.BAS recognizes three axioms:

- 1) All primes greater than 2 are odd (it steps through trial integers by 2).
- 2) It's necessary to try division by all lower *prime* numbers only (dividing by nonprimes is redundant; their prime factors are sufficient to rule out a new prime number if the division results in an integer).
- 3) It's necessary to try prime divisors only up to the square root of the new trial prime number (beyond that you will be traversing a range of numbers already ruled out when the lower numbers were tested).

The program stores each generated prime in an array, using the primes sequentially as divisors for

(continues)

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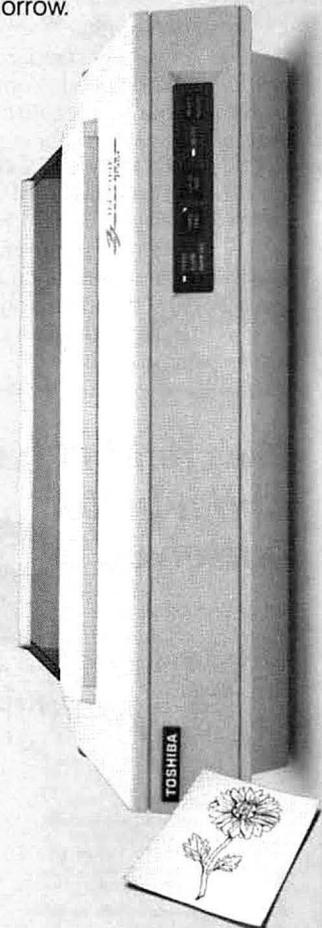
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testing each potential odd number. If an integer results from any such test, the program skips further testing of that number and begins testing the next odd number. If no integer results from testing with the entire series of primes less than the square root of the number, a new prime number is identified and added to the array. This process continues until the desired number of primes is generated.

*Joseph Gatewood
 St. Louis, Missouri*

Editor’s note: Indeed, using the PRIMES.BAS, the PC does “clock in” significantly faster than the Apple IIc, generating all primes less than 1000 in 32 seconds. You’ll need to change the size of the PRIME array defined in line 100 to find primes over 7500. The program runs even faster if you omit the PRINT statement from line 210.

Creating Batch Files With Echo
 Batch files reduce typing, information to remember, and errors, and generally speed things up. It’s not unusual to find 10, 20, or more batch files on a disk, especially a hard disk.

But batch files consume excessive disk space. Because of the way DOS works, files occupy space in multiples of a large value—usually 1024 or 4096 bytes, occasionally more.

(continues)

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As an example, you can include the line `echo basica menu.bas/f:6 > d:menu.bat` among the others in an AUTOEXEC.BAT file. (You can place it in any batch file, as long as it executes before you need the file it creates.) The greater-than symbol (>) sends the output of the ECHO command to a file instead of to the screen. When the AUTOEXEC.BAT file executes, it creates the batch file MENU.BAT on drive D:. The RAM disk runs the batch file more quickly than a floppy disk can, too.

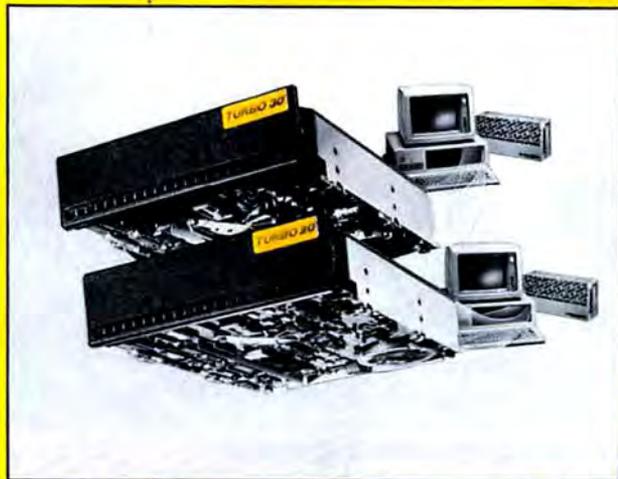
This technique can be enhanced by using the FOR subcommand. For example, the command `echo for %%%%%f in (cls dbase pause d:menu) do %%%%%f > d:db.bat` creates a batch file that clears the screen, runs dBASE, waits for you to press a key, and then runs a menu program on drive D:. Note that the line uses quadruple percent signs; they are necessary because DOS strips some of them as the command executes.

Bob Unferth
Wilmette, Illinois

Editor's note: You can create multiline batch files by sending several ECHO statements in a row to the same file, using double greater-than signs to append the new lines

(continues)

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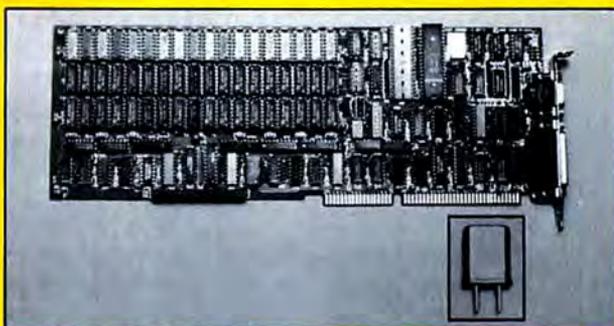


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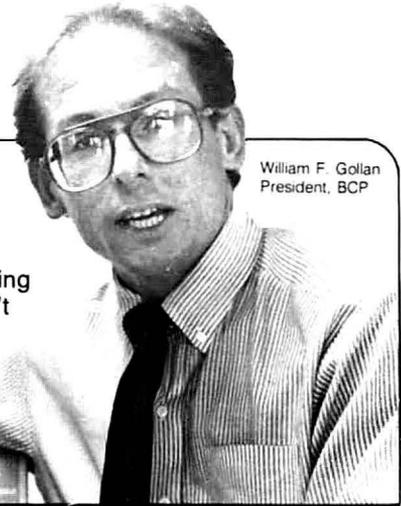
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Circle 972 on reader service card



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```
echo echo off >>d.bat
echo cls >>d.bat
echo prompt $p$g >>d.bat
echo pause >>d.bat
echo dir >>d.bat
```

BUILDBAT.BAT: Demonstrates using the ECHO command and I/O redirection to create batch files

to those already sent. For example, if you place the lines shown in BUILDBAT.BAT in an AUTO-EXEC.BAT or other batch file, they create a five-line batch file called D.BAT, which turns echo off, clears the screen, changes the DOS prompt, waits for the user to press a key, and then lists the directory of the current disk. Also, with the aid of the IF subcommand, it's easy to create a complex menu system that uses just two batch files.

Total Solution

Often, a row and a column of a worksheet should yield equal totals. Unfortunately, 1-2-3 offers no easy way to check this, since the spreadsheet can place only one value in a cell—either the sum of the row or the sum of the column. The formula below compares two totals from a hypothetical worksheet. If they match, the program

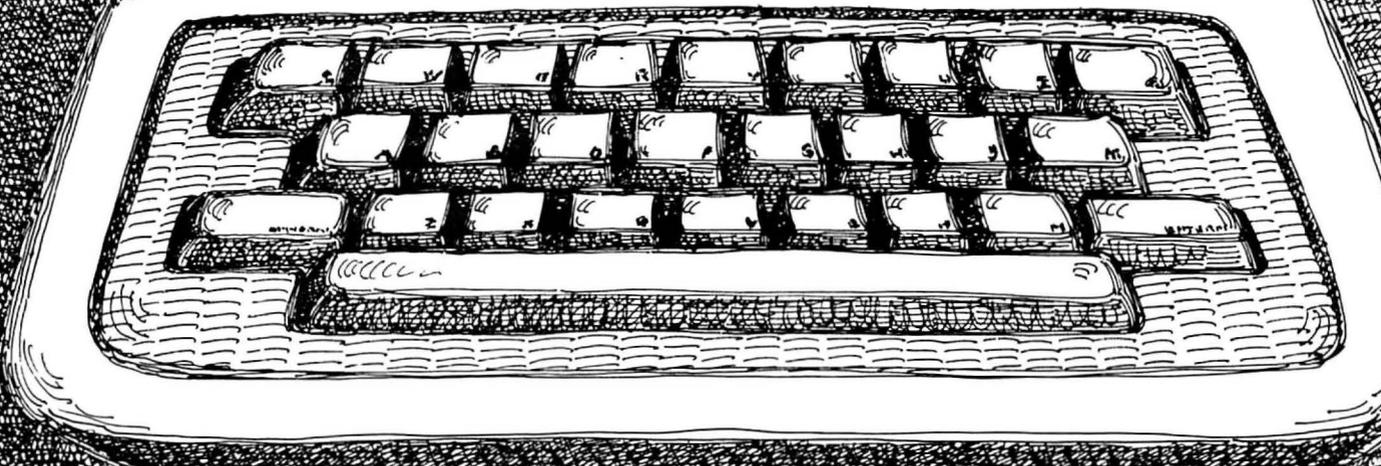
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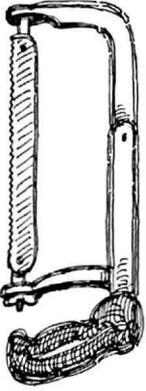
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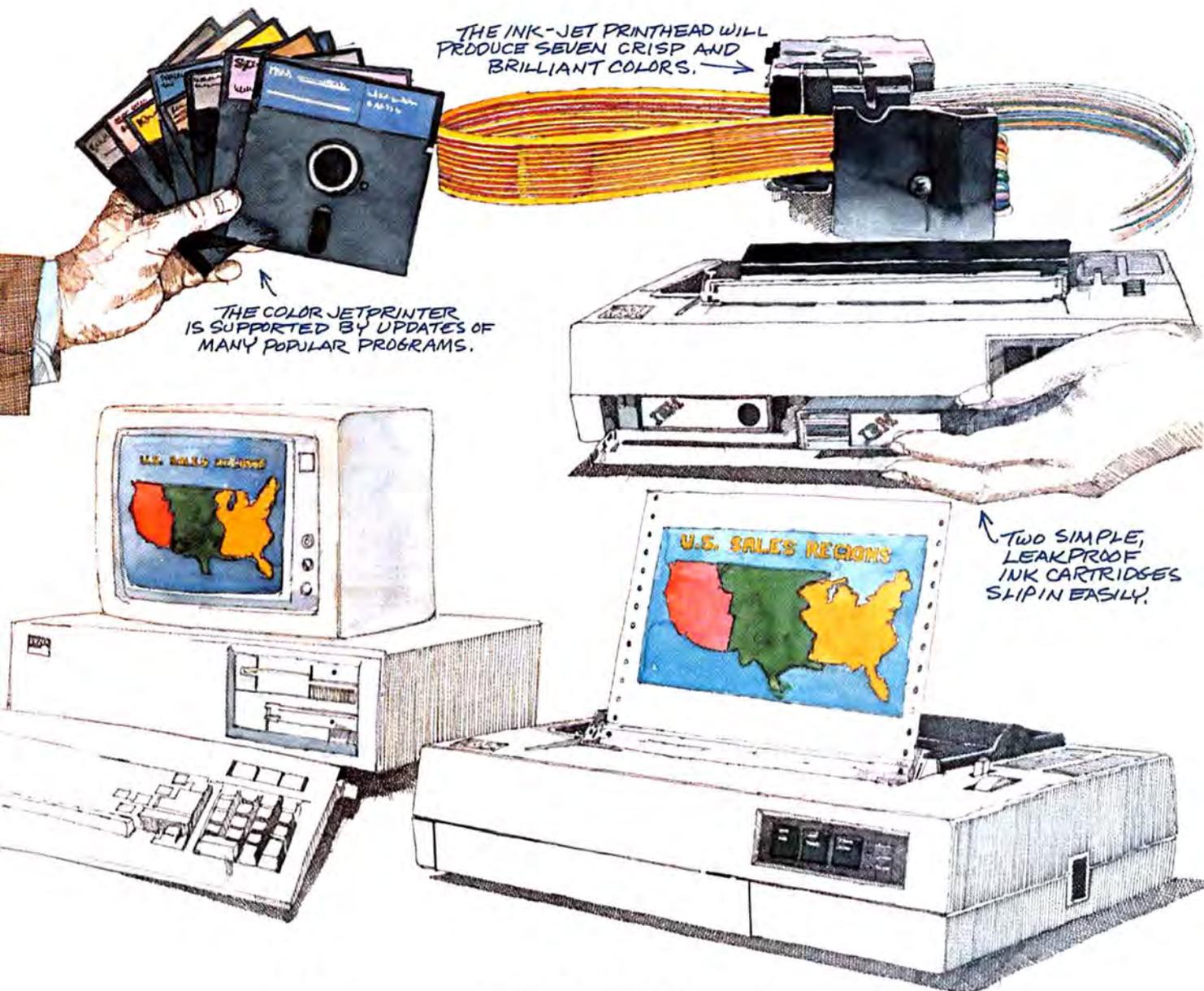
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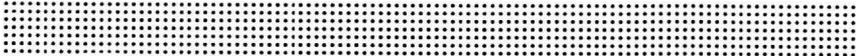
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Circle 358 on reader service card



```

10 DEFINT A-Z:CLS:KEY OFF:DEF FNHEX(X$)=VAL("&h"+X$)
20 LOCATE 3,1:PRINT "X-Maker":READ F$
30 LOCATE 5,1,1:PRINT "Now testing for data errors...please wait";
40 SUM=0:READ LN:IF LN<0 THEN 80
50 READ H$:IF VAL(H$)<0 THEN 70
60 SUM=(SUM+FNHEX(H$))*2:SUM=(SUM\256)+(SUM MOD 256):GOTO 50
70 READ CKSUM$:IF SUM=FNHEX(CKSUM$) THEN 40 ELSE GOTO 170
80 RESTORE:CLS:LOCATE 3,1:PRINT "X-Maker":READ F$
90 LOCATE 5,1,1:PRINT "Press any key except ESC to create ";F$;" ";
100 A$=INPUT$(1):PRINT:IF A$=CHR$(27) THEN END
110 LOCATE 6,1:PRINT "Working...";
120 OPEN F$ AS #1 LEN=1:FIELD #1,1 AS BX$
130 READ LN:IF LN<0 THEN 160
140 READ H$:IF VAL(H$)<0 THEN READ CKSUM$:GOTO 130
150 LSET BX$=CHR$(FNHEX(H$)):PUT #1:GOTO 140
160 CLOSE:PRINT:PRINT F$;" has now been created.":END
170 PRINT:PRINT "Error in DATA Line":STR$(LN);": ";
180 PRINT "Check your work.":BEEP:END
1000 DATA "a:qdel.com"
1010 DATA 1,BA,71,01,84,CD,75,5B,BE,A5,01,BF,5D,00,B9,0B,00,-1,A2
1020 DATA 2,80,3D,20,75,03,90,F3,A4,BA,5C,00,B4,11,CD,21,BA,-1,9C
1030 DATA 3,85,01,84,CD,75,3C,BE,81,00,BF,96,01,B9,08,00,F3,-1,DF
1040 DATA 4,A4,47,B9,03,00,F3,A4,BA,96,01,B4,09,CD,21,B4,01,-1,DE
1050 DATA 5,CD,21,3C,03,74,1A,3C,59,74,1E,3C,79,74,1A,BA,82,-1,53
1060 DATA 6,01,B4,09,CD,21,BA,5C,00,B4,12,CD,21,84,CD,74,C6,-1,B3
1070 DATA 7,CD,20,B4,09,CD,21,CD,20,BA,80,00,B4,13,CD,21,EB,-1,17
1080 DATA 8,DD,51,44,45,4C,20,5B,64,3A,5D,66,69,6C,65,6E,61,-1,5A
1090 DATA 9,6D,65,0D,0A,24,46,69,6C,65,20,6E,6F,74,20,66,6F,-1,57
1100 DATA 10,75,6E,64,0D,0A,24,20,20,20,20,20,20,20,20,2E,20,-1,BB
1110 DATA 11,20,20,3F,20,24,3F,3F,3F,3F,3F,3F,3F,3F,3F,-1,BB
1120 DATA -1

```

QDEL.BAS: Star-Dot-Star's X-MAKER program configured to create a file deletion utility program

displays the total; if the values differ, you'll see 'ERR'.

```

@if(@sum(g5..g16) = @sum(B17..F17),
@SUM(G5 ... G16),@ERR)

```

Of course, you'll have to change the cell references to match those of the row and column you wish to compare.

*Paul Cunningham
Seattle, Washington*

Queried Deletion

I have written a BASIC program called QDEL.COM that lets you selectively delete files from a disk.

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To create QDEL.COM, type in the X-MAKER. BAS program [*.*, PCW, August 1985] along

(continues)

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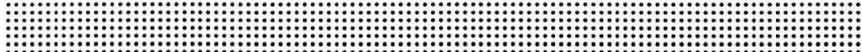
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```

10 'MACHINE.BAS: Identifies the type of IBM computer in use
20 'by testing the machine identification byte in ROM
30 '
40 SCREEN 0,1:WIDTH 80:KEY OFF:CLS
50 DEF SEG=&HF000:IDNUM=PEEK(&HFFFE)
55 MACH$ = "unrecognized computer"
60 IF IDNUM = 255 THEN MACH$ = "IBM PC"
70 IF IDNUM = 254 THEN MACH$ = "IBM PC/XT or Portable PC"
80 IF IDNUM = 253 THEN MACH$ = "IBM PCjr"
90 IF IDNUM = 252 THEN MACH$ = "IBM PC-AT"
120 PRINT "The computer in use is an ";MACH$;"":END

```

MACHINE.BAS: A simple program to determine the type of computer in use

with the data as shown in QDEL.BAS. Run that program to create QDEL.COM on your disk.

*Clifford Vander Yacht
Jackson, Michigan*

Positive Identification

The program shown in MACHINE.BAS identifies the type of IBM computer currently in use. This is accomplished by testing the value at location F000:FFFE in the ROM—the machine identification byte. MACHINE.BAS can be used as a subroutine in other programs to make them more portable between machines. For example, programs run much more rapidly on the AT and much more slowly on the PCjr than they do on the standard PC, XT, and Portable PC.

*Mike Williams
Middleton, Wisconsin*

Editor's note: Some interesting things show up when this program is run on compatible computers. Remember: When in doubt it's best to assume the machine is a standard IBM PC.

Same Time Next Month

While *dBASE III* performs many more date calculations than *dBASE II*, it's not capable of moving forward or backward in full months while maintaining the same day of the month, for instance, from January 5 to February 5. I have written the routines MTHFWRD.PRG and MTHBACK.PRG to accomplish this task.

I keep both these programs in a procedure file and call them when needed. The programs make adjustments for months that have different numbers of days. For example, when moving forward a month from January 30, the program calculates February 28. Similarly, when going backward, March 30 becomes February 28.

*Gary Colnar
Walsenburg, Colorado*

(continues)

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Circle 10 on reader service card

```
* MTHFWRD.PRG
* Calculates forward from the starting date
* Variables used:
* MDATE_FWD is supplied by the calling program
*           set to the starting date and will be
*           returned as the future date
* MCOUNT is supplied by the calling program as a
*           counter for the number of months to go
*           forward in time
* MTH, YR are used internally, then released

* Start of program
YR = year(MDATE_FWD)
MTH = month(MDATE_FWD) + MCOUNT
do while MTH > 12
    MTH = MTH - 12
    YR = YR + 1
enddo
MDATE_FWD = ctod(str(MTH,2) + '/' + str(day(MDATE_FWD),2) + '/' + str(YR,4))
if month(MDATE_FWD) > MTH
    MDATE_FWD = MDATE_FWD - day(MDATE_FWD)
endif
release MTH, YR
```

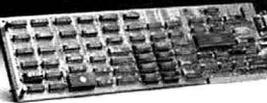
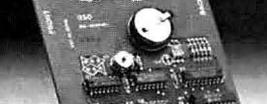
```
* MTHBACK.PRG
* Calculates backward from the starting date
* Variables used:
* MDATE_FWD is supplied by the calling program
*           set to the starting date and will be
*           returned as the prior date
* MCOUNT is supplied by the calling program as a
*           counter for the number of months to go
*           backward in time
* MTH, YR are used internally, then released

* Start of program
YR = year(MDATE_FWD)
MTH = month(MDATE_FWD) - MCOUNT
do while MTH < 1
    MTH = MTH + 12
    YR = YR - 1
enddo
MDATE_FWD = ctod(str(MTH,2) + '/' + str(day(MDATE_FWD),2) + '/' + str(YR,4))
if month(MDATE_FWD) > MTH
    MDATE_FWD = MDATE_FWD - day(MDATE_FWD)
endif
release MTH, YR
```

MTHFWRD.PRG and MTHBACK.PRG: dBASE III programs to move forward or backward in months while retaining the same date

(continues)

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Introducing Super Star Diskettes: the high quality diskette with the lowest price and the best LIFETIME WARRANTY!

In the course of selling more than a million diskettes every month, we've learned something: higher prices don't necessarily mean higher quality.

In fact, we've found that a good diskette manufacturer simply manufactures a good diskette...no matter what they charge for it. (By way of example, consider that none of the brands that we carry has a return rate of greater than 1/1,000th of 1 percent!)

In other words, when people buy a more expensive diskette, they aren't necessarily buying higher quality.

The extra money might be going toward flashier advertising, snazzier packaging or simply higher profits.

But the extra money in a higher price isn't buying better quality.

All of the good manufacturers put out a good diskette. Period.

How to cut diskette prices ...without cutting quality.

Now this discovery posed a dilemma: how to cut the price of diskettes without lowering the quality.

There are about 85 companies claiming to be "diskette" manufacturers.

Trouble is, most of them aren't manufacturers.

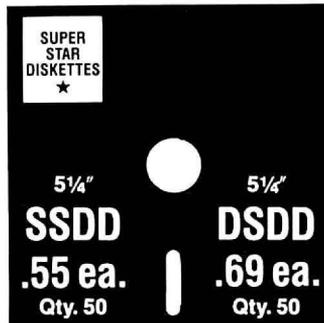
Rather they are fabricators or marketers, taking other company's components, possibly doing one or more steps of the processing themselves and pasting their labels on the finished product.

The new Eastman Kodak diskettes, for example, are one of these. So are IBM 5 1/4" diskettes. Same for DYSPAN, Polaroid and many, many other familiar diskette brand names. Each of these diskettes is manufactured in whole or in part by another company!

So, we decided to act just like the big guys. That's how we would cut diskette prices...without lowering the quality.

We would go out and find smaller companies to manufacture a diskette to our specifications...specifications which are higher than most...and simply create our own "name brand" diskette.

Name brand diskettes that offered high quality at low prices.



Super Star diskettes are sold in multiples of 50 only. Diskettes are shipped with white Tyvec sleeves, reinforced hubs, user ID labels and write-protect tabs.

Boy, did we get lucky. Our Super Star Diskettes are the same ones you've been using for years...without knowing it.

In our search for the low priced, high quality diskette of our dreams, we found something even more interesting.

We found that there are several manufacturers who don't give a hoot about the consumer market for their diskettes. They don't spend millions of dollars in advertising trying to get you, the computer user, to use their diskettes.

Instead, they concentrate their efforts on turning out the highest quality diskettes they can...because they sell them to the software publishers, computer manufacturers and other folks who (in turn) put their name on them...and sell them for much higher prices to you!

After all, when a software publisher or computer manufacturer or diskette marketer puts their name on a diskette, they want it to work time after time, everytime. (Especially software publishers who have the nasty habit of copy-protecting their originals!)

Super Star Diskettes. You already know how good they are. Now you can buy them...cheap.

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Super Star diskettes don't roll off the boat from Pago-Pago or emerge from a basement plant just east of Nowhere.

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Super Star Diskettes are good. So good that a lot of major software publishers, computer manufacturers and other diskette marketers buy them in the tens or hundreds of thousands.

We buy them in the millions.
And then we sell them to you.
Cheap.

**When every little bit counts,
it's Super Star Diskettes.**

You've used them a hundred times...under different names.

Now, you can buy the real McCoy, the same diskette that major software publishers, computer manufacturers and diskette marketers buy...and call their own.

We simply charge less.

Super Special!

Order 50 Super Star Diskettes and we'll be happy to sell you an Amaray Media-Mate 50 for only \$8.75, shipping included...a lot less than the suggested retail price of \$15.95.



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Super Star Diskettes are unconditionally warranted against defects in original material and workmanship so long as owned by the original purchaser. Returns are simple: just send the defective diskettes with proof of purchase, postage-paid by you with a short explanation of the problem, and we'll send you the replacements. (Incidentally, coffee stained diskettes and diskettes with staples driven through them don't qualify as "defective".)

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Circle 780 on reader service card

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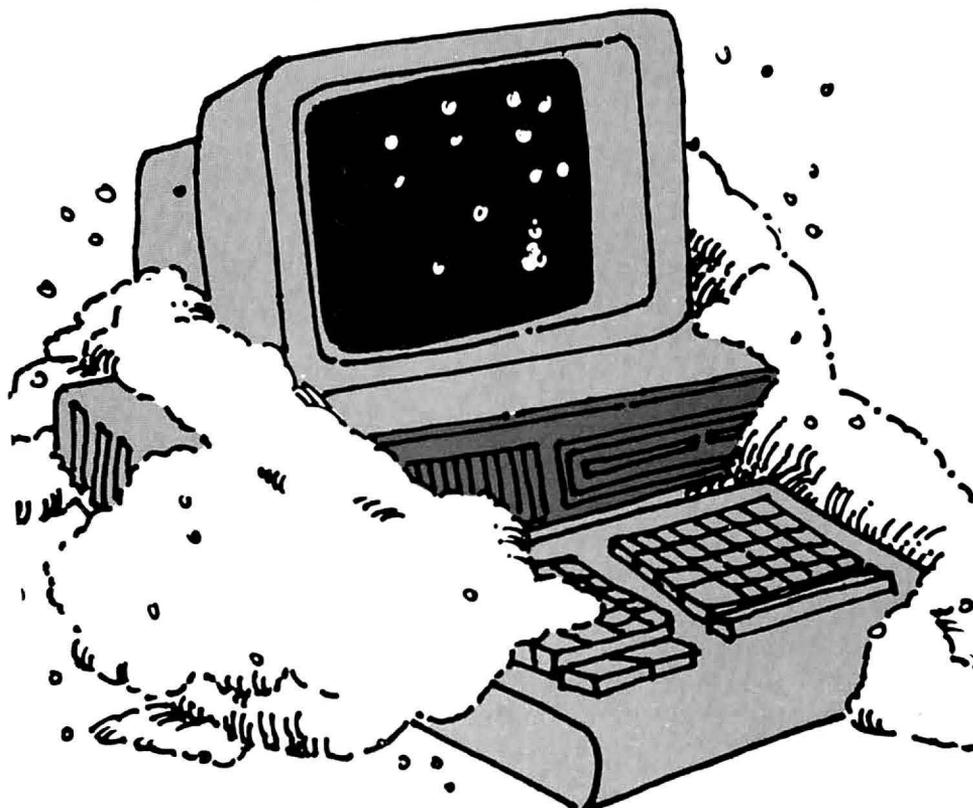
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READ/RIGHT™



Circle 582 on reader service card

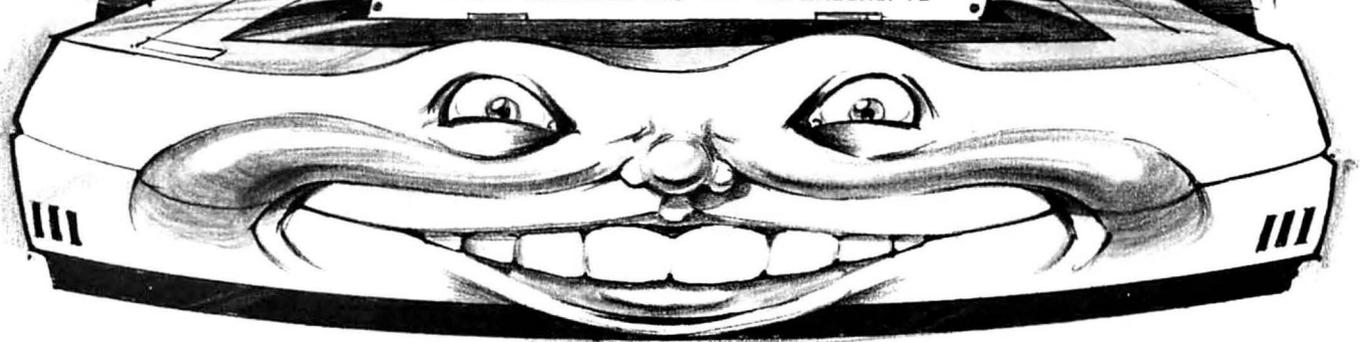
RENDIR Correction

The data to create the program RENDIR.COM was published with an error (*.* , PCW, August 1985). To correct the error, replace line 1070 with the following: **1070**

DATA 7,FF00,00,00,00,10, -1,20, -1

*Join the *.* global exchange. We'll pay \$25 to \$100 for each item published. Send your personal computer discoveries to Star-Dot-Star, PC World, 555 De Haro St., San Francisco, CA 94107, or electronically to CompuServe 74055,412 or The Source STE908. All published submissions become the property of PC World and are subject to editing for length and style. Due to the volume of mail, we cannot return any submitted materials. ●*

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Boxed in 10's with heavy-duty cardboard sleeves, user ID labels,
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Two years ago, if you'd told me I'd be writing this ad, I would have laughed.

At that time, Wabash diskettes were synonymous with "s—t".

Just saying that quality control was poor would be charitable.

So much was wrong that DISK WORLD! wouldn't sell them.

That was yesterday.

Kearney-National Inc., a \$202-million division of a much larger company, came into Wabash.

Out went the old management, the old methods, the old production techniques...and in went a lot of new people, ideas, production lines and some really imaginative thinking.

The end result.

Today, I'm proud to offer you the Wabash Pinnacle Series of diskettes at the prices shown.

This isn't evolution in diskette manufacturing; it's revolution.

Here's what you get.

- Wabash Pinnacle diskettes are
- ...certified 100% Error Free
- ...are covered by a LIFETIME WARRANTY
- ...meet or exceed all industry specifications (by quite some distance)
- ...and are simply the best value in diskettes available today.

The torture test.

Considering Wabash's earlier dubious reputation, I wasn't exactly a true believer when their Director of Marketing came into my office with samples.

So I took a box at random, selected a disk, bent the thing every which way and slipped it into my IBM-PC. It formatted. It booted. It stored and retrieved data.

That wasn't enough.

I gave samples of the diskettes to Curt Rostenbach and, in turn, to Tom Streit, both hackers of long experience and members of the Waukegan (Illinois) Apple Users Group.

Tom really went at it.

He took a quartz-halogen lamp, aimed it at the diskette until it started to smoke (and melt)...and then formatted, booted the diskette and stored and retrieved data!

The same terribly (and intentionally) mutilated diskette ran on an ITT, Corona and IBM.

Curt was nicer.

He simply bent the diskette every which way...and it still formatted, booted and ran on his Apple.

The best buy I've ever seen.

DISK WORLD! Inc. sells more flexible magnetic media by mail-order than anyone else in the world.

I, as President of the corporation, won't tolerate a product with a failure rate of more than 1/1000th of 1 percent.

I also don't like companies who try to milk a "quality" or "premium" image for a higher price like Dysan and Verbatim did...until they failed.

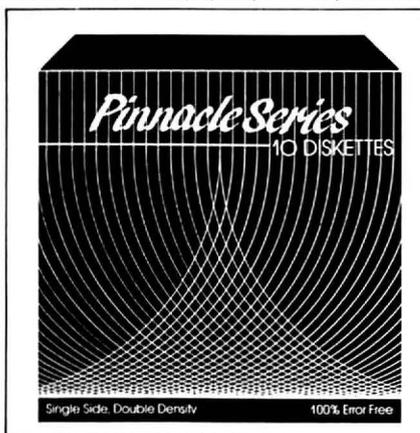
As President of DISK WORLD! Inc., my motto is simple: "the best diskette for the least amount of money."

Wabash is it.

Right now, there is no better value than the Wabash Pinnacle Series of diskettes.

Granted, you have to buy a hundred at a time, but so what? Split the order with friends, relatives, co-workers or even your worst enemies.

The key thing is to get the most diskette for the money. And this is it. (Incidentally, as a corporation, we put our money where our



mouth is. Our first order for Wabash Pinnacle Diskettes was 1.5-million units.)

That's an awful lot of faith and confidence. But, then again, I have the diskette that Tom Streit literally melted...and kept on running.

The truth about \$1.00 or less diskettes.

More and more ads are popping up offering diskettes for \$1.00 or less.

By the same token, more and more people who were selling used cars a few months ago are now selling diskettes by mail.

We did a little survey of current ads for diskettes advertised for a dollar or less and did some analysis of the market and here's what we found as it applies to 5.25" DSDD diskettes "supposedly" selling for a dollar or less.

VENDOR:	ADVERTISED LOW PRICE:	ACTUAL PRICE PER 100:	ACTUAL MFGR.:
Unitech	89 ea.	92 ea.	Unspecified.
Datatech	99 ea.	99 ea.	Unspecified.
Computer Club	95 ea.	98 ea.	Unspecified.
		99 ea.	1.02 ea. Unspecified.
Communications & Electronics	49 ea.	80 ea.	Unspecified.
Precision Data	89 ea.	93 ea.	Unspecified.
Diskette Connec.	93 ea.	93 ea.	Unspecified.
Comp Soft Serv.	77 ea.	77 ea.	Unspecified.
Computer/Computer	99 ea.	99 ea.	Unspecified.
DISK WORLD	89 ea.	92 ea.	Unspecified.

The real truth about \$1.00 or less diskettes.

It costs all diskette manufacturers about the same to produce a diskette. Some may charge more because they want to project a "premium quality" image, ala the late, lamented Dysan who bought their basic media from 3M.

Some charge less because they sell a sub-standard product...and we're not foolish enough to name names here.

But here's the truth about the \$1.00 or less diskette market. It falls into four categories:

1. The DISK WORLD's of the universe who simply are so big that they can buy first quality product in massive quantities and choose to pass on the savings to you. (Precision Data and Diskette Connection on **BRAND NAME** products also fall into this category.)

2. The people who buy "cosmos"...stuff from major manufacturers that usually hits quality control standards, but is cosmetically blemished and thus can't be packaged and sold under the manufacturer's own name.

3. "Duplicator Quality". Uncertified media, usually below manufacturer's own standards and frequently below ANSI and IBM standards. Sold on an "as-is" basis with the understanding that the manufacturer's name will never be divulged. Usually about a 20% reject rate...as compared to DISK WORLD's standard of less than 1/1000th of 1% reject/return rate. Next to garbage, this is the source of most diskettes advertised at a dollar or less.

They may work...and then again they may not. (Frankly, the odds at the Blackjack table in Las Vegas are more in your favor.)

4. Garbage. Stuff that shouldn't be sold at all. But some manufacturers are hurting for cash, so they sell it anyway. (After all, they want to meet their payroll. Look what happens when you don't: you become a Dysan or Verbatim. Lots of history, but no money.) More and more garbage is being dumped into the market as manufacturers become pressed for cash and are motivated into selling anything and everything they can manufacture. (Read the article in FORBES about Verbatim and its "Bonus" brand.)

Finally, the Taiwanese counterfeiters are moving into the act. Perfect duplicates of the packaging of major manufacturers with one exception: the quality isn't there.

The Critical Factor.

Only DISK WORLD! Inc. offers fully brand-identified, LIFETIME-WARRANTY product for less than a dollar.

Every one else offering 5.25" product for less than a buck doesn't tell you who makes it.

We do.

And that ought to tell you a lot right there.

Ordering & Shipping Instructions

SHIPPING: Wabash Pinnacle Diskettes are sold in multiples of 100 only. Shipping charges are \$3.00 per 100, regardless of type or size.

PAYMENT: VISA, MASTERCARD and PREPAID orders accepted. Corporations rated 3A2 or better and government and quasi-government open accounts are accepted on a NET 15 basis.

C.O.D. orders are subject to a \$5.00 special handling charge. (Sorry for the increase, but too many people have been refusing C.O.D. orders or using bad checks. It's a classic example of a few "bad eggs" making life more expensive for everyone else.)

AP0, FPO, AK, HI & PR ORDERS: Include shipping as shown and an additional 5% of the total amount of the order to cover PAL and insurance.

No other non-continental U.S. orders are accepted.

TAXES: Illinois residents only, add 7%.

MINIMUM ORDER \$35.00

All orders subject to acceptance. Not responsible for typographical errors.

ORDERS ONLY:

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(In Illinois: 1-312-256-7140)

INQUIRIES & INFORMATION

1-312-256-7140

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Wilmette, Illinois 60091

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PC 20 MB 1, 1 or 2 floppies	IBM XT 10 MB 256k, 1 or 2 floppies	IBM AT 20 MB 512k, 1 or 2 floppies
PC 30 MB 1, 1 or 2 floppies	IBM XT 20 MB 256k, 1 or 2 floppies	IBM AT 30 MB 512k, 1 or 2 floppies
PC 10 + 10 1, 1 or 2 floppies 3 HD & 10MB Backup	IBM XT 30 MB 256k, 1 or 2 floppies	IBM AT 40 MB 512k, 1 or 2 floppies



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COMPAQ PORTABLE 256k, 1 or 2 floppies	COMPAQ DESKPRO 30 MB Backup Available	IBM AT COMPATIBLE Custom Configurations
COMPAQ PORTABLE 10 MB 256k, 1 or 2 floppies	COMPAQ DESKPRO 40 MB Backup Available	IBM COMPATIBLES ARE YOUR LOW COST ALTERNATIVE

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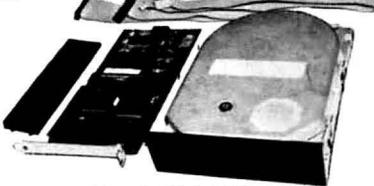
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 Fully compatible with IBM PC and XT. Comes with Ram card and print spooler software.

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 Single bin feeder, mechanically driven for high reliability - no electronics, no motor. Easy installation. Available for Diablo 630/630, C. Itoh F-10, NEC 3550 (please specify). \$399

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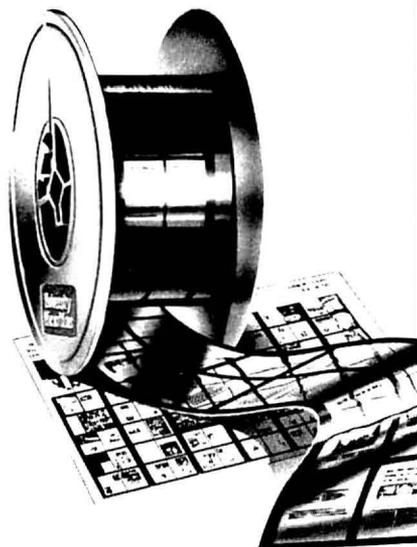
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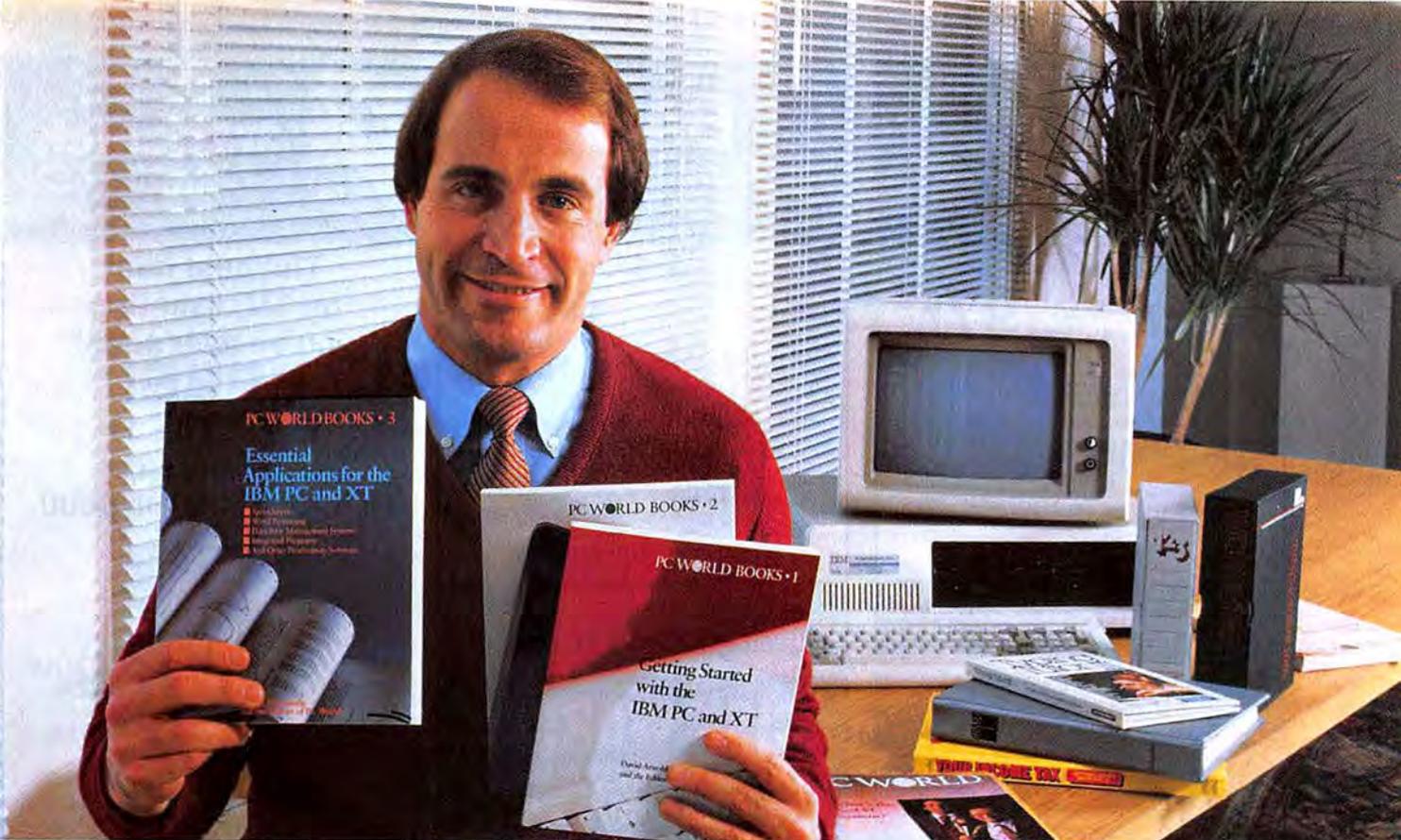
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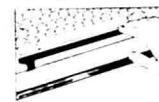
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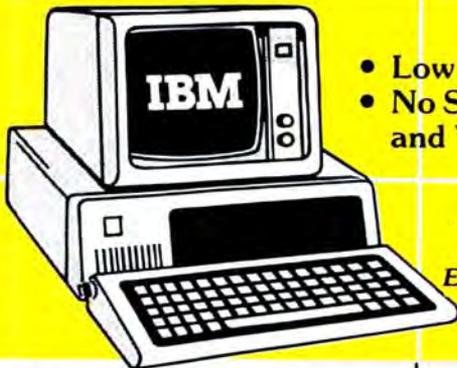
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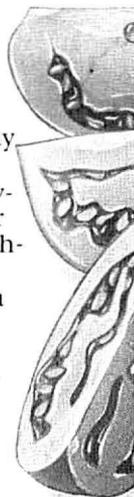
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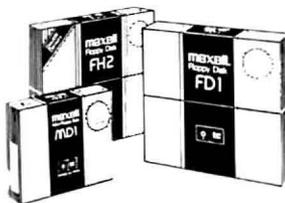
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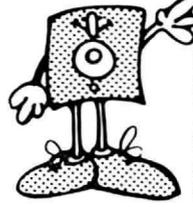
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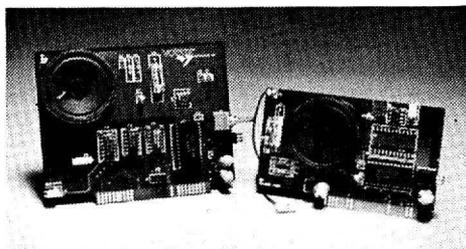
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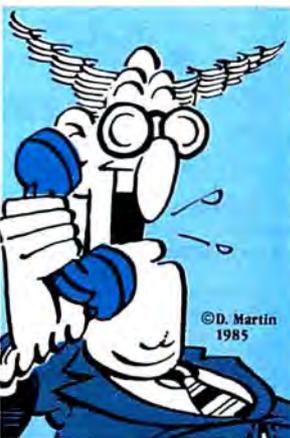
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42MB Internal AT/XT	2195	1755
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Sysgen

Sysgen II G-20	3995	2938
Quic-File 45 Int. AT	1395	1058
Quic-File 45 Ext.	1495	1115
Image 10MB Tape B.U.	995	805

Tallgrass Technologies

25MB/60MB Tape B.U.	3495	2815
80MB/60MB Tape B.U.	7495	6260

MEMORY EXPANSION CHIPS

64K RAM Set of 9		19
256K RAM Set of 9		69

MODEMS

AST Reach 1/2 Card 1200	549	395
2400 Baud Sync	795	716
Anchor Mark XII	399	240
Hayes Smartmodem 1200	599	430
Smartmodem 2400	899	655
Prentice Poppcom X 100 External	475	380
U.S. Robotics Courier 2400	699	490

MONITORS

AMDEK Amber 310A	230	159
Color 500 RGB	450	335
Color 600 RGB	599	430
Color 710 RGB	799	540

PGS

Max 12 Amber	249	179
HX 12 RGB	695	466

MULTIFUNCTION CARDS

AST MegaPlus II 64K	395	265
SixPakPlus 64K w/Sidekick	395	275

Intel

Above Board 64K	395	308
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Orchid Technology

PC Turbo 256K w/Blossom Dgter d	895	677
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Quadram

Quadboard "O"K	325	230
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PLOTTERS

	Retail Price	Micro Flash
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Houston Instruments DMP 51 or DMP 52	5995	4676
DMP 695	799	640
DT-114 Digitizer	810	720

Roland

DXY 880	1295	970
Nicolet Zeta Zeta 824		CALL

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MSP 15 160 CPS	649	489

Diablo

630 API	2095	1704
150 Inkjet	1295	1025

Epson

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FX-85	499	370
FX-185	699	520
JX-80 Color	699	498
LQ 1500	1295	920

JUKI

6300	995	750
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Okidata

Microline 192 IBM	499	385
Microline 193 IBM	699	545
Microline 84P	899	710

NEC

Elf 360, S/W & Cable	595	468
3550 Spinwriter	1440	1030

Qume

Sprint 1140	1681	1379
Sprint 1155	1895	1565

Toshiba

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1351	1895	1345
351 Par/Ser.	1945	1375

TERMINALS

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KT-7ASCII 14 inch	945	819

Wyse

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WY-75	799	650

Televideo

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925	995	799

Qume

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Microsoft Serial Mouse w/Paint Brush	195	155

Mouse Systems

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Power Backup	559	454
Isobar 4	89	62

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Innovative Software

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Microrim

R:Base 5000	700	425
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Software Publishing

PFS:File	140	99
PFS:Report	125	88

GRAPHICS

BPS

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Graphic Communications

Graphicwriter	395	279
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Microsoft

Chart	250	160
Windows		CALL

Software Publishing

PFS:Graph	140	99
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LANGUAGES

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Turbo Pascal w/8087	95	69

Digital Research

C Compiler 3.0	350	220
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Microsoft

FORTRAN Compiler	350	230
C Compiler	395	276

Nantucket

The Clipper Compiler	695	495
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SCHEDULING

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Harvard Software

Total Project Manager	495	309
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Microsoft

Project	250	155
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Software Publishing

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Microsoft

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UTILITIES

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SideKick Unprotected	85	48
SuperKey	70	45
Bourbaki '1 Dir'	95	60
Digital Research GEM Desktop	50	35
Funk Software Sideways	60	35

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Living Videotext

Think Tank	195	107
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Micropro

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Microsoft

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Multimate International

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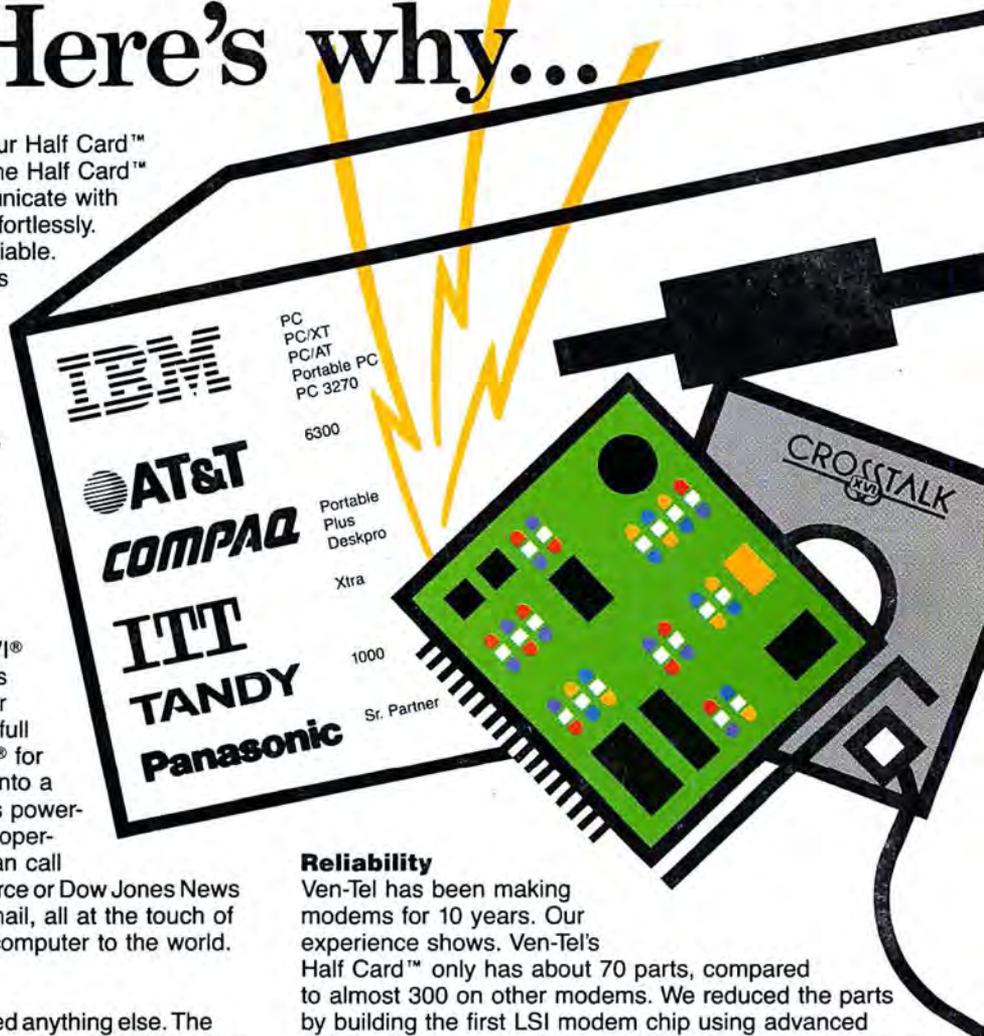
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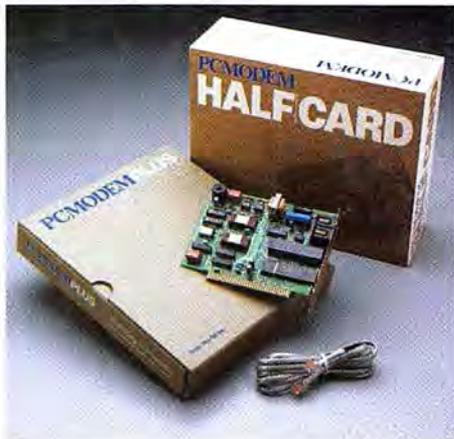


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