

PC WORLD

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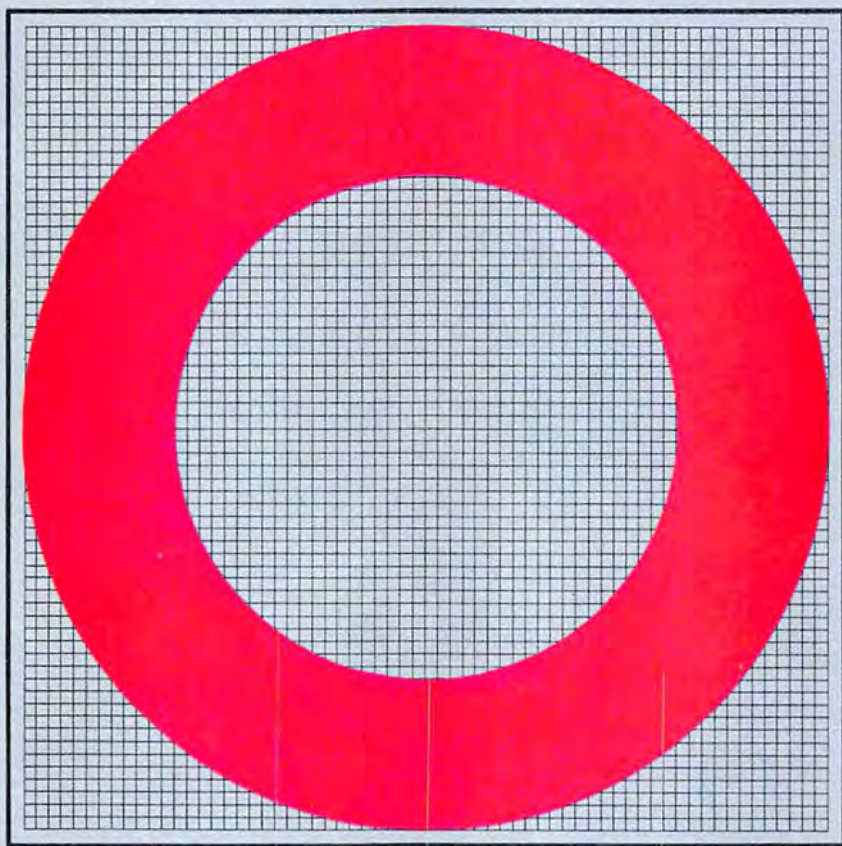
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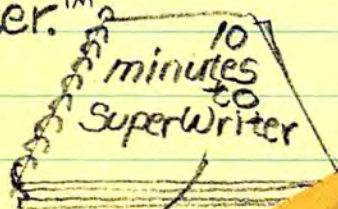
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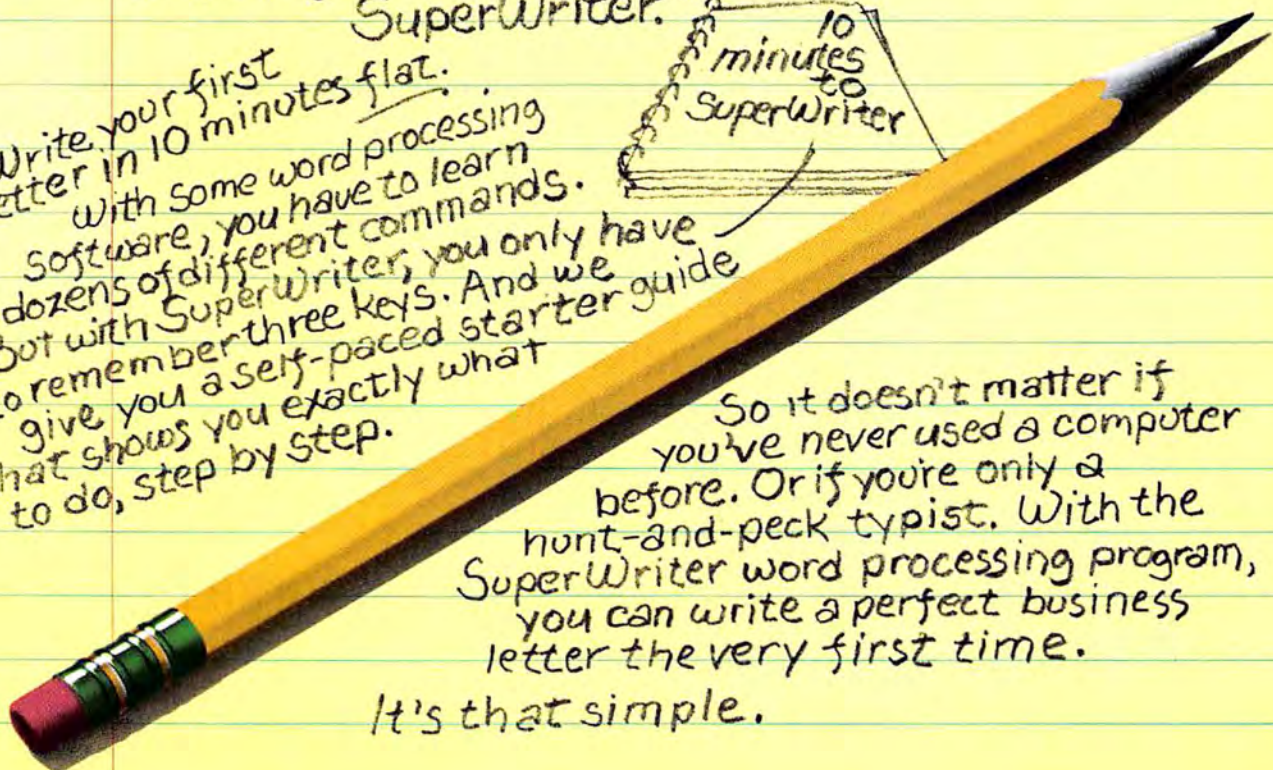
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PC WORLD

*The Personal Computer Magazine for
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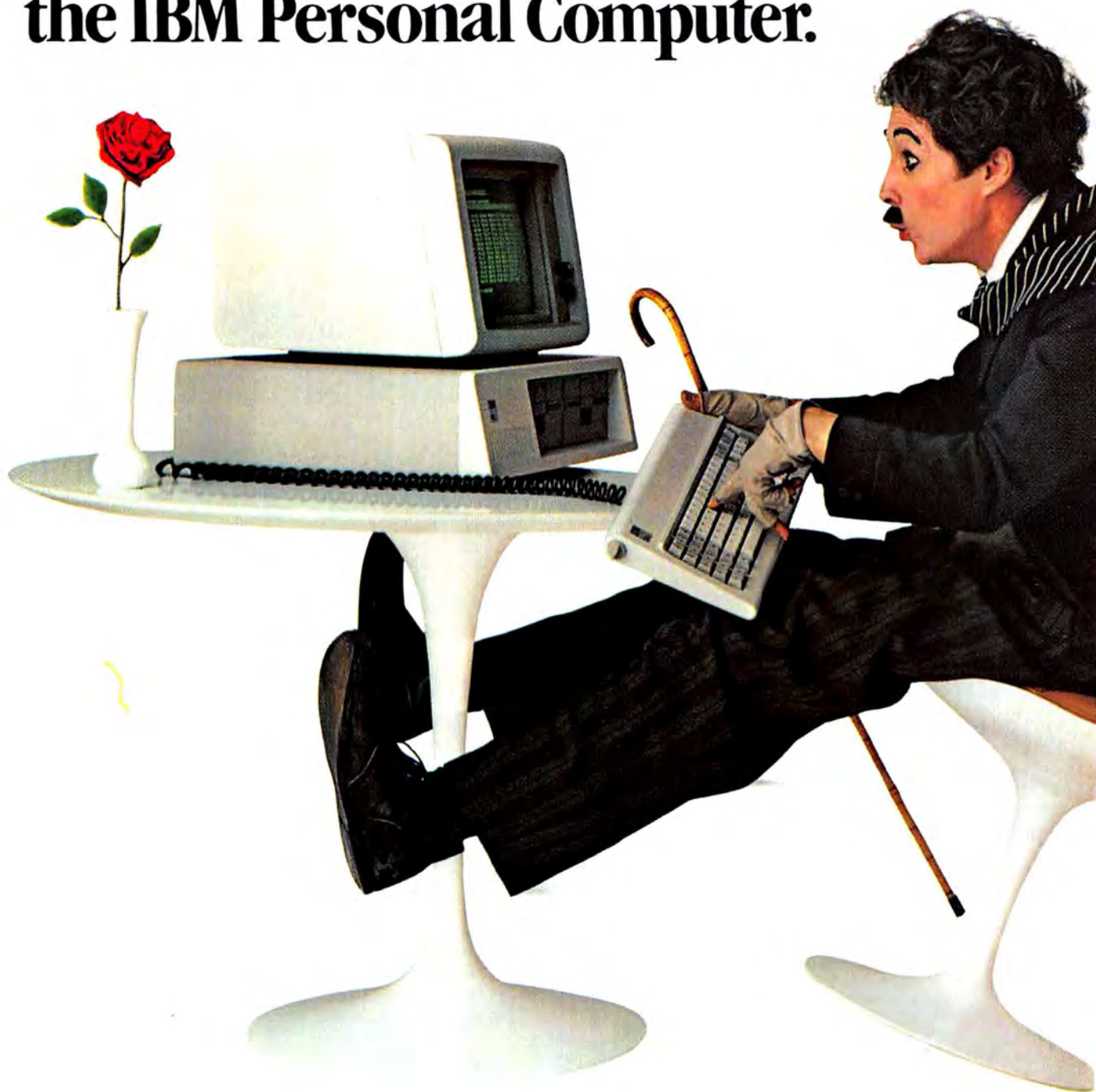
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How to test drive the IBM Personal Computer.



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Auxiliary Memory 2 optional internal diskette drives, 5¼" 160KB/180KB or 320KB/360KB per diskette	Languages BASIC, Pascal, FORTRAN, MACRO Assembler, COBOL	<i>Graphics mode:</i> 4-color resolution: 320h x 200v Black & white resolution: 640h x 200v Simultaneous graphics & text capability
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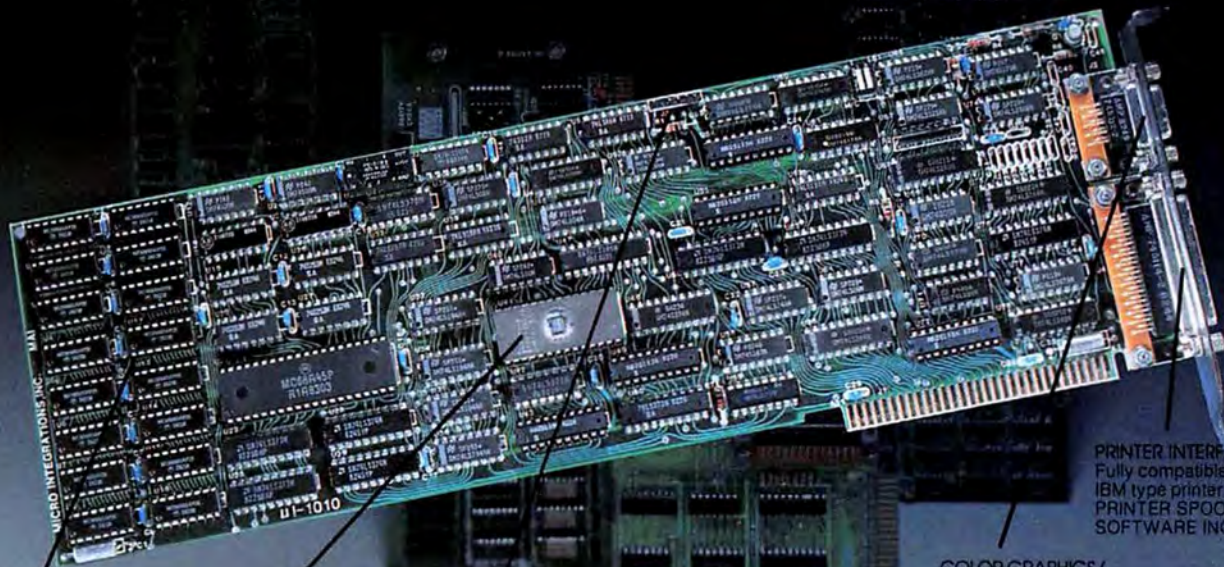


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PC Lingo

Many people are so intellectually tantalized by their PCs that they are rapidly merging PC jargon into their everyday conversation. Take the symbol *k*, for example. Depending on who you are talking to and under what circumstances, it means either 1000 or 1024. In computer terminology, memory is often measured in kilobytes (K) or in megabytes (M). It is not uncommon to hear people speak of other commodities such as money (an \$80K salary, for example, is megabucks) using these computer memory designations.

Concurrent (more lingo!) with the transformation of PC jargon to everyday speech is the reverse process, by which everyday words and phrases become computer jargon. Two current examples are *compatibility* and *integration*.

During the heyday of encounter groups and *Psychology Today* in the '60s, *compatibility* was one of the most common buzzwords of a prevalent pastime—pop psychology. In the '80s *compatibility* is a computer buzzword that means that two computers can use the same software, or nearly use it. The word is no more precise as a computer term than it was in its pop psychology days.

In the computer community, the word *integration* no longer conjures



up images of civil rights struggles; instead, it means two or more applications wrapped up in one program.

Does our involvement with PCs and the changes in language that mirror this reality make us less concerned with social issues? Or is it in fact the opposite? I am convinced that learning about computers helps us understand our own thinking and communications processes. In this sense PC awareness has a definite humanizing potential.

Think about the term *co-processors*. Some computers have, in effect, two brains. One brain can be dedicated to one set of tasks while the other is dedicated to the remaining tasks, or the two can share the same functions and thereby speed up computation time.

Some people believe that the human brain also has co-processors, a right brain and a left brain. Common wisdom has it that the right brain performs artistic and conceptual thinking, while the left brain handles logic and common sense. But suppose that, like computers, we could choose to teach (program) our right and left brains to act as co-processors that could handle the same or different types of tasks at one time. This would allow us, for example, to follow two lines of thought at once or read a book while carrying on a conversation. After learning to use our co-processors, we could move on to multiprocessing.

No one can know for sure if the ultimate impact of computers on our society will be good, bad, or indifferent—or if they will have any ultimate impact at all. While PCs are becoming tremendous information tools that can unleash human potential on a new scale, other computers are being used to create nuclear weapons systems. The outcome, of course, will be determined by how we decide to use computers.

So meanwhile, compatible people, keep on processing that input and transmitting those kilobytes, and don't forget to back up your data. ●

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Now your IBM[®] PC can do more than one thing at a time.



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Reader Service #62


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Our expertise in both hardware and software has gone into the development of the Microsoft Mouse. Now you can plug in the most exciting computer product of the year and put it to work.

The Mouse lets you move the cursor freely and naturally, then execute commands at the push of a button.

The Microsoft Mouse is a complete system. It comes with an on-screen tutorial, a practice application, and the Multi-Tool™ Notepad, a mouse-based text editor, so you can begin using the Mouse right away. And for application developers, the Mouse includes a programmable

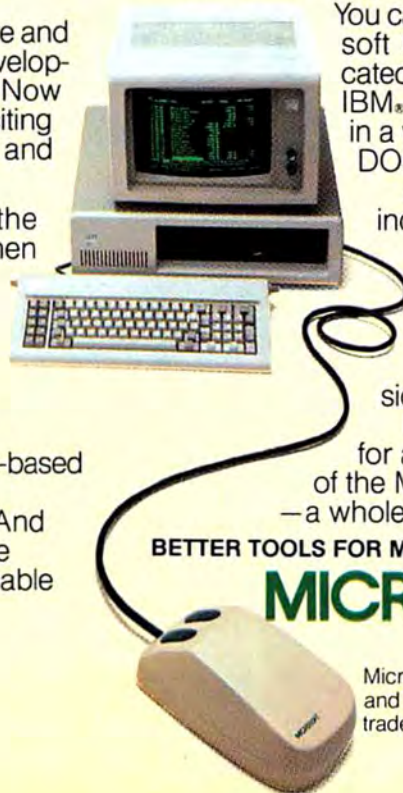
interface driver to give your application program complete control over the Mouse's operation.

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You can get the Microsoft Mouse in dedicated versions for the IBM®-PC, PC XT, and in a version for MS-DOS machines with serial interfaces, including the IBM-PC. The Mouse supports all versions of MS-DOS, including version 2.0. Ask your Microsoft dealer for a demonstration of the Microsoft Mouse — a whole new standard.

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Software by Subscription

In the days before the personal computer we used to hire people on occasion to come into our offices and perform services such as typing, drawing, filing, and sorting. These services kept a number of clerical workers busy. Now, without thinking that the computer is performing a service for us, we purchase computer programs that assist us in these activities.

The programs that perform these tasks are not without flaws. Software developers are always looking for ways to refine their products—adapting to advances in computer technology and trying to stay ahead of the competition. Unfortunately, software manufacturers do not emphasize the evolutionary nature of computer software in their marketing strategies.

Until now software sellers have had a field day because consumers are easily impressed by a full-color, glossy package. Like an expensive box of candy, the typical software package is sold in the finest wrapping and promoted as an object to be desired and consumed, with little or no maintenance required. But consumers seek out software not to use and then discard; rather, they are looking for solutions to ongoing needs. Manufacturers try to make us forget this fact so that we will put up with a product's defects and limitations.



The software industry should focus more on providing adequate service to users than on sophisticated advertising and packaging. The nature of service is to be sensitive to the client, the recipient of the service. Publishers should provide every software product as an ongoing service to users. Developers need to bring products to a functional state of completion before putting them on the market. Products that have potential defects or have not been fully tested should be labeled as such.

After a product's introduction, the software publisher should cultivate a continuing service relationship with its customers. One of the best examples of such a relationship can be found in the pages you are now reading. With a magazine you receive the benefits of the subscription process. When you subscribe, you don't expect every issue to be the same. You expect change, novelty, and current information.

If only we could enjoy the same benefits when we subscribe to the services of the software publisher. Instead, we get one copy of the program. Maybe it allows us to make a backup copy. If the software is copy protected, we feel the need to wear surgical gloves when we use it, for fear the program will disappear in our hands.

Why can't software publishers offer periodic updates or editions? Surely providing updates creates overhead, but overhead can be minimized if users are required to show proof of purchase and pay a nominal fee for the update. Purchasers expect that the price they pay for a software package includes the good will of the publisher. Why not make that good will explicit?

Many people buy software only to find that the program crashes, destroys data, and sometimes even erases itself. These purchasers are

REMark

often told by the publishers to buy the program again or are put on hold when they telephone. Eventually they may decide not to bother complaining. The next year the same program may be sold without the bugs, which means that everyone but the customer who had early faith in the product gets to use a trouble-free package.

No customer should ever be made to feel that others have been treated more generously. Software publishers

Software publishers
create a sense of betrayal
in customers by
not keeping them up-
to-date.

worry that their work will be illegally copied, yet they create a sense of betrayal in customers by not keeping them up-to-date. A dissatisfied customer may be tempted to copy a friend's new version of the program, a practice that software publishers concerned with copy protection do not want to encourage.

The word *customer* used to mean the same thing as *consumer*, except that *customer* implied that it was the consumer's "custom" to buy regularly from a certain vendor. Clearly, this customary relationship continued because the vendor made it worthwhile for the customer to return.

One way to establish a customary relationship between software publishers and customers is to structure software vending so that it uses the subscription process. Such a method would ensure that people be able to

get a copy of the most current version of a program for a nominal fee. To get updates they would return the disk with the original label on it to the publisher. As long as the disk arrived accompanied by a prepaid, self-addressed mailer, the publisher could copy the latest version of the program onto it, put it in the mailer, and drop it in the mailbox. Documentation could be made available to customers for a fee with proof of purchase. The overhead to implement this method wouldn't have to be great and could be factored into the publisher's business plan.

The personal computer software industry has not yet recognized software development as a complex, evolving process that requires close interaction between users and programmers. Products that evolve gradually are usually durable because their complexity results from a carefully woven series of decisions based on user experiences and technological progress. Such a process is never really finished.

I expect that in a short time we will see less of the software publisher who puts a product on the market, pockets the money, and tells the customer to take a hike. As the industry matures, we will see more of the kind of publisher who provides a way for customers to benefit from the most updated version of a software investment. Over the long haul, satisfied customers are a better advertisement than fancy packaging. ☸

Nelson Johnson is the author of a three-dimensional computer-aided design program called MicroCAD. His special interest is combining architectural and civil engineering with personal computer technology.

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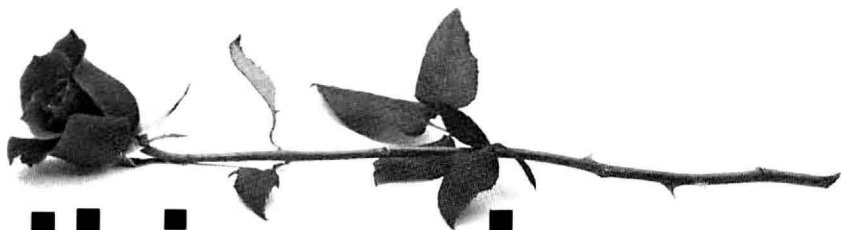
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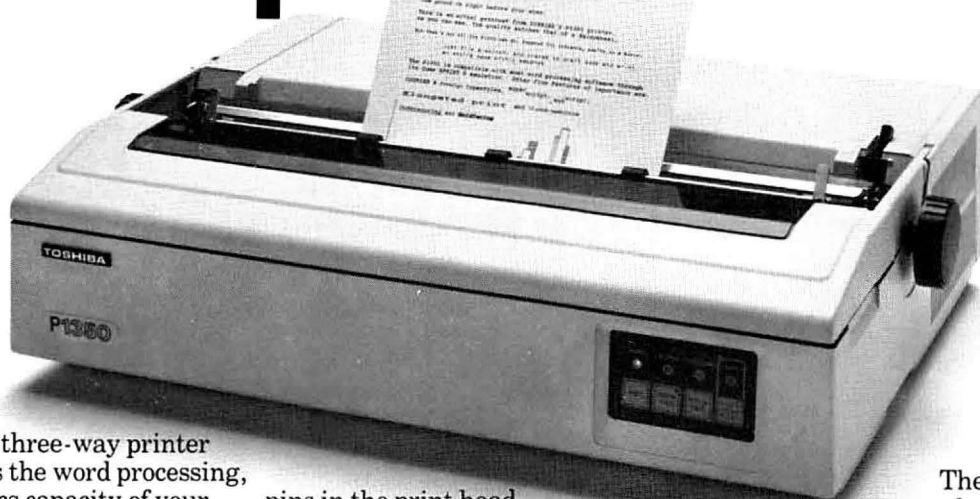
In Touch with Tomorrow

TOSHIBA

Reader Service #285



Nothing shows off your IBM PCTM like Toshiba's P1350 printer.



Now there's one three-way printer that fully equals the word processing, data and graphics capacity of your IBM PC: Toshiba's P1350.

But the P1350 is more than compatible with PC hardware. It will print programs like Lotus 1-2-3 data processing and graphics output with remarkable character definition.*

For even more flexibility, the Toshiba P1350 with Qume SPRINT 5 emulation handles all popular word processing programs. Under software command, the P1350 will print high-speed drafts or switch to letter-quality text and graphics.

The innovation behind this three-in-one flexibility is Toshiba's print head. Pin diameter has been reduced to just eight mils. And the number of

pins in the print head has been increased to 24.

The result is a superior 360 by 180 dot-per-inch density pattern in the text mode. Instead of spinning your wheels at 40 cps, the P1350 produces letter-quality printing at 100 cps. In its draft mode, Toshiba's P1350 can accelerate up to 192 cps.

When it comes to graphics, the P1350 really shows its stuff. Whatever your computer displays, Toshiba's P1350 prints. With astonishingly clear definition. And extra-fine reproduction that can only come from a print head capable of 200 million impressions and exclusive 180 by 180 dot-per-inch graphics density pattern.

Then, if that's not enough to pique your interest, the P1350 also

features three different fonts. Variable pitch. Subscripts, superscripts and underlining without the need of a second pass. A super-reliable optional sheet feeder. And more.

So show off your IBM. Or any other personal computer. With the superior quality and flexibility of Toshiba's spectacular P1350 printer.

Distributors on the adjacent list make it easy to find the P1350. Or get more information by calling toll-free, 1-800-457-7777.

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In Touch with Tomorrow

TOSHIBA

For further information, contact: Information Systems Division, TOSHIBA AMERICA, INC., 2441 Michelle Drive, Tustin, CA 92680. Telex 183-812.

Reader Service #285

(END)
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YOU'VE GOT TO SEE IT TO BELIEVE IT

Consolidated Profit and Loss Projection (Dollars in Thousands)

	Jan84	Feb84	Mar84	Apr84	May84	Jun84	Jul84	Aug84	Sep84	Oct84	Nov84	Dec84	Total84
Revenue:													
Components Div	100	115	135	150	215	260	325	430	540	645	750	955	4620
Micro Systems Div	10	20	40	80	120	165	240	325	430	535	630	750	3345
Industrial Sys. Div	25	25	50	75	100	130	160	190	225	250	300	350	1880
Total Revenue	135	160	225	305	435	555	725	945	1195	1430	1680	2055	9845
Cost of Sales:													
Components Div	80	90	100	110	135	165	210	245	350	485	525	685	3180
Micro Systems Div	15	15	20	40	55	75	100	140	185	230	300	335	1510
Industrial Sys. Div	25	35	35	50	75	100	125	150	175	200	225	275	1470
Total COS	120	140	155	200	265	340	435	535	710	915	1050	1295	6160
Operating Expenses:													
Components Div	100	125	150	170	190	200	200	200	205	200	205	190	2135
Micro Systems Div	75	85	95	100	105	105	110	110	115	115	120	120	1255
Industrial Sys. Div	50	65	75	90	105	100	100	105	110	105	100	100	1105
Total Op. Exp.	225	275	320	360	400	405	410	415	430	420	425	410	4495

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Reader Service #305

With Eyes Wide Open

In our premier issue Andrew Fluegelman, then editor, initiated our *REMark* column with a description of the journey to a new world of personal computing and an invitation to you, our readers, to join us in the exploration of that new world. Half a dozen issues later, as the new editor, I'd like to offer a reassessment of our vision—our course—and your participation in this adventure.

Since we started, our eyes have been held wide open. There seems to be no end to the innovations in this fast-moving marketplace. Every month we discover and report on new and more sophisticated products as well as on research and development activities that make Jules Verne look shortsighted. Our perennial fascination may be our greatest asset; it is certainly our guiding light.

You'd think we'd get jaded amid this shower of innovation and excitement. To be honest, it does take a bit more to perk our ears these days, but there always seems to be a bit more excitement with each new product announcement.

It's clear to all of us that the IBM PC is setting a new standard in computing. People who use the PC and compatibles have learned to expect more of their machines from the minute they turn them on. The hardware has to look sleeker and run more reliably. The software has to be easier to use and must automate many of



the tasks that 8-bit (and even mainframe) computers left to the user. As PC users assimilate the computer into their professional lives, they establish and perpetuate these standards of computer accessibility and productivity—standards that must be met or exceeded by any hardware or software vendor who wants to succeed. Thus, as the PC community (our readers) demands higher quality and greater usefulness from the industry, the vendors respond with the creativity and innovation that keep us fascinated.

It's easy for us to maintain our "reader-friendly" perspective. In our day-to-day work and in most of our

spare time, we're PC users like any others. We are writers who use word processors, planners who use spreadsheets, and managers who use database software. When deadlines approach, we're thankful for the ability to telecommunicate, and after 5 o'clock we're likely to be found relaxing with a new computer game.

Let's look at some of the things that have kept our interest and excitement high over these last few months.

We've discussed the State of the Art in compatibility, multitasking, display technology, user interface design, and operating systems. This month we even get to see how PCs can exhibit performance similar to a VAX—the high end of the much more expensive minicomputers.

Included in the "Review" section has been everything from communications programs to clones, from keyboard enhancers to color graphics boards, and from integrated applications programs to computer games. This month we compare three computer-aided design programs that run on the PC. Yes, computer-aided design. When I said that the applications grow ever more sophisticated, I meant it.

And the future is just as bright for new products. Some of us were treated to a unique sight recently at NCC: a lighthearted joker in a

No one else is using this simple method to teach you Lotus 1-2-3.

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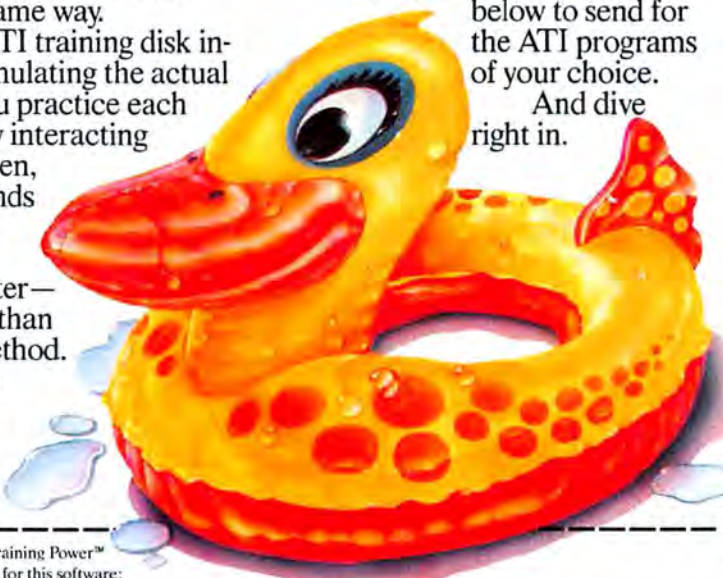
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Reader Service #7

Harry Miller

Snoopy-type aviator hat controlling Microsoft's *Flight Simulator*—itself a marvel of realism—solely by spoken commands fed through a gizmo that Key Tronic calls an "intelligent keyboard."

In our "Hands On" section we've brought you applications-oriented insights into the PC and its most advanced and popular software. We've published listings of some very useful and instructive programs and routines. These listings have been selected not only on the basis of their slickness or clever programming techniques, but also on their value as learning tools. The best way to learn a programming language is to use it and experiment with it. There is always an opportunity to improve on or add features to a program. We encourage you to seize that opportunity with some of the suggestions offered in the "Hands On" section. This month's "Hands On" articles include instructions for integrating assembly language subroutines into your BASIC programs and a handy program that dials the telephone automatically using your modem.

Topics in the "Community" section have run from pioneers to prophets, explored some issues in the retail marketplace, discussed how PCs are being used in a variety of work and leisure settings, and even brought the highlights of some special events to readers who couldn't be there. Described in this issue are an examination of Japan's efforts in the artificial intelligence race and a bit of the PC's lesser-known ancestry.

During the past six months, our vision and purpose have not changed; they have become clearer. We are sometimes explorers but always map makers. Where personal computing takes new leaps in technology, applications, and sheer excitement, that's where you'll find us—doing our best to document, analyze, and illustrate the developments.

Stay with us...and keep your eyes wide open. ☹

YOUR IBM[®] PERSONAL COMPUTER IS ABOUT TO BECOME MORE POWERFUL THAN YOU EVER DREAMED POSSIBLE.



Boston's Bayside Exposition Center.
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TUES-THURS, OCT 4-6, 1983

(Note these are the new Show days. The event was once scheduled for Saturday-Monday, October 8-10.)

PC '83 is the largest gathering of PC-compatible products ever held on the East Coast. You'll find under one roof more than 500 exhibits of software for business, professional, home, personal and education applications; plug-in cards for memory expansion, telecommunications, speech and many other functions; hundreds of peripherals, including printers, networking systems and innovative new storage devices; plus dozens of publications, books and invaluable support services.

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ADMISSION PRICES

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To receive more information about attending or exhibiting at PC '83 call or write Northeast Expositions, Inc., 822 Boylston Street, Chestnut Hill, Mass. 02167. Tel: 800-841-7000 or 617-739-2000 (within Massachusetts).

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Reader Service #407

Thank god

Business at Bundtweiller Brass Beds is booming! And now that Friday!'s here to help out, I've got everything under control.

Friday!'s the revolutionary new micro-computer information management system from Ashton-Tate, the people who invented dBASE II.[®]

It came in Tuesday, and it took me almost no time at all to get the hang of it because Friday! works *with* me, not against me. I've already turned stacks and stacks of paper files into much more efficient "electronic files." And it's so easy to use that even Mr. Bundtweiller can do it.

So now, no matter what Mr. Bundtweiller needs to know—no matter when he needs it—he or I can find it in seconds.

The names and commissions earned by our top 25 salespeople since January 1st.

The total number of #3455 Brass Beds sold year-to-date, by region.

A quick report on our cash receivables.

Or the special report for the Board of Directors meeting this afternoon. Mr. Bundtweiller forgot to tell me about it until just before lunch, but Friday! and I got it done in no time at all. It looks gorgeous!

Friday! even knows how to keep private

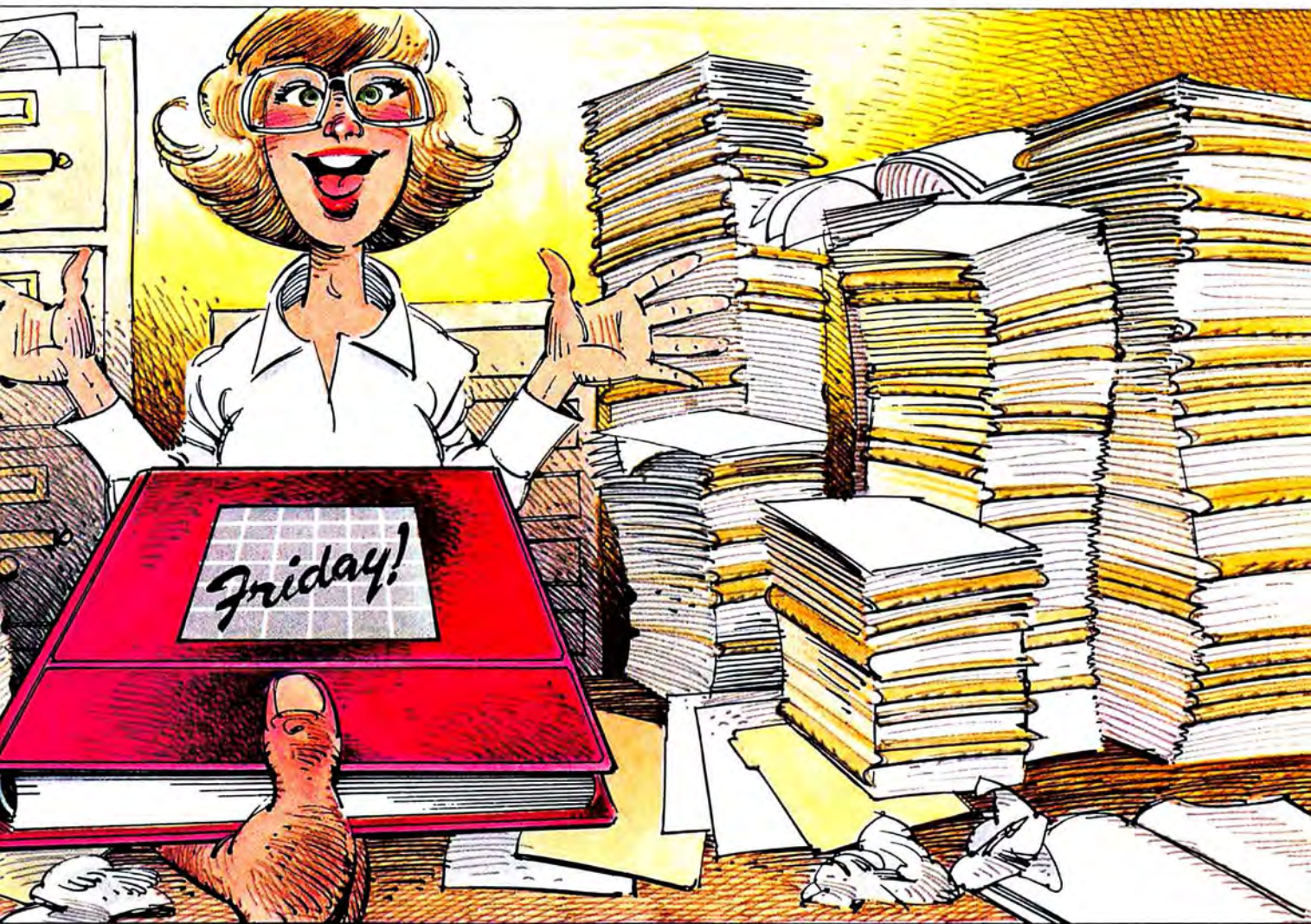


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ASHTON · TATE



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Friday! runs under CP/M³-80, CP/M-86, PC-DOS⁴ and MS-DOS⁵.

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Letters

Small Is Beautiful

OK, enough is enough. Ever since *BYTE* magazine became so obese several years ago, it has been fashionable for computer magazines to look as if you'd need a forklift to maneuver them about. This "fatter is better" mentality would be fine if the quality of the contents matched the quantity of pages. In *PC World's* first few issues, it looked as if this would be the case. However, I've just finished reading Volume 1, Number 5 and have reached the conclusion that it's about time to put the magazine on a diet.

I mean, it's enough to read David Bunnell's page, which, to be honest, reads like the same column month after month, but he is the Publisher and all, and anyway we can always skip that part. But then we're confronted with Martine Boot's *REMark* all about her kids and her garbage disposal. Do we really need this information to continue our PC education? Then there's the FORTRAN article ("Going to Bat with FORTRAN"), but some people still use FORTRAN, I guess, so that's all right. But then David Sudnow has to tell us all about his grand experiences with BASIC's SOUND command and the trauma he underwent debugging a simple FOR statement ("First Debugging"). For God's sake, don't tell him about BASIC's PLAY command or you'll have a dissertation on your hands. (He really needs to stick to piano playing.) After Sudnow comes a wordfind puzzle composed of BASIC's reserved words ("BASIC Boggler")...valuable information indeed.

Don't get me wrong, Number 5 was loaded with great information about hard disk backup, the FORTH

language, communications packages, etc. I just think it was a little overloaded with articles that we, the readers, would have been just as happy without. Don't get yourself in the situation that the "other magazine" is in, where the thing is so large that it is actually uncomfortable to read at times. (What "other magazine," you ask? Hint: `THIS__MAGS = "PCWORLD": OTHER__MAGS = LEFTS(THIS__MAGS,2)`)

Some of the best and most informative computer magazines on the stands are also some of the thinnest (albeit, terribly unfashionable). Follow their lead: keep up the good work but get rid of the excess, and you'll have an excellent magazine on your hands.

*Michael C. Mitchell
Sunnyvale, California*

```
ANSWERS = "DISAGREE":  
FATTER = 0: BETTER = 1: IF FATTER <>  
BETTER THEN ANSWERS =  
RIGHTS(ANSWERS,5)—Ed.
```

The Missing Librarian

This note concerns the case of the missing librarian. It is a puzzling tale. The librarian should have been on its post. In fact, reputable parties are behaving as if there were a librarian. Unfortunately, there is no doubt that the librarian is missing! The question is, has the librarian failed to make an appearance because of someone's knavery? Or was it just stupidity?

The librarian I have sought in vain is not a person dispensing books. Rather it is a program without which it is very difficult to make full use of a compiler. It is a program that as-

sembles compiled subroutines into a library that can be used by the linker to assemble the execution version of a program.

A word of explanation may be in order. An advantage of such languages as FORTRAN is that one can write real subroutines. These are quite different from the pseudo-subroutines available in BASIC. A real subroutine is one that can be written without much regard for the calling program. As long as the caller knows the exact calling sequence, there is no need to assure that variable names do not conflict with names in the main program or that statement numbers in the subroutine do not duplicate statement numbers in the main program.

These subroutines are usually written as independent packets of code that are compiled separately into object modules. Any good programmer soon assembles a large collection of such subroutines. When a new program is written, subroutine calls are inserted where needed. The new program is compiled into relocatable object code, but, of course, the program cannot be used until it has been linked by a Link program. The process requires that you specify all the OBJ modules of the subroutines into one well-ordered file, ready for submission to the Link program.

One would assume that such a librarian would be available for the IBM PC as part of PC-DOS. After all, IBM, Microsoft, Supersoft, and many others sell compilers. The cost of garden variety compilers is about \$500. The vendors know all about libraries. In fact, they supply one or more libraries with their compilers,



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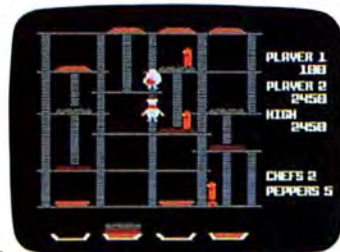
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Letters

so they must have some means for preparing libraries. But for the user there is no publicly available librarian!

Why is the librarian missing? It is not because there is no need for one. The IBM PC-DOS manual (version 1.10) tells you in great detail (see pages 5-12 and 5-13) how to present libraries to the Link program. When I called my (usually helpful) dealer, he called IBM's hot line and was told that the answer is in the compiler manual. But this is simply not true. I have searched the manuals of all the compilers (BASIC, Pascal, and FORTRAN) currently available from IBM; there is absolutely no mention of a librarian. So much for the IBM hot line.

On further investigation I found that Microsoft has actually written a librarian. It is called MS-LIB, and it will accomplish the task. However, for some reason IBM has chosen not to include MS-LIB in PC-DOS. Furthermore, the only way one can purchase MS-LIB from Microsoft is by purchasing the C Compiler. The Microsoft hot line person was quite apologetic when she relayed this information. She admitted that it does not make much sense, but she said, "It was a marketing-management decision."

If one were to be uncharitable, one might think it a trifle fraudulent to sell \$500 compilers that cannot be fully used for lack of a critical element. But it is also possible that rather than knavery, we are witnessing foolishness. Whoever decided to include a cassette port in the PC may have been sufficiently steeped in the toy mentality of the early micro-processors, or perhaps so committed to BASIC that the needs of serious users were not considered.

In any event, those out there who do need the librarian, perhaps if we all scream together either IBM will decide to rescue the librarian, or else Microsoft will unbundle the librarian from C and let us get it. For either love or for money, give us a librarian.

*Emanuel Donchin
Champaign, Illinois*

Cache/Q Correction

We were quite pleased to see our product *Cache/Q* mentioned in your recent article "Torture Testing dBASE II" (PCW, Vol. 1, No. 3). We would like to take this opportunity to point out an inaccuracy in one of the technical specifics: *Cache/Q* buffers sectors accessed, not the whole track. At the same time, the user can determine buffer size and can buffer files according to file extension, name, drive, or directories.

*Mike Weiskopf
Corporate Communications
Director, Techne
Lafayette, California*

Dismantling COMPAQ

Thanks for your detailed review of the COMPAQ computer ("Travels with COMPAQ," PCW, Vol. 1, No. 2). I recently bought one and am very happy with it; however, I would probably still be trying to get the cover off if it hadn't been for the explanation and pictures in your article. Unfortunately, installing an 8087 chip requires practically dismantling the whole computer. Oh well. Please keep up the good work in *PC World*. I find your articles very helpful.

*Ray Duncan
Los Angeles, California*

Word Challenge

Thank you for such a favorable review of *Word Challenge* ("For Game Gourmets," PCW, Vol. 1, No. 5). Regarding the problems Mr. Cook described:

We have already dealt with the problem of the small letters in the grid. Since April we have shipped only versions that use capital letters.

As for the game going back to its default values after each match, this will be changed in a future release.

There seems to be a misunderstanding concerning the Embedded Words option. During standard play if you type *strainers*, you receive credit for only that word. However, with the option set to Suffix, you receive credit for *strain*, *strainer*, and *strainers*. With the option set to All, you receive credit for *rain*, *train*, *trainer*, *trainers*, *strain*, *strainer*, and *strainers*. This is an option that most people appreciate because it saves typing.

*Chengi Jimmy Kuo
Author, Word Challenge
Proximity Devices Corp.
Ft. Lauderdale, Florida*

Business and Pleasure

I sincerely hope that your magazine will not act upon the letter from the Florida businessman (Michael Truffer) in PCW, Vol. 1, No. 3. The PC is not just a business tool; it can also be used for education, entertainment, and communications.

*Mike Kelleher
Ann Arbor, Michigan*

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Randy Marble, Project Supervisor
Grinnell, Inc.
Oklahoma City, Oklahoma

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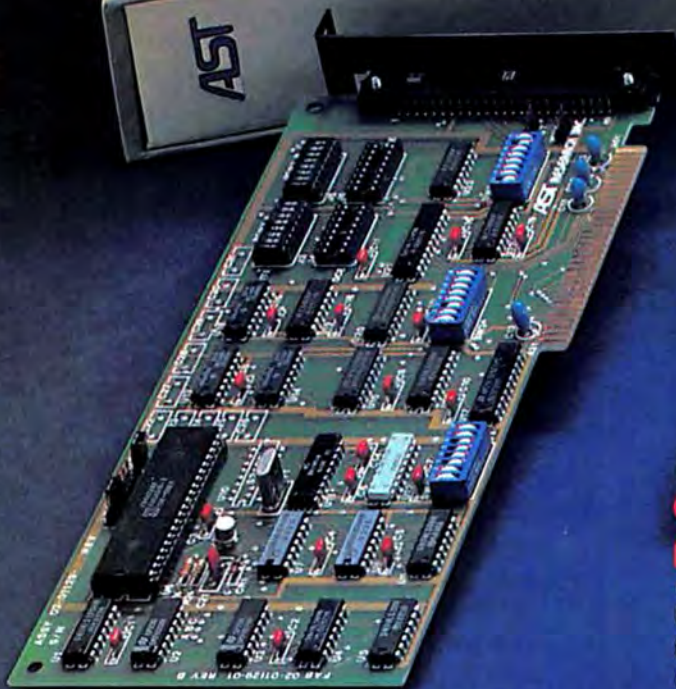
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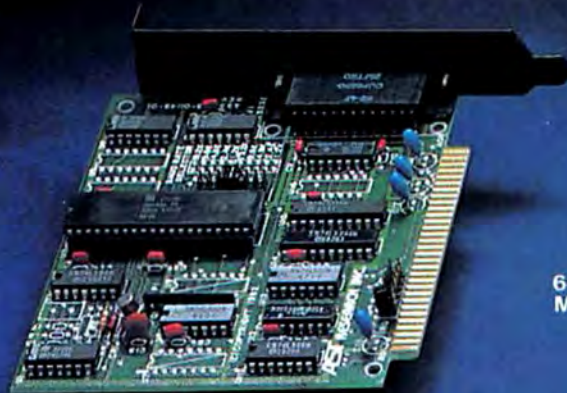
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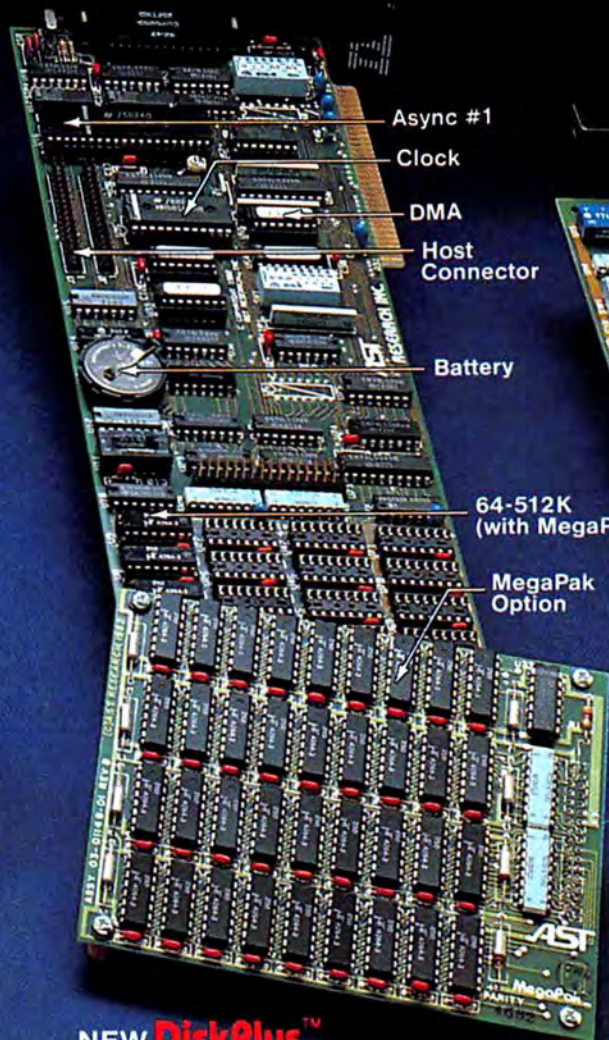
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Bits of Speech

Henry Polard

Speech technologists are discovering new ways to enter data and receive output, enabling microcomputers to do what only mainframes could do formerly. Instead of relying on keyboards, joysticks, or mice, people today can talk to their computers. They can also listen to their computers talk as information traditionally conveyed by display messages and printouts is communicated by synthesized or stored computer speech. This article explores speech technology and describes the methods, applications, and products currently available for the IBM PC.

Wouldn't it be great to be able to program or enter data to a computer verbally? No clumsy typing, no program crashes because of missing or wrong punctuation, no eye-straining monitors—not even a mouse. Having the computer talk to you would also be great; it could teach you a foreign language, verify the data you entered, or talk you through a tutorial about itself when you needed help. These applications are now becoming available to personal computer users.

In general, speech recognition and verbal output are most useful in situations in which a person's hands or eyes are needed away from the computer. In the case of verbal input, this means situations like inventory taking, in which your hands are moving objects around and your eyes are checking quantities, or laboratory work, in which your hands are busy operating equipment and your eyes are looking through a microscope or watching gauges. In terms of vocal output, applications include status warnings, as when something is overheating, or progress indications, such as calling out the floors in an elevator—whenever attention is not likely to be focused on the computer.

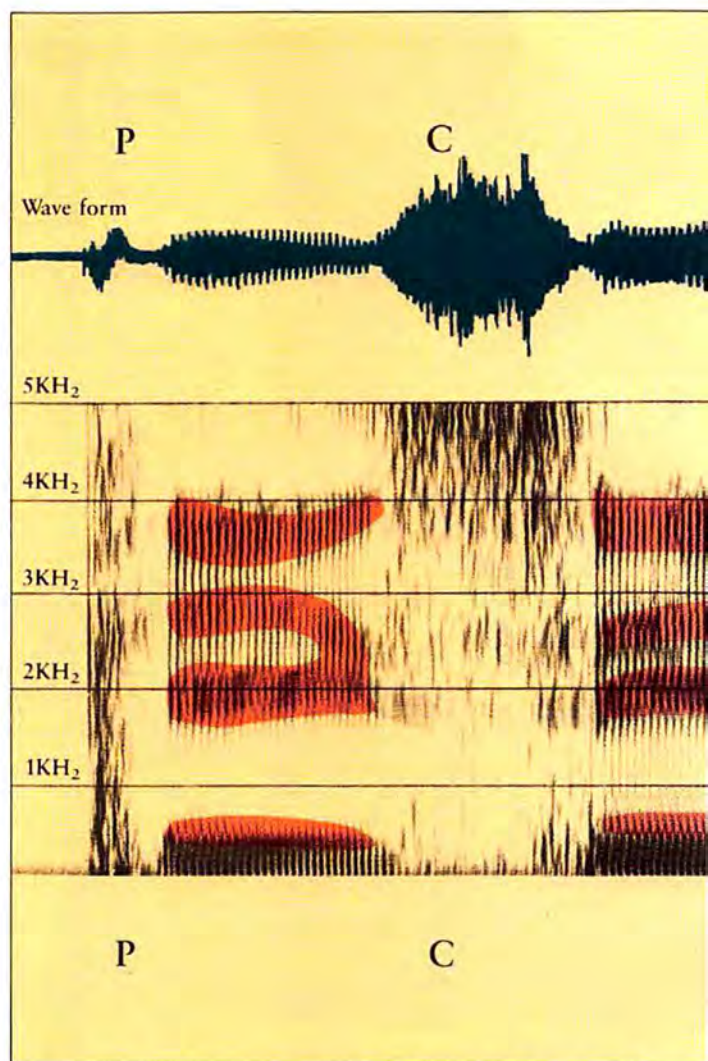


Figure 1: Speech spectrogram of the words "PC World magazine." The spectrogram shows frequency versus

Courtesy of Elemetrics Co.



time versus amplitude. The stronger the signal at a frequency, the darker the line. Vertical striations

indicate individual vibrations of the vocal cords. Formants of vowels are shaded in color.

● State of the Art

Speech

Let's examine speech itself. Speech is sound produced by people that transmits information about such things as the physical environment or our mental and physical activities. There is no limit to the number of things you can say in any one human language, and there is variation within a language—each person who speaks English, for example, has a particular voice, an individual style of speaking, and a distinct way of writing.

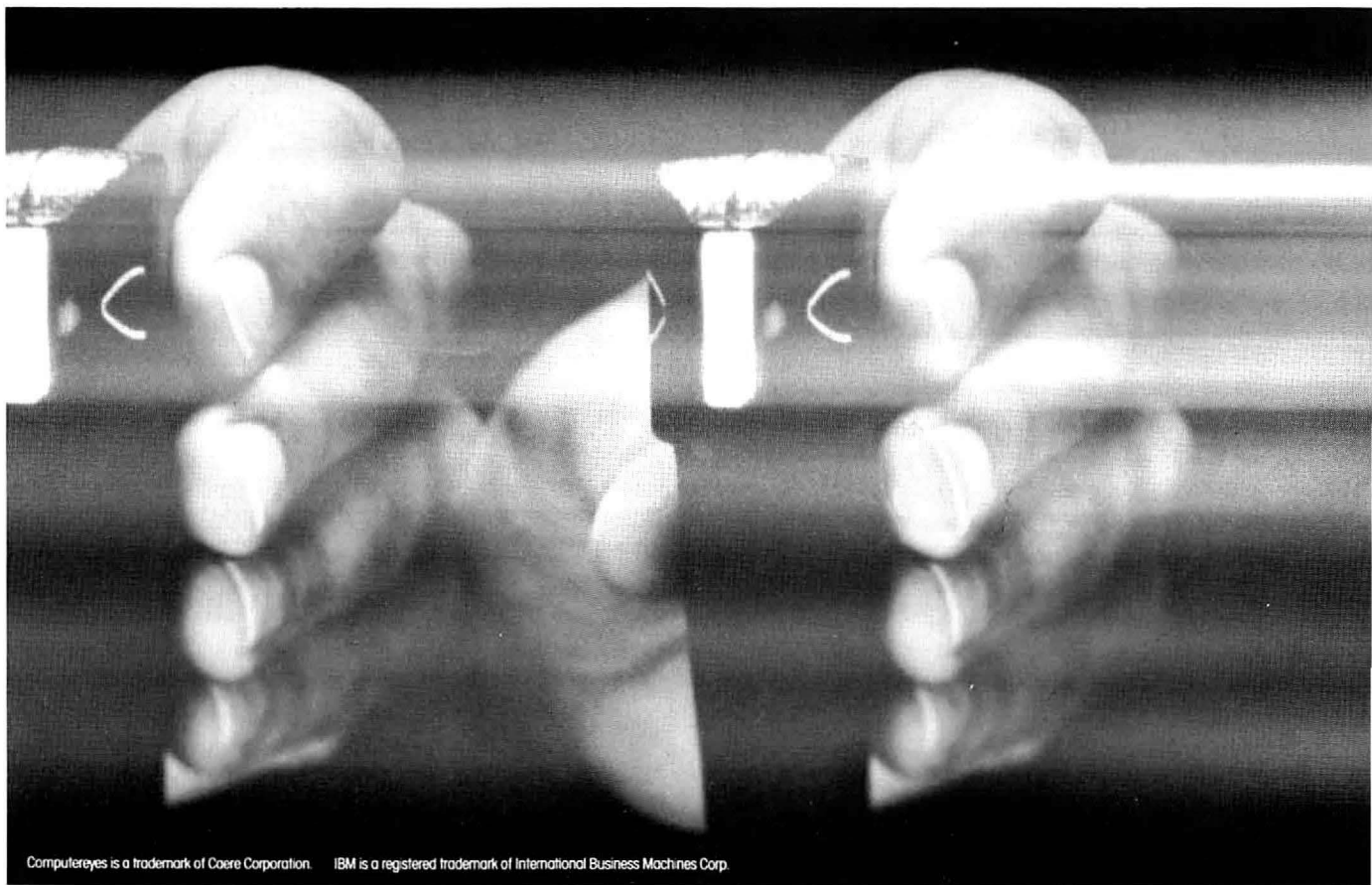
Examining the sounds of a language, we find that the sound pattern of any language has regular variations that its speakers may not be conscious of. *Phoneme* is the term linguists use to refer to a set of sounds that function as one unit in a given language. For example, the English phoneme *t* is composed of four sounds. In *top*, the *t* is followed by a puff of air strong enough to blow out a match held a couple of inches from the lips; in *stop*, however, no such puff of breath follows the *t*. In *pot* the breath is stopped and the consonant is not even released. In *betting*, when said at a conversational speed, the *t* is sounded as a quick *d*; the word is actually pronounced just like the word *bedding* said at the same speed. Phonemes have no connection with spelling. *To*, *too*, and *two*, for example, are composed of the same phonemes.

In physical terms, when speech sounds are made the vocal tract creates and changes cavities in which certain frequencies resonate. These frequencies may be produced by the vocal cords or by air moving through constrictions, as in the *s* sound. We are usually unaware of each resonance, or *formant*, in the words we speak. Two resonances may be sounded by flicking a finger against your cheek and against your throat just above the Adam's apple. It is best to try this while shaping your mouth to say vowels but not actually saying them. The formants appear as dark bands on a graph called a speech spectrogram (see Figure 1).

The human voice produces many formants, but only four of them are essential to understanding English. The other formants are heard as the qualities that give voices individuality. Because each vocal tract is unique, a person's individual formant pattern can be analyzed and used in the same way as fingerprints.

Computers and Speech

Speech products for microcomputers perform one or more of the following functions: storage, which includes recording and playing back speech; synthesis, which is the creation of speech; and automatic speech recognition. Often speech-product manufacturers label speech storage as synthesis because speech storage involves analysis, storage, and synthesis. You should examine prod-



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ucts carefully and note what they really do before buying.

Speech storage devices work like very sophisticated tape recorders, the important difference being that speech storage devices enable you to program stored words together to create a variety of messages. For example, if you want an alert to be announced when any

It takes 64,000 bits of memory to store 1 second of speech.

one of ten boilers is overheating, you need to record only 12 phrases: "attention, boiler number," "is overheating," and the numbers one through ten. The program for this application would select the appropriate number, depending on the signal received by the computer from the boilers, and insert the number between the first two phrases. You may enjoy thinking up a dozen phrases relevant to your applications and seeing the variety of messages you can come up with by combining them. An example of a speech storage product is *Supertalker II*, by Mountain Computer, Inc. (see *PCW*, Vol. 1, No. 4 for a review).

Other important applications of speech storage include sending verbal memos (voice mail), leaving verbal messages (voice store and forward), sending verbal messages via telecommunications (vocoding), and recording verbal commentaries about written material.

Time-Domain Synthesis

There are two popular ways for computers to store speech: time-domain synthesis and frequency-domain synthesis. With the time-domain synthesis process, the waveform of a signal coming from a microphone or telephone is analyzed (see Figure 2). In the simplest form of this method, called pulse code modulation (PCM), the strength of the signal (the amplitude of the waveform) is sampled at regular intervals, and numbers representing the signal strengths are stored in sequence. The conversion to numbers is carried out by an analog-to-digital converter, which acts somewhat like a modem. To play the word or phrase back, the signal is reconstituted by retrieving the numbers in sequence from memory and sending out a signal whose strength corresponds to the numbers that have been retrieved. Usually, the transition from numbers to a continuous wave is made by a separate hardware device, a digital-to-analog converter.

The number of samples taken during time-domain analysis must be twice as great as the highest frequency of the speech signal to avoid losing information about



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the waveform. The larger the number of amplitude samplings stored, the more accurately the utterance can be reconstructed. Since 4000 Hz is the highest frequency that needs to be stored for comprehensible speech, accurate time-domain analysis requires 8000 samples per second. According to the United States sampling rate standard for telephone speech transmission, numbers 8 bits long are required to store the amplitude of each sampling. Using the 255 levels of amplitude that can be stored in 8 bits, it takes 64,000 bits of memory to store 1 second of speech (8000 samples per second x 8 bits). This amounts to 8K bytes per second of speech stored.

Although storing speech using as little memory as possible is desirable, it is impossible to cut back from the standard just described and retain the same level of accuracy, or fidelity. The less information about something

One approach to reducing memory needs is to eliminate redundant information about the waveform.

you have, the less accurately you can reconstruct it. The trade-off between memory requirements and fidelity of reproduction is an important aspect of speech technology.

One approach to reducing memory needs is to eliminate redundant information about the waveform. This process is called speech compression and is analogous to freeze-drying coffee. The redundant and unwieldy information in the case of coffee is water. When water is eliminated from coffee, the coffee is easy to store and transport. However, in the process the quality of the coffee is compromised, as a comparison between reconstituted freeze-dried coffee and freshly brewed coffee shows. Similarly, reconstituted, or synthesized, speech does not sound the same as spoken speech.

One way of eliminating redundant information from a waveform is to calculate and store only the change in the amplitude of the waveform between one sampling period and the next. An increase in amplitude is stored as a 1, a decrease as a 0, and silence as alternating 1s and 0s. This process, known as delta modulation, requires fewer bits per sample than PCM since recording the relative change in amplitude takes only 1 bit per sample. Delta modulation, however, requires more frequent sampling than PCM.

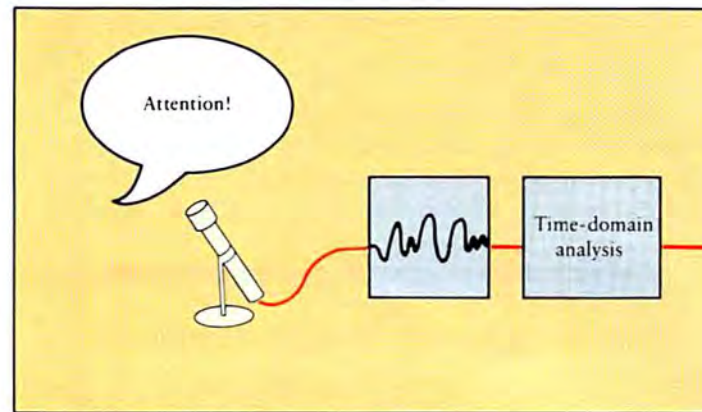


Figure 2: Time-domain synthesis

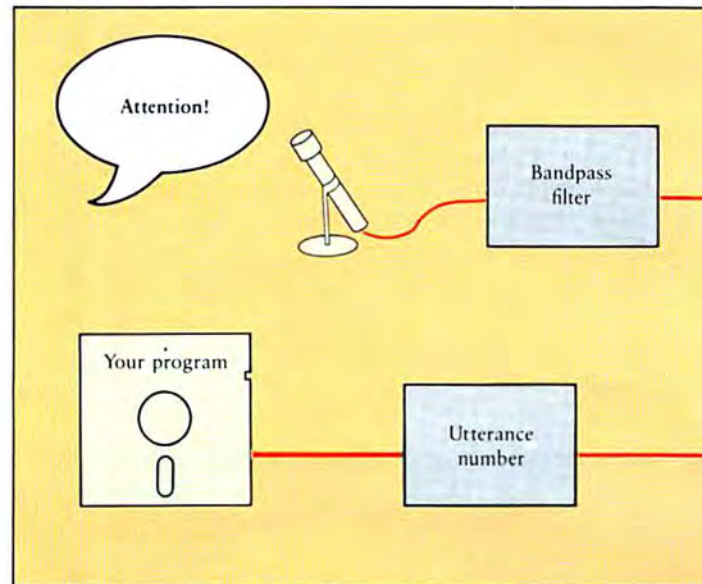


Figure 3: Frequency-domain synthesis (linear-predictive coding)

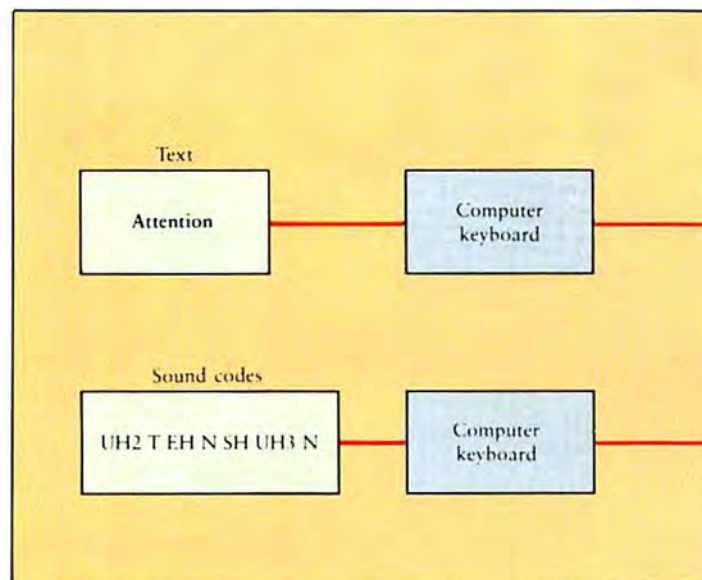
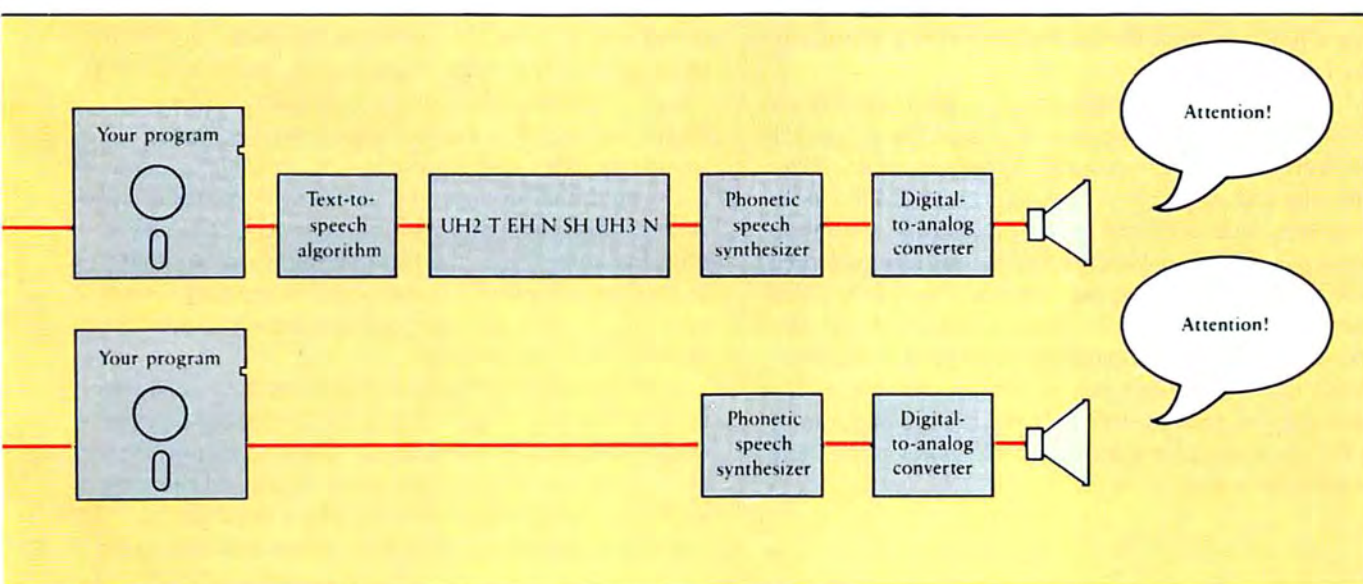
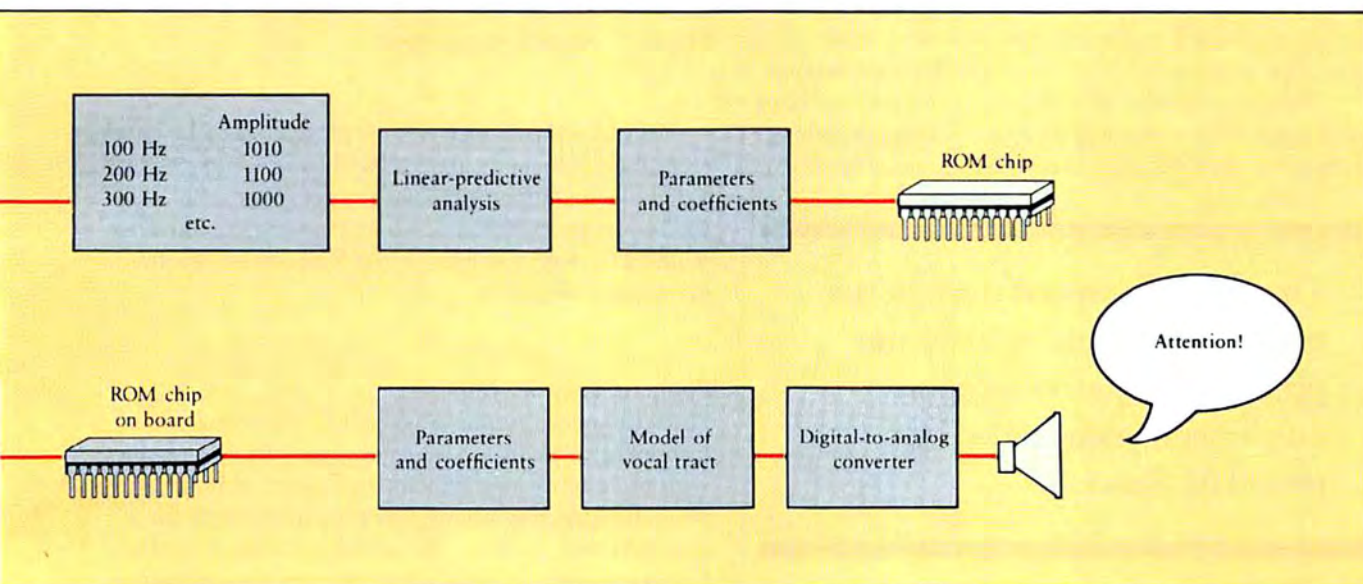
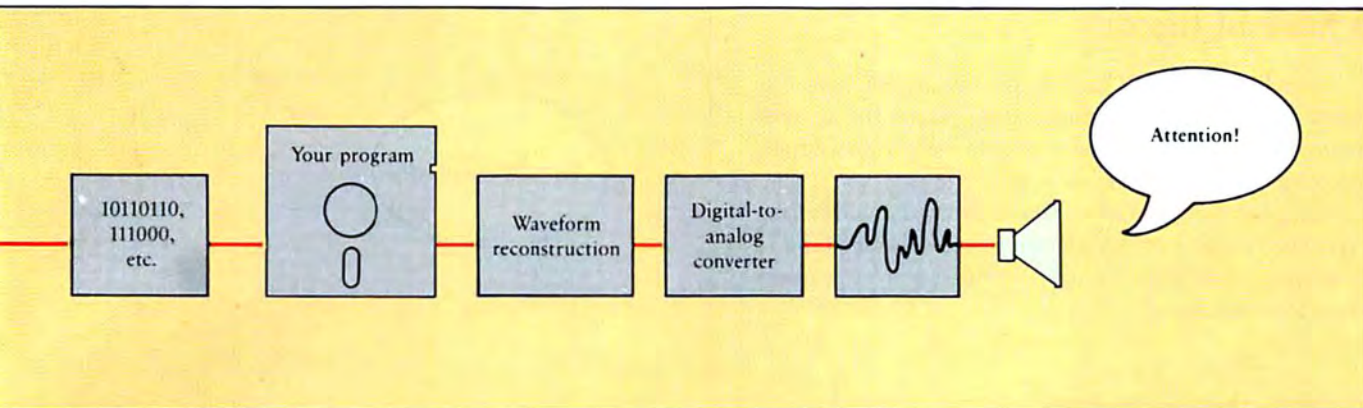


Figure 4: Phonetic synthesis



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A variation on this basic space-saving principle, adaptive delta pulse code modulation, varies the significance of a 1 or a 0 bit based on the history of the signal. This leads to even greater memory savings.

On playback, the information about the waveform is retrieved from memory, the process is reversed, and the results are sent to a digital-to-analog converter to be converted into sound.

Frequency-Domain Synthesis

In frequency-domain synthesis, an incoming utterance is analyzed in terms of the loudness of individual frequencies of a speech sound (see Figure 3). The results of the analysis are related to a mathematical model of the vocal tract. This process involves many complex calculations.

Encoding hardware for frequency-domain synthesis is not available for personal computers. Only decoding hardware and ROM chips containing encoded words and

The automatic speech recognition products currently available for personal computers recognize only utterances bounded by a period of silence.

phrases are sold by personal computer speech-product manufacturers. Each word or phrase stored by the manufacturer can be accessed by using a number that requires only a few bits, since the utterances are on a board separate from main memory.

Linear-predictive coding (LPC) is the major type of frequency-domain synthesis used in the United States. In this method speech is analyzed digitally in terms of coefficients and parameters, each representing one aspect of speech, such as overall pitch or amplitude at a given frequency. These coefficients and parameters are stored in ROM chips. Knowing the characteristics of the vocal tract, engineers can predict future coefficients and parameters based on past patterns. For example, the regularity of vowel sounds makes them predictable; to save memory, you need to store only the basic configuration of the vocal tract for a desired vowel sound and a duration for the sound.

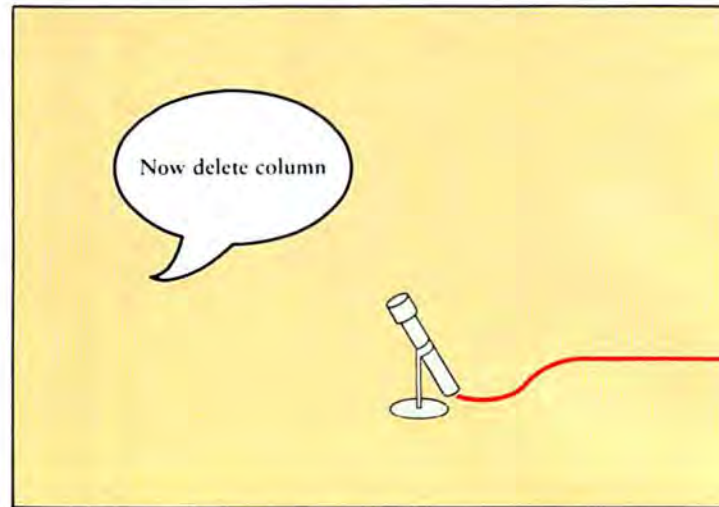


Figure 5: Speech recognition

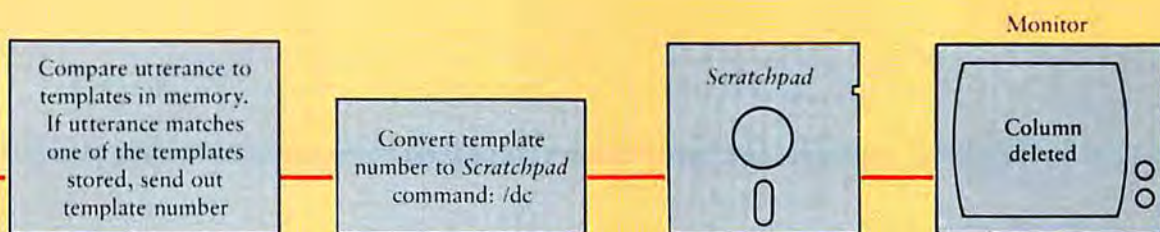
When an utterance is to be played back, the parameters and coefficients are retrieved from ROM and drive a digital simulation of the vocal tract. This simulation sends out speech through a digital-to-analog converter. With LPC, only 800 bits, or 100 bytes, need be stored per second of speech.

Phonetic Speech Synthesis

Phonetic speech synthesis is the least expensive speech technology. The process creates speech from scratch, with no input from a human voice (see Figure 4). With phonetic speech synthesis, you type in the code for a speech sound, such as "oh" or "ah." A code from the keyboard selects a block of memory in the synthesizer that contains the directions to operate a simulation of the vocal tract, and the sound is produced. In one method of speech synthesis, LPC parameters and coefficients are stored and drive an LPC model of the vocal tract. In another approach, variable filters modify sound from an oscillator to produce the formants of vowels, and a noise source connected to another filter generates hissing sounds such as those represented by *f* and *sh*.

The sound produced by speech synthesizers sounds artificial in comparison with stored speech. The artificiality comes from the fact that the words and phrases of synthesized speech are composed of separate sounds in sequence, without the transitions between sounds that characterize normal speech.

With speech synthesizers, however, there is no limit to vocabulary or length of utterance, since any combination or number of sounds can be specified by putting the appropriate symbols in a program or entering them via a keyboard. Using stored speech is like a situation in which the amount of coffee you can carry is limited by



the size of your thermos. Using speech synthesis is like having a device that can produce an unlimited amount of artificial coffee.

Given the ability to produce an unlimited number of sequences of sounds when you input sound codes, using phonetic synthesis you can type in words and have the synthesizer produce the sounds. This conversion of spelling to sound is done with text-to-speech algorithms. These algorithms usually take up 6K of memory each. The quality of these algorithms varies, since predicting pronunciation from English spelling requires many rules. The greater the number of rules and exceptions, the greater the accuracy, cost, and memory requirements to produce comprehensible speech. Because some spellings are ambiguous (*read*, for example, can be pronounced in two ways), it is sometimes necessary to type in sound codes that access speech sounds directly.

The sounds produced by typing in sound codes last an average of 100 milliseconds. At 8 bits per sound, including intonation and pitch, 1 second of synthesized speech uses only 80 bits (10 bytes) of memory.

Speech Recognition

Automatic speech recognition devices accept speech input rather than keyboard input (see Figure 5). This input activates parts of programs so that the computer seems to obey verbal instructions. The automatic speech recognition products currently available for personal computers recognize only utterances bounded by a period of silence. Speech products that recognize continuous speech must locate the boundaries of an utterance. In true recognition of continuous speech, utterances have to

be parsed (analyzed for grammar and meaning), and appropriate signals have to be returned to the main program for each unit parsed. An instruction such as, "Send copies of the following memo to all district managers," could be executed after the parsing process. Speech recognition at this level of sophistication is available only on mainframe computers.

Another type of speech recognition procedure consists of matching a stretch of speech to a pattern, called a template, that is stored in memory. Using statistical methods, distance evaluations, and dynamic program-

The sound produced by speech synthesizers sounds artificial in comparison with stored speech.

ming to find the least degree of difference between two patterns, speech recognition products compare a set of templates to an incoming signal. Through complex algorithms the closest match is determined from all possible matches. For every match attempted, the algorithms must account for variations, since no word is said exactly the same way twice.

When an incoming utterance is matched to a template, a signal is returned to the computer program, which branches based on whether the signal indicated a successful match or not.

Templates may be entered either by the speaker or by the manufacturer. Templates are entered by the

● State of the Art

speaker in the case of speaker-verification systems, which match only the voice of a particular speaker to the template. Templates are also entered by the speaker in speaker-dependent systems, which recognize the voice of the original speaker and possibly those of other speakers. The vocabulary of speaker-verification and speaker-dependent systems is limited only by the memory of the

computer. In the case in which a match is to be made to a template regardless of the individual speaker (speaker-independent systems), the templates are usually entered by the manufacturer and the vocabulary is quite limited.

The actions that can be executed given a successful match of speech signal to template are unlimited and may range from dimming the lights in a room to activating a file to make more vocabulary available. Theoretically it would be possible to link an utterance to a

Talking Technology

The following is a list of speech products available for the IBM PC. The products are of three types: speech storage, phonetic synthesizers, and speech-recognition. Many of these products are versatile and will surprise you with their wide variety of applications.

ComNet

A telephone interface that enables you to phone a computer and leave or retrieve messages and request specific information. List price: \$1695 to \$2995. Tecmar, 23600 Mercantile Rd., Cleveland, OH 44122, 216/349-0600.

Heuristics 7000

A speech recognition unit that has a capacity of 64 words or phrases that can last up to 3 seconds each. The system is expandable to 128 words. It offers 99 percent speech recognition and requires an asynchronous port. List price: \$3000. Heuristics, 1285 Hammerwood Ave., Sunnyvale, CA 94086, 408/738-8532.

Intex Talker

A phoneme-based speech synthesizer that has 64 inflection levels. It includes a 6K text-to-speech algorithm, phoneme access, and spelling output modes. It comes with an expandable 750-character buffer, adjustable baud rate, and asynchronous and parallel connectors. The system requires an asynchronous port. List price: \$295; \$25 each for optional loudspeaker, 2700-character buffer, or user-programmable memory board with a directly accessible 6502 microprocessor. Intex Micro Systems Corporation, 775 W. Big Beaver Rd. #1717, Troy, MI 48084, 313/540-7601.

Key Tronic Voice Input Device

A board that integrates voice recognition as part of the keyboard output. It recognizes approximately 100 phrases and includes a keyboard, a microphone, and a mouse. It requires one disk drive. List price: \$1200. Key Tronic, P.O. Box 14687, Spokane, WA 99214, 509/928-8000.

Parle PC

A synthesizer that has an unlimited user-defined vocabulary and synthesizes foreign words. It includes an amplifier and a speaker. The system stores 1 second of speech in 10 bytes and enables the synchronization of external events with speech output. List price: \$199. GM Enterprises, 485 E. Granville Ave., Roselle, IL 60172, 312/893-1171.

Speech 1000

A board that stores more than 6 minutes of speech (approximately 540 words). It requires an asynchronous port. List price: \$1200, \$2500 boxed with power supply, \$3.50 per word from stock list, \$50 per word custom stored. Speech Plus, 461 N. Bernardo Ave., Mountain View, CA 94043, 415/964-7023.

Speech Master

A board that combines phonetic synthesis and unlimited vocabulary with limited-vocabulary, high-quality speech. The product uses two chip types and is bus connected. An amplifier is included in the system. List price: \$395. Tecmar, 23600 Mercantile Rd., Cleveland, OH 44122, 216/349-0600.

BASIC keyword, a letter of the alphabet, or a punctuation mark, enabling a computer to be programmed verbally. This capability is becoming available. Supersoft's *Voicedrive*, for example, enables the *Scratchpad* spreadsheet to be operated verbally. Each command, however, has to be entered by the user in training sessions before *Voicedrive* can be used. Each stretch of speech entered is linked to a single command in the *Scratchpad* command set.

What speech technology means for you is that you can make your computer speak right now. Talk to your personal computer, or have it talk to you and your friends. Speech technology will add a new dimension to your computing. Let your imagination run wild, and keep your ears open. ☹

Henry Polard is a linguistics and speech consultant in the San Francisco Bay Area.

Supertalker II

A board that enables you to include spoken messages in your programs. It uses delta modulation storage and offers four sampling rates. *Supertalker II* requires 64K and one disk drive and includes 32K ROM. List price: \$565. Mountain Computer Inc., 300 El Pueblo Rd., Scotts Valley, CA 95066, 408/438-6650.

Tecmar Voice Recognition

A board that has user-dependent voice recognition and a capacity of 100 words, expandable to 200. The system achieves 98 percent accuracy and allows the computer to respond to voice input. A microphone is required for system operation. List price: \$995. Tecmar, 23600 Mercantile Rd., Cleveland, OH 44122, 216/349-0600

Voice-Alive

A board that stores up to 37 seconds of speech or 24 seconds of higher-quality speech. It can hold up to 16 messages of varying length. Messages are recorded by the manufacturer. List price: \$1900. Data-Voice, 2 N. La Salle St. #1900, Chicago, IL 60620, 312/327-8488.

Voicedrive

A board that allows you to operate the *ScratchPad* spreadsheet program verbally. It requires 128K. List price: \$495, \$995 with a Tecmar Voice Recognition board. Supersoft, P.O. Box 1628, Champaign, IL 61820, 217/359-2112.

Votan V-8000

A system consisting of an IBM PC, speech software, and a speech development unit. It recognizes 255 utterances, and voice commands can trigger an additional library of words to be recognized. One training session is required per word. Voice response and voice store-and-forward capabilities are included. List price: \$9000. Votan, 4487 Technology Dr., Fremont, CA 94538, 415/490-7600.

Votrax Personal Speech System

A phonetic synthesizer that has a 95 percent accurate text-to-speech algorithm. It has adjustable frequencies, amplitude levels, and inflections. The system can produce simultaneous speech and sound or music, and features eight user alarms and a 3500-character buffer. List price: \$395. Votrax, 500 Stephenson Hwy., Troy MI 48084, 800/521-1350, 313/588-0341 in Michigan.

Votrax Type 'n Talk

A synthesizer with a text-to-speech algorithm that achieves 65 to 70 percent speech production accuracy and has phoneme access. It includes a 750-character input buffer. List price: \$249. Votrax, 500 Stephenson Hwy., Troy, MI 48084, 800/521-1350, 313/588-0341 in Michigan.

Vynet 1000

A telephone-line interface that features programmable speech output. It answers phone calls and detects touch-tone signals. The product has a vocabulary of 300 words, and customized versions are available. List price: \$295 for interactive interface, \$1490 for voice module. Vynet Corporation, 2405 Qume Dr., San Jose, CA 95131, 408/370-0555.



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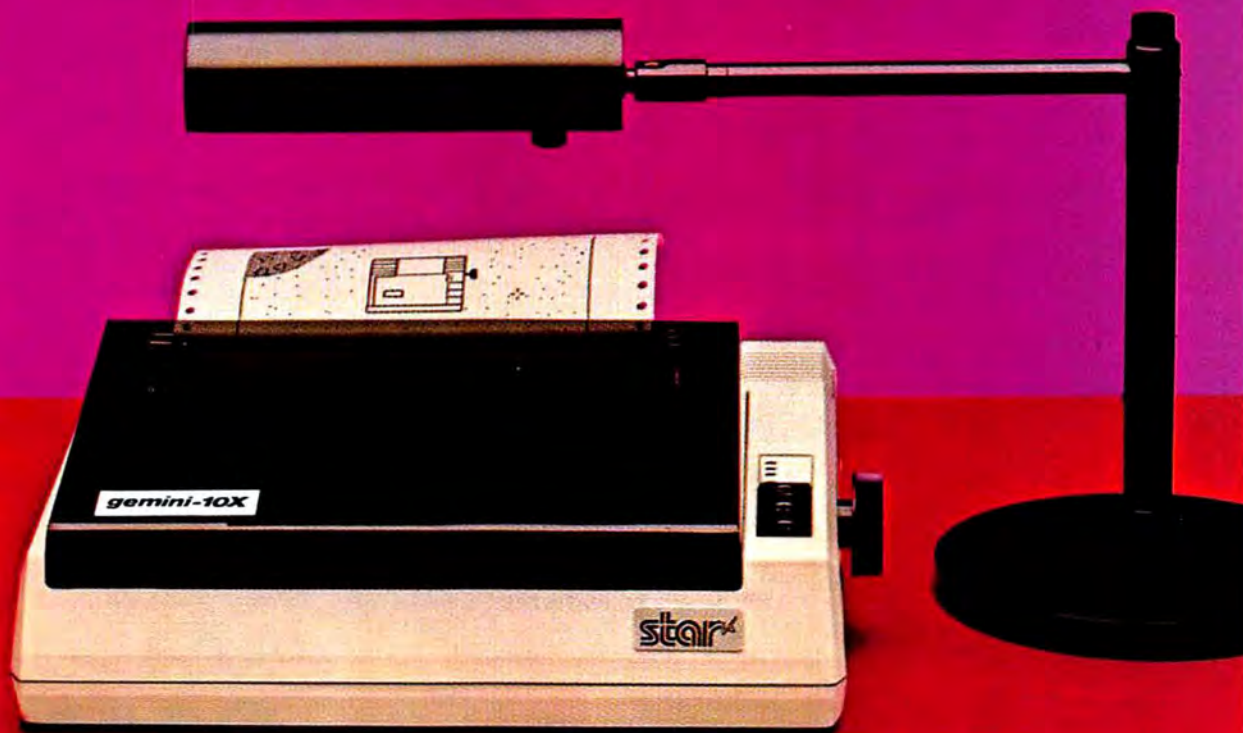
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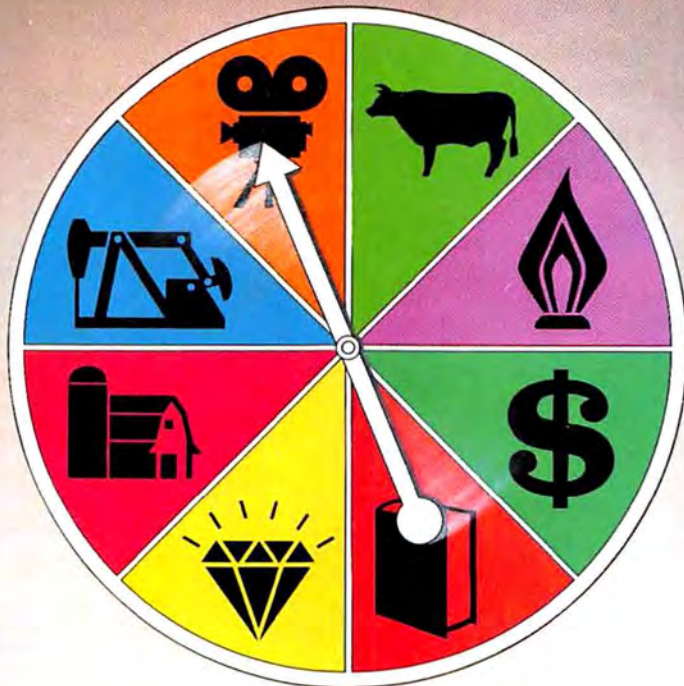
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NOTE: The Smartmodem 1200B may also be installed in the IBM Personal Computer XT or the Expansion Unit.

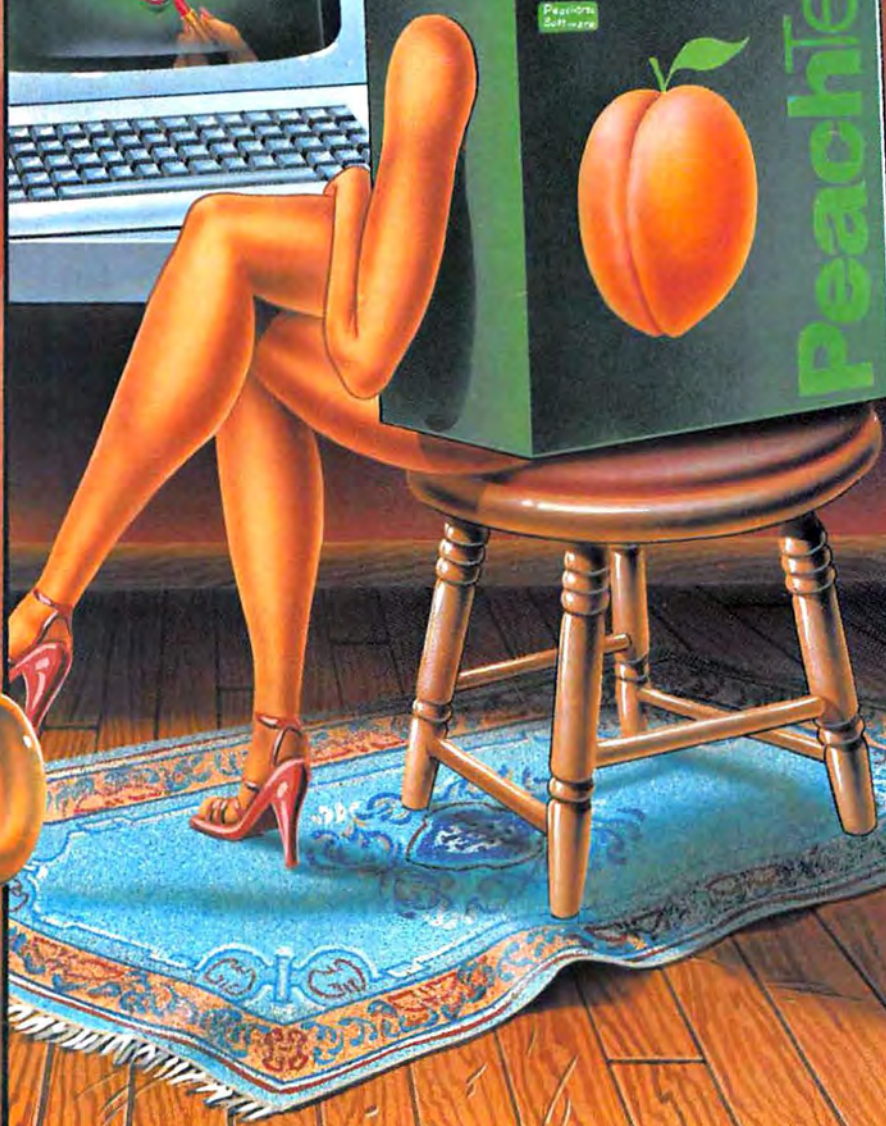
In those units, another board installed in the slot to the immediate right of the Smartmodem 1200B may not clear the modem; also, the brackets may not fit properly. If this occurs, the slot to the right of the modem should be left empty.

Reader Service #221

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Reader Service #286

PCW 783

Plug In a Processor

Sritek's MicroCards can take the place of the 8088 microprocessor and turn the PC into a far more powerful computer.

Steven Cook

There was much disappointment among computer aficionados when IBM announced that its Personal Computer would use the Intel 8088 microprocessor, for while the 8088 is a perfectly adequate device, it lacks pizzazz. Comparing the technical specifications of the 8088 to those of more advanced microprocessors is like comparing the handling characteristics of a Ford and a Ferrari.

IBM has a long history of building Ford-like computers, machines that do a job without frills.

Of course, IBM's choice of the 8088 was a wise and not altogether unexpected decision. IBM has a long history of building Ford-like computers, machines that do a job without frills. Nevertheless, many industry pundits had secret hopes that the PC would blaze new trails in the lands of personal computing. Maybe next time.

One company, however, has not been content to wait. The company is Sritek, Inc. of Cleveland, and its

product is the VersaCard, a 256K memory expansion card with a twist (see Figure 1). The VersaCard is designed as a foundation for a MicroCard (Figure 2), an optional circuit card that includes a microprocessor and other chips needed to connect it to the VersaCard. Sritek intends to provide MicroCards for all of the most technically sophisticated microprocessors.

When plugged into the PC, the MicroCard takes control, but that does not mean that the PC's 8088 will go to waste. Sritek has designed the VersaCard system to obtain maximum performance from the PC. Using a technique called co-processing, the PC's 8088 microprocessor is put to use controlling input and output operations between the MicroCard and peripherals such as the disk drives and printer while the MicroCard simultaneously performs other tasks.

The VersaCard is designed so that a system can be upgraded to use a new microprocessor by simply changing the MicroCard. An optional RAM Module (Figure 3) can be added to the VersaCard to raise the total memory on the board to 512K, and additional RAM can be added externally. This modular de-

sign means that keeping up with advances in computer technology will be easy and inexpensive.

Some MicroCards have additional co-processors for floating-point arithmetic, a time-consuming task that is best done by special math processing chips such as the Intel 8087. These cards give a PC blazing speed, the kind that attracts the attention of the Ferrari crowd.

But there is more. The VersaCard comes with software that increases the amount of information a PC can process in a given period of time. Called *FastCache*, the software stores blocks of disk data in memory so that they will be readily available for processing. Also available are an optional program to cache frequently used disk data such as the disk directory tracks, and a program to emulate a disk in memory.

A unique feature of the VersaCard is hardware that protects the memory used by *FastCache* and similar programs. Hardware protection ensures that data stored in memory cannot be accidentally destroyed by runaway programs.

68000 Features

One of the most popular high-performance microprocessors currently available is the Motorola 68000. The 68000 is a 32-bit microprocessor that

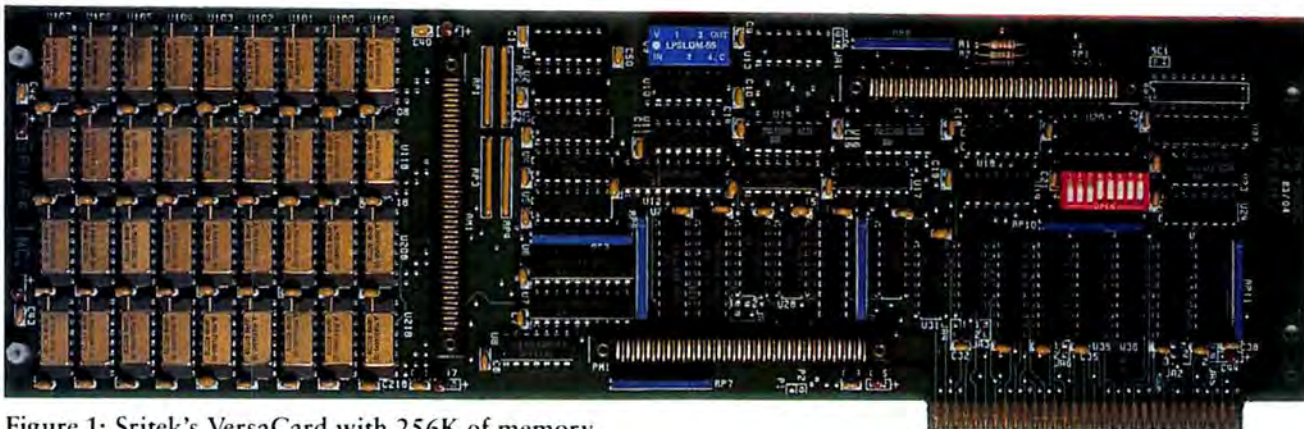


Figure 1: Sritek's VersaCard with 256K of memory

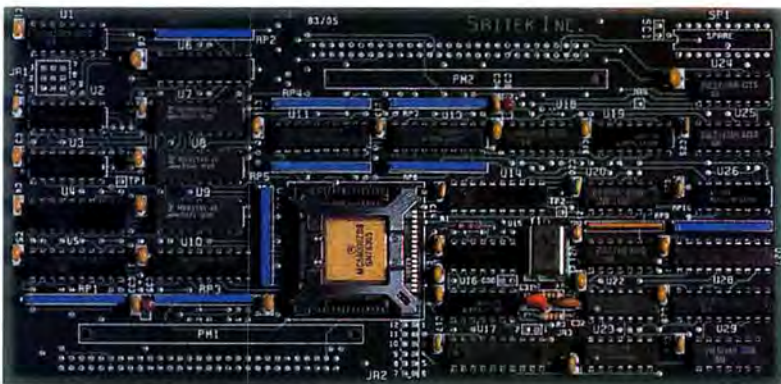


Figure 2: MicroCard for the Motorola 68000 microprocessor

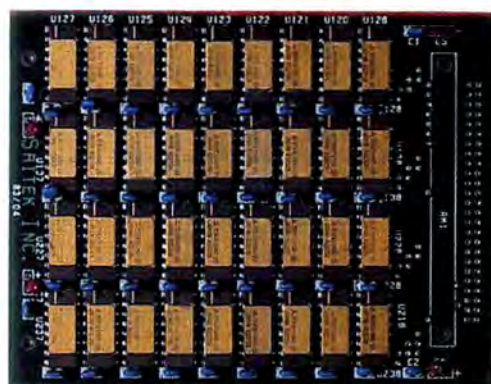


Figure 3: 256K RAM Module

uses a 16-bit data path to communicate with external devices such as memory. It can directly address up to 16 megabytes of memory, and Sritek's 68000 MicroCard has memory-management circuitry to allow it to support up to 16 users.

The 68000 MicroCard comes with the XENIX operating system. XENIX is Microsoft's version of UNIX, a powerful multiuser operating system created at Bell Labs that has gained much popularity in recent years. One feature of UNIX is its ability to support a "guest" operating system. Sritek has taken advantage of this and implemented MS-DOS as a guest, allowing an MS-DOS program to be executed on the 8088 while other programs are running under XENIX on the 68000.

The 68000 MicroCard is the first of several MicroCards that Sritek will be offering during the coming months. The other MicroCards announced by the company are for the Zilog Z-80, the Intel 8086, the Intel 80286, and the National Semiconductor 16032 microprocessors.

Popular Microprocessors

The Z-80 MicroCard provides a link to the past for users who would like to use older, Z-80 software in conjunction with the high-quality hardware and wide variety of options designed for the PC. In a step typical of Sritek's approach to technology, software is included with the card to emulate the CP/M operating system under MS-DOS. This means that CP/M itself is not needed in the system, and all disk files are stored in standard MS-DOS format. Of course, programs and data must first be

transferred from a CP/M computer onto PC disks; Sritek provides software to facilitate this process. Once transferred, data can be exchanged freely between CP/M and MS-DOS programs, eliminating the nuisance of separate disks and cumbersome conversion procedures.

The Intel 8086 microprocessor is almost identical to the 8088 microprocessor used in the PC, except that the 8086 uses a 16-bit data path—twice as large as the 8-bit path used by the 8088—to communicate with memory and other external devices. A 16-bit path means the 8086 performs external device operations about twice as rapidly as the 8088. Sritek's 8086 MicroCard operates at a clock speed of 8 megahertz (MHz), more than 60 percent faster than the PC's 4.77 MHz clock. The result is a

● State of the Art

processor that can use all the software written for the PC but executes that software three or four times faster. And since this processor requires no special programming, it can be put to use immediately.

Faster and Better

The capabilities of the 80286 microprocessor are truly amazing. As described by James Fawcette in "Mighty Chips" (*PCW*, Vol. 1, No. 5), the 80286 is software compatible with the 8086 and 8088 and provides the kind of computer power needed for multiuser systems. According to Sritek, the 80286 performs tasks ap-

The combination of the 16032 microprocessor and Berkeley UNIX forms what is probably the most powerful computer system ever to sit on top of a desk.

proximately six times faster than an 8086, and like the Motorola 68000, it can address 16 megabytes of memory. Comparisons performed by David A. Patterson of the University of California at Berkeley show that in some situations the 80286 can outperform a large mainframe computer by a ratio of 2 to 1.

Microsoft has contributed to the future success of this microprocessor by announcing XENIX-286, a multiuser operating system that will allow the 80286 to be used immediately in a wide range of applications.

One use envisioned for the 80286 is as the node processor for a local area network, accepting data from small groups of terminals called clusters and forwarding it in large packets to the network's central controller. Distributing tasks in this manner is the most efficient way to implement a network, but until recently the cost of such computer power has prevented its widespread use. These networks will become more popular as products such as the 80286 MicroCard make the technology more readily available.

Mainframe Capabilities

The National Semiconductor 16032 is perhaps the most powerful microprocessor currently available. The 16032 MicroCard has built-in logic to perform a sophisticated operation called demand-paged virtual memory management, a technique to ensure that frequently used data remains easily accessible to the microprocessor. Demand-paged virtual memory management is a feature of such powerful computers as Digital Equipment Corporation's VAX-11 series and IBM's System 370. Its application to personal computers is yet another step in a long series of technological advances that have continually provided more computer power at lower prices.

To support all of the 16032's computer power, Sritek offers Berkeley UNIX version 4.1, a robust and proven operating system that is the result of over a decade of work at the University of California's Berkeley campus. The combination of the 16032 microprocessor and Berkeley UNIX forms what is probably the most powerful computer system ever to sit on top of a desk, at a total cost of about \$6000. The ratio of price to performance in this system paves the way for the PC to be used in applications that in the past were not feasible, such as computer-aided engineering. The VersaCard system makes this technology readily avail-



Figure 4: 68000 microprocessor in leadless package

able, which creates a snowball effect of more applications developing as the technology becomes even more widespread. In this way Sritek is playing an important role in advancing the state of the art of personal computing.

The products described in this article clearly indicate Sritek's commitment to technology, and further examination reveals that Sritek is also dedicated to quality. All of its products are built using military-quality components—the best available—and Sritek claims that less than 1 product in 10,000 fails to pass final inspection. Some of the cards contain 12 layers of printed circuitry, a level of engineering uncommon in microcomputer products. Although expensive, this technique allows a higher number of components to be mounted on a printed circuit card, because the wires that connect the various components can be printed on the inner layers of the card.

So many components are included on some of the MicroCards that special integrated circuits must be used to fit everything onto one card. Most normal integrated circuits are mounted in rectangular packages that have a row of metal pins extending

from the long sides, but Sritek employs one of the newest developments in printed circuit technology: the leadless package (Figure 4). Leadless packages are square, and they have contacts, not pins, extending from all four sides. The leadless packages are mounted in sockets, rather than soldered to the card. The socket, though more expensive, allows the microprocessor itself to be replaced easily. With faster versions of these microprocessors already being developed, this is an important feature.

For PC owners, the Sritek products provide a path for future expansion and a way to protect their investments in hardware as technology advances and their need for computing power grows. The multiuser capabilities of the MicroCards allow several users to access the facilities of a personal computer and to share a data base for substantially less than the cost of separate PCs for each user.

But Sritek's largest customers will be companies that supply turnkey systems, computers already configured with the hardware and software needed to perform a specific task. The result of this technological partnership will be increasingly powerful systems available for a wide variety of specialized applications—Ferrari computing for the Ford computer crowd. ●

VersaCard
MicroCard
RAM Module
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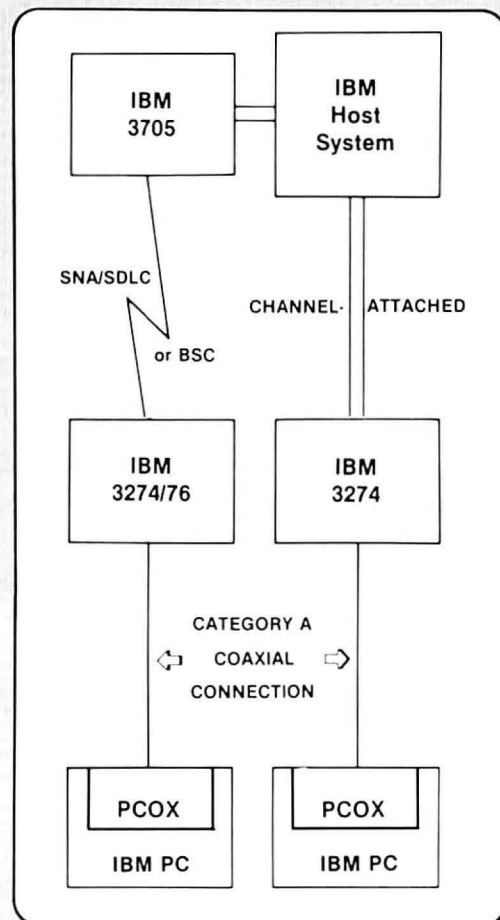
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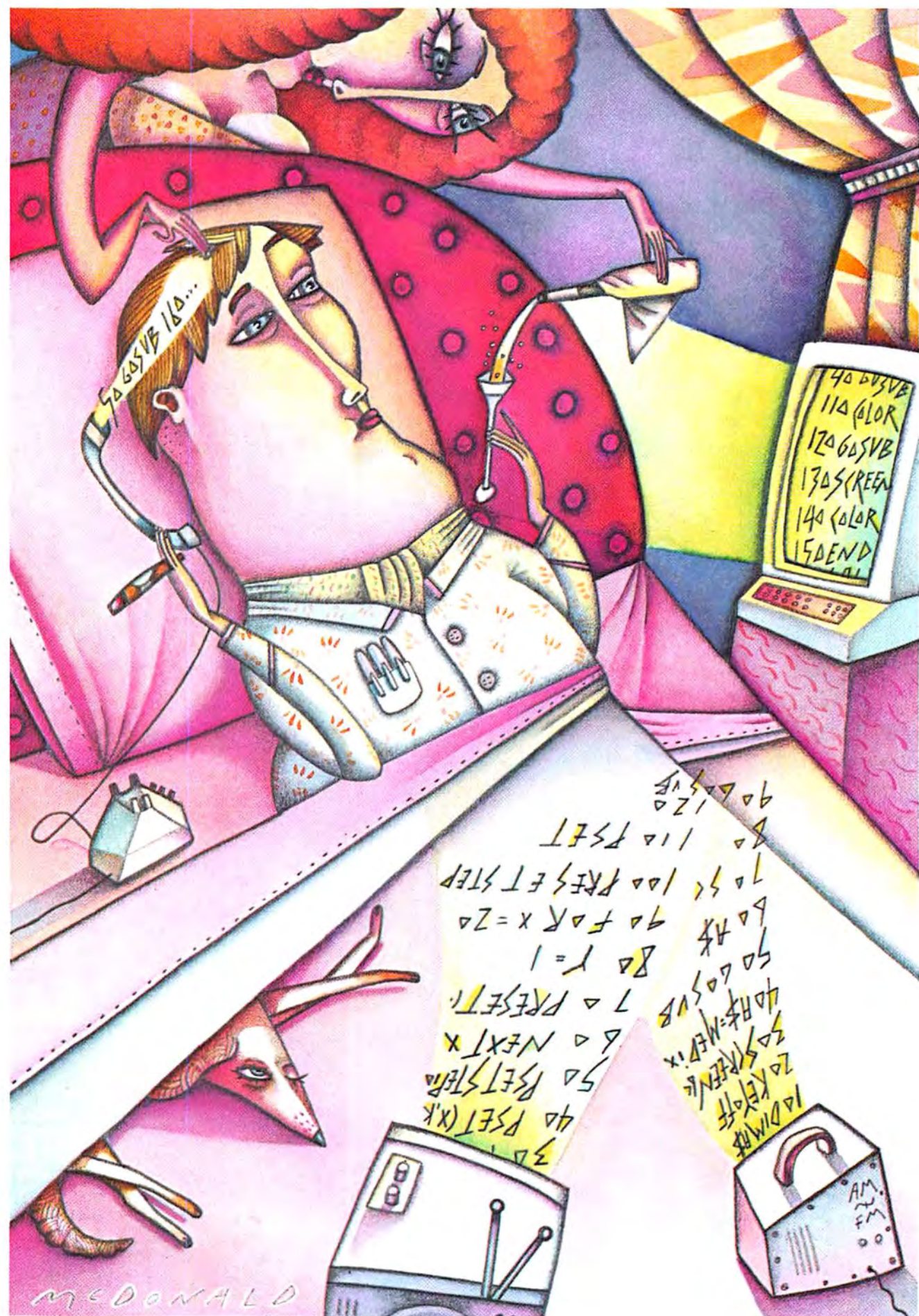
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Special Delivery Software

With teledistribution you may never have to leave your computer to buy software again.

Lisa B. Stahr

At one time the only way to get a computer program was either to buy it bound in a plastic sandwich bag at a computer show or to write it yourself. Since then software has unzipped the Zip-Lock on its plastic prison and proliferated shamelessly in an unsuspecting world. To many computer users, today's plethora of programs personalizes personal computing; to others it offers a multitude of program choices when only one is desired. Whether users like it or not, having so many program choices means infinite computing possibilities.

In 1986 computer users are expected to reach a \$4 billion software-buying frenzy, market researchers say. Today software creators and sellers, in a frenzy themselves at the thought of such sales, are looking for ways to make their products more widely available to these future buyers.

Mail order houses already sell about half the software that personal computer users buy today. These houses are so successful that some retail store owners who can't stock as many programs as mail order houses refuse to sell computer magazines that run mail order advertisements.

In the race to provide the most software choices to the most end users, mail order houses, because of

their low prices, are in a strong position. But other factors must be considered, including service and support.

Software-only stores, based on the same concept as record stores, keep a large stock of programs for a variety of personal computers. Unlike mail order houses, however, software-only stores provide their customers with a "try before you buy" service. Before purchasing a program, users can try it out on any of the store's many demonstration computers. What's more, software-only stores offer buyers a place to return to if they have problems with the program, an extra that mail order houses can't offer.

Each sales channel has its own advantages; mail order houses save the user money, while software-only stores offer prepurchase demonstrations. But while these two battle it out for software sales supremacy, a unique method of selling software is gaining popularity. The method is teledistribution of software, which in the coming age of communications could become a formidable contender in the software sales campaign. If the idea catches on, computer users may

never visit another software store or write to another mail order house again.

A handful of teledistribution, or teledelivery, companies are already downloading software right into users' computers using cable broadcasts, FM subchannels, and telephone lines. To these users teledistribution

'Cable companies are fragmented, so the audience coverage isn't universal like it is with telephone lines.'

is the most convenient, efficient, and inexpensive software sales channel around.

Telephone Software Connection, Inc. (TSC) in Torrance, California, has been delivering programs over the phone to Apple II users for four years. With this two-way communication, a customer calls TSC anytime, day or night, via modem. The answering TSC computer sends the caller a greeting that appears on his

● State of the Art

or her computer screen. If the caller already has an account with TSC, he supplies his name and password. If the caller is new to TSC's services, he receives an explanation of the system, and his credit information is collected.

Once the caller's credit is determined or the password verified, a catalog of available programs, including free demonstration versions, is displayed. To purchase a program the caller selects the item from a list, and the TSC computer transmits the software to the caller's computer, which saves the new program to disk. Once the transaction is complete and the caller disconnects, the TSC computer records the call to a system log and generates a credit card transaction. The caller is not charged for initiation or connection time, but only for the program purchased.

Telephone Transmissions

TSC uses leased telephone lines for transmission, according to President Ed Magnin, "because they go everywhere." With phone lines, Magnin says, TSC can also run a cyclic redundancy check that indicates problems, backs up, and makes corrections during transmission. "After every 256 characters, which is about every 8 seconds, 2 more characters are sent to do the check," Magnin explains. The frequency of the check makes it easy to catch and correct any errors that may occur.

TSC, which has downloaded Apple software to Saudi Arabia, Venezuela, Hong Kong, Australia, and Europe, is going to tackle the IBM PC in the near future. "The techniques we've developed for transmitting to the Apple will work with the PC," Magnin says, "and we've got a stable of software for the Apple that could be easily converted." To enter the PC

market Magnin will work with PC experts to write TSC's communications software for the Hayes Smartmodem, the Ventel board, and other IBM PC modems.

Games

Although only a few companies such as TSC are teledistributing applications software over phone lines, other companies may soon increase the competition. Control Video Corp. (CVC) of McLean, Virginia, has opened a teledistribution service called GameLine. An Atari VCS 2600 owner can buy a CVC receiver, called a Master Module, for \$59.95 at a local video game retail store, plug it into the Atari's cartridge slot, and enter his personal identification number. Once the system accepts the ID number, a command screen appears with game numbers on it (such as Frogger-05). Once a player selects a game number, the Master Module, which has brought the preceding screens up from its memory, automatically dials CVC. The game is downloaded in 20 seconds via the 2000 baud modem inside the Master Module. The player is charged for each game played, and because most of CVC's customers are kids, each player has a weekly credit limit to keep the game time in check.

William von Meister, who founded CVC after starting The Source with Jack Taub, entered the games market because of the "12 to 15 million video game systems out there." Already von Meister's company has sold more than 250,000 Master Modules. "But a Master Module can be made to plug into a PC just as easily as into the Atari VCS," von Meister adds. In fact, a CVC Master Module for all personal computers will be announced at the January 1984 Consumer Electronics Show.

Similar to CVC, Source Telecomputing Corp., also in McLean, offers a teledistribution service called Texnet. Up to now the service has been available to Texas Instruments 99-4A owners, although it will open up to

other users within the next year. Texnet, which is free to users except for hourly connect charges to The Source, enables users to upload or download user-programmed and contributed software to or from their TI computers. "Teledelivery is a very popular area," says The Source's manager of public relations, Nancy Beckman. Texnet, introduced about 18 months ago, has 1000 users out of 35,000 Source subscribers.

Not to be outdone by the competition, CompuServe of Columbus, Ohio, The Source's electronic net-

Teledistributing software to retailers may keep them from floundering.

work rival, is also teledistributing software to its subscribers. "We have an area on CompuServe called The Software Exchange that allows our customers to purchase software from us and to download it into their computers over the telephone lines," says Editorial Director Richard Baker. "We have over 100 programs on The Software Exchange," including educational, word processing, and financial programs. Like other teledistribution channels, purchases are billed to subscribers' credit card accounts. The Software Exchange, which has been in operation for three years, offers programs ranging in price from under \$10 to \$1000.

On Your FM Dial

Of all methods of downloading software, ordinary telephone lines are the most popular. Yet another McLean firm, INC Telecommunications, finds leasing telephone lines too cost-prohibitive for teledistribution. "Dis-

tributing software to 1000 people, for example, means making 1000 phone calls," explains Stephen Dull, product manager for INC. "With FM transmission you send it all in one fell swoop."

INC Telecommunications, founded by Jack Taub of The Source, is the result of a joint venture between National Information Utilities (NIU) and National Public Radio (NPR), the largest public radio station in the United States. "NPR has a sophisticated satellite network, while NIU has the technology that enables it to send digital information over FM subcarriers to users' computers," Dull says. These subcarriers are used for analog transmissions such as Muzak (often heard in elevators and dentists' offices) and foreign language radio broadcasts. "NPR's satellite is used for the long haul," Dull adds, "and then an FM subcarrier for the last mile."

The primary focus of INC's activity is now electronic mail and electronic messaging. Dull expects to have these services in operation in the Washington, D.C. area by late 1983 and across the nation by the end of 1984. He adds, "We'll work with the software distribution aspect [of teledistribution] all along but probably not get into it as a commercial operation until the end of 1984."

At that time INC will be the carrier for the information and a division of NIU will supply the software. "The division will contract with INC—just as any other company can—to supply the software we'll send," Dull explains. INC has already been approached by several large computer manufacturers interested in teledistributing their software.

From the user's side, INC subscribers will be given a special receiver for their computers. The software transmission, sent via satellite and FM subcarrier, will be addressed to go to a particular location (that is, to INC receivers). Subscribers' computers must be ready to accept the data at the time of transmission, which could take as little as 100 seconds for a 32K program. To take care of

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garbled data, which could render the transmitted program useless, Dull says that the home receivers will be "smart" so that they can make corrections when errors occur. Errors also can be checked at the INC transmitter; errors where long strings of bits are lost will be uncorrectable, but Dull thinks that those incidents will be as rare as getting a bad disk.

Data Broadcasting

Downloading software via FM subcarriers is not the only one-way communications method available; in Toronto, Canada, TCP Business Systems is using cable broadcasts to send electronic messages and download software to personal computers. "This will probably be one of the better ways to distribute software in the future," predicts Murray Desnoyer, president of the new company. Desnoyer predicts that once the computer industry moves into large-scale integrated circuit design, the cost of a board that plugs into the PC to receive the video signal will drop to about \$400 or \$500.

Although TCP is now involved primarily in electronic messaging, its data broadcasting service uses a television signal to deliver software also. Desnoyer envisions teledistribution customers setting up their home video cassette recorders (VCRs) to record the video signal when it is sent, probably during the off hours of midnight to 6 a.m., and then loading it back into their computers from the VCRs when they're ready to use it. The programs they receive, however, will be encrypted so that only part of the program is available to demonstrate what the package can do.

"The user will need to call up a local clearinghouse to have the program billed to his credit card account," Desnoyer explains. Once billed, customers are given a series of numbers to type into their computers

to unlock the remainder of the software. Although the technology is available to do this downloading today, the cost is too high to stir much user interest.

The Drawbacks

One-way teledistribution, whether via FM subcarriers or data broadcasts, may be cheaper for mass transmissions than telephone lines, but opponents claim that the service is fraught with problems. Vendors "never can check if the software's been received," complains von Meister of CVC. INC's Dull says, "But I don't see that as a problem, because customers will contact you if the transmission is garbled and then you can resend it."

And for cable companies, TSC's Ed Magnin offers a dismal prognosis as well: "Cable companies are fragmented in areas and some serve different socioeconomic classes, so the audience coverage isn't universal like it is with telephone lines." In addition, Magnin points out that one-way subscribers will be frustrated by having to set up their computers for the exact time of the FM transmission or cable broadcasts.

Another problem FM transmission opponents cite is software piracy. According to Dull, however, piracy is not as much a worry as his rivals think. "Data would be difficult to pirate because it's encoded. You'd need INC's special receiver, which has a demodulator inside it, to decode the data." Using a personal computer to decode the data would also be impossible, Dull says, because the 9600 bits per second transmission rate is too fast for those machines.

The Long Arm of the Law

While Dull may be able to defend the use of one-way transmissions, his company and other one-way broadcasters may eventually have to defend themselves in court as well.

In August 1971 a United States patent covering the concept of distributing computer programming via one-way broadcast communications was issued to Washington University in St. Louis, Missouri. As Dull points out, the patent is "pretty broad," yet the institution is being contacted for licensing agreements by companies interested in developing one-way broadcast communications for computer programs. INC hasn't had any problems with the patent yet, according to Dull, nor has TCP, which is under the jurisdiction of the patent even though it's in Canada.

Software Vending Machines

While those involved in teledistributing software argue the relative merits of each method, the program authors, sellers, and users may be asking whether the idea of teledistribution is a good one. Software retailers, who have a lot to lose if teledistribution catches on, are understandably against the entire concept; teledistribution companies are split on what to do about the retailers they may replace.

According to Magnin at TSC, retailers are already "losing ground fast." He suggests that they might get back into the game with a software vending machine connected to a teledistribution system. "A customer without a modem could go to the dealer, view a selection list of available programs, and even get a demonstration on the software vending machine," Magnin explains. "When the customer is ready to make a purchase, the dealer could initiate the sale with a special card or key or whatever." One drawback to the vending machine concept, Magnin admits, is that it would be expensive to implement.

Von Meister agrees that teledistributing software to retailers may keep them from floundering under the new teledistribution system. "You could limit the programs companies send to just games and sample programs," von Meister suggests. "You just can't put the retailers out of business."

To some teledistribution proponents, however, eliminating the retailer means cutting out the middleman. "There's a direct relationship between the customer and the software house with teledistribution," says Magnin. "If there is a bug in the program, then the customer can go directly to the supplier with the problem." Also, by checking the serial number on the package the software teledistributor knows if the person with the complaint actually bought the program or just copied it, Magnin explains.

Expanding the Options

Magnin eagerly points out the many other advantages of teledistribution, including sending users the most recent version of a program plus free updates if the program has flaws, and being able to lower product cost per unit. At TSC, for example, programs average between \$25 and \$30 each, with the most expensive package listing at \$75.

Magnin adds that teledistribution means greater program differentiation too: "We have around 45 programs available now." CVC's von Meister concurs; "Teledistribution means that the little guys can get anything published—they don't have to get into ComputerLand to get something sold." The result, he says, is a market that will flourish. "Multi-time users will find teledistribution just what they need," adds Stephen Dull of INC. "Unit costs will be less for them, although those who buy only one or two programs a year probably won't have a need for the service."

Greater communications capabilities offer computer users access to more information more quickly. Teledistribution of software, a perfect example of communications convenience, offers users a choice of what software to buy and where to buy it without ever leaving their computer consoles. But after all, expanding options is what personal computing is all about. ●



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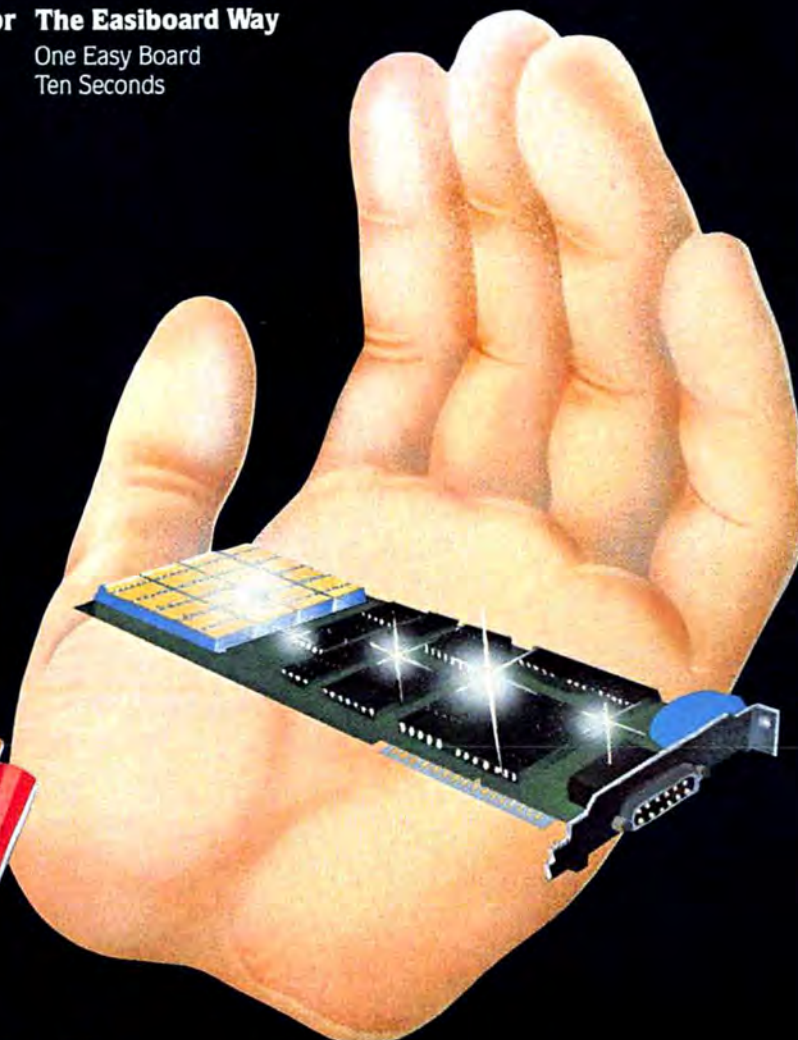
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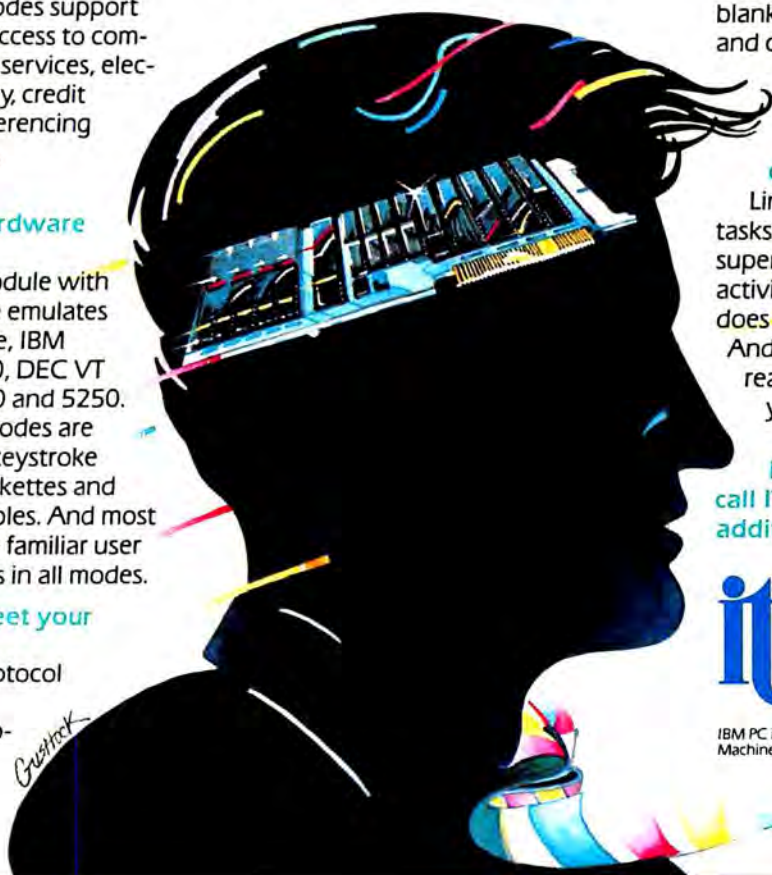
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File Types: ASCII, EBCDIC and Binary.

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Modems: 103, 212, 201, 208 Bell compatible, Hayes, Vadic, Rixon smart modems, or user defined.

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Base Price: \$795 each, including TTY and Asynchronous block software.

PC World View

News and notes for the computing community

Miriam Medom

The *PC World View* staff is avidly attuned to new developments in computer technology, and we hear lots of rumors, speculation, and advance news that interest us. We want to share the most promising and unusual of these developments, and we'll do that here. We've reserved the "Grapevine" section of this column for industry reports, speculation, and rumors that we find especially enticing.



Grapevine

PC's Corporate Reward

Industry intelligence speculates that IBM will recognize the astounding success of its Personal Computer by creating a separate corporate division for the PC. Such a move would be a departure from IBM's recent tendency to consolidate its marketing operations, but apparently the folks in Boca Raton have earned the honor of being singled out. Don't rush to sell your IBM stock, though—it's all still one big happy company.

Ma Bell's Indecision

The newly deregulated, decentralized phone company—Ma Bell to most of us—has been rumored to be readying several microcomputers for imminent release. Now industry sources report that American Bell, one of Ma Bell's many subdivisions, has prototypes for four microcomputers: two are planned as low-cost consumer items and two are slated to compete with office systems such as the PC or Apple's Lisa.

But, observers note, Ma Bell is reluctant to enter the volatile computer market just yet. Reportedly the phone company wants to wait to release its micros until ancillary products are also ready—particularly the technology for linking the computers in local area networks and long-distance communications. So we may have to wait some more for a ringing announcement from Bell.

A Franklin PC?

Franklin Computer Corporation, the folks who made a highly successful Apple II lookalike computer, may now be planning one that is IBM PC-compatible. Two signs of obvious growth at Franklin are the recent expansion of its manufacturing facilities and the doubling of its staff. A more telltale sign of PC emulation may be the hiring by Franklin of William Sydnes as vice-president of engineering. Sydnes previously worked for IBM, where he was the principal design engineer for the PC.

Although Franklin's president, Joel Schusterman, will not confirm or deny plans to offer a PC lookalike, he readily acknowledges, "We look at plug compatibility as a very essential thing."

Going Establishment

If any corporate entity can be said to represent the Establishment, certainly IBM qualifies for the title. Now the company is reportedly giving that title to one of its new products, the Establishment Information System, a local area network for office use. This system is rumored to use Intel's 80186 microprocessor as its computing brain—that's the more advanced chip that is compatible with the PC's 8088 processor. Yet this Establishment system is said to be incompatible with the PC. Instead, it is apparently intended to perform most operations now done by the Displaywriter and Datamaster systems.

Chip Slips

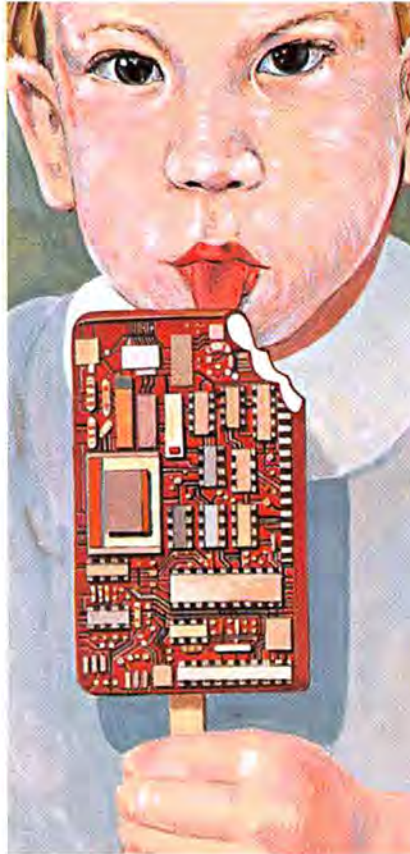
Speaking of Intel's 80186 microprocessor, one industry source reports that a recent problem with the chip has required replacement of the processor in machines where it was originally installed. The bug supposedly involves improper execution of one type of move instruction. The problem occurs when the instruction

is given immediately after information has passed from memory directly to the processor without going through any peripheral interface. The problem has been corrected in new versions of the 80186.

Kid Stuff

Kids have been dumping several tons of quarters down video game coin slots every hour for a couple years, so it's not surprising that the video and computer craze is spawning more traditional media for young people as well. The top of the list in entertainment, of course, is the movie *War Games*, the box-office sensation that features a teenager with his Imsai 8080 playing shoot-'em-up with the mainframes in the nation's nuclear attack warning system. In fact, *War Games* is so informative on the subject of breaking into supposedly secure computer systems that several large corporations have referred to the movie in their standard protect-your-data/change-your-password memos.

On a less threatening front, a new magazine and a television series will also feature kids and computers this fall. The magazine is *Digit*, the brainchild of San Francisco publisher and mother Lassie Benton. *Digit*'s recently released first issue features robotics as well as 14 programs for various home computers. The magazine's editorial board is made up of 15 kids (soon to be increased to 30) who contribute story ideas and critique each issue's content. Many of *Digit*'s articles are also written by young people with editorial help from the magazine's adult staff.



Digit is published bimonthly. A one-year charter subscription is \$8.95, and the magazine costs \$1.95 per issue on newsstands. For more information contact *Digit*, P. O. Box 29996, San Francisco, CA 94129, 415/931-1885.

A new television series, "Whiz Kids," will soon feature "teenage computer geniuses who battle the forces of evil through the amazing things they do with computers," according to a press release about the series. "Whiz Kids" is the invention of producer Philip DeGuere, who also created "Simon and Simon." DeGuere is no stranger to computers; he has replaced typewriters in his office with micros and even used The

Source to gather viewer response to "Simon and Simon" when it debuted two seasons ago. DeGuere has gotten IBM, Apple, and Xerox to provide computers for "Whiz Kids," and he promises that the show "will accurately reflect the reality of computers."

We hope this hour-long adventure program serves both kids and computers well, but we wonder how even whiz kids can "reflect the reality of computers" while at the same time "doing battle with the forces of evil." Maybe for starters the amazing teenagers could zap their press agent's comic-book prose.

COMPAQ Con-fusion

If your COMPAQ computer starts making funny noises and your CRT suddenly goes blank, relax. It probably isn't your fault. The Texas-based COMPAQ Computer Corporation discovered in May that some software packages "execute a nonstandard command to the video control logic" that causes a fuse in the monitor to blow out. Ken Price, COMPAQ director of marketing communications, stressed that such incidences are "extremely rare." The problem occurs with "less than 1 percent of the software on the market," he said. A recent modification to the monitor assembly design has rectified the fuse problem.

Price said that COMPAQ dealers were notified of the problem and given the serial numbers of the defective computers. The dealers were authorized to contact customers and

replace each computer's monitor free of charge. Computers do not have to be under warranty to qualify for this replacement offer. Replacing COMPAQ's monitor is about a half-hour operation, Price said.

Price would not say how many COMPAQ computers need new monitors. However, one source told *PC World View* that COMPAQs with serial numbers 1427 to 7017 are being recalled.

Big Blue's News

IBM's Logo

Logo seems to be coming on strong for the PC. Digital Research announced its DR Logo in January (though it's not available yet), and Harvard Associates of Cambridge, Massachusetts, has already released a PC version of the language. IBM now has joined the fray, promising that its Logo will be available late this year. A preliminary version of IBM's Logo is reportedly being used in some of the firm's educational programs.

IBM Switches Phone Deals

In short order recently, IBM acquired 15 percent of Rolm Corporation and canceled its working agreement with Mitel Corporation. Both of these companies specialize in designing and manufacturing telephone switching equipment and similar devices—an area in which IBM has had no notable successes as yet. The Rolm-IBM pact was established so that the two firms can work together on communications among large computers, telephone exchanges, individual telephone lines, microcomputers, and terminals.

The Missing Chip

With its announcement of the Intel 8087 coprocessor for the PC (and the XT), IBM has finally clarified the purpose of the empty socket on the motherboard. Although other suppliers have already offered an 8087 and some software to use it for the PC, IBM has not until now officially acknowledged that the computer was designed to accommodate the number-crunching chip. The 8087 will be supplied as part of a pair of chips; the second is a replacement 8088 processor designed to work in tandem with the 8087. The chip set will cost \$260.

To make the 8087 more easily accessible to PC users and programmers, IBM will also release a version of its APL language that is especially well suited to the 8087.

similarity in names and products would confuse potential customers. SoftwareLand, which is based in Scottsdale, Arizona, plans to open a dozen software stores by mid-1984.

Meanwhile, ComputerLand has established a new marketing arm called ComputerLand Large Account Support and Service (CLASS). As its name implies, the new program is aimed at Fortune 500-type accounts and will provide discount prices for volume purchases of equipment.

Sharing the Wealth

Most computer stores are doing a booming business these days, and this good fortune has motivated at least one dealer to share the wealth. Prodigy Computer Center of Iselin,



Lots of Land

The battle of trademarks and company names may just be beginning. Recently, ComputerLand Corporation sued a start-up firm, SoftwareLand, to keep it from using *land* in its name. ComputerLand claims that the

New Jersey, has been giving classes in computer literacy to anyone who is unemployed. The class meets one day a week and presents the fundamentals of computer use to all comers. The immediate goal of the class' limited hands-on exposure to computers

is to provide familiarity with the machines and their uses and to help unemployed clerical workers upgrade their skills to include computer proficiency.

This notion of community service is a good one, and Prodigy has received favorable publicity for its efforts. If more business people would take this approach, we might begin to conquer unemployment and bridge the computer literacy gap in the process.

Move Over, Hallmark

Contributing Editor Larry Magid recently discovered yet another sign of the computer's pervasive influence on our lives. Now, Larry reports, we can all send computer greeting cards. Here are the details.

Computer Greetings provide high-tech humor for that special occasion. Shaped like floppy disks and adorned with pertinent cartoons, these cards offer more messages than an on-line data base. There are invitations (You are invited for a byte at my place), get well cards (Got a bug in your system?), and friendship messages (I am user-friendly, are you?).

The line of 25 greetings covers most events, including belated birthdays (Your birthday slipped my memory) and weddings (May you interface with happiness). The only thing missing from this line of greeting cards is a message of condolence—the cards' creator probably thought better of remarking about "terminal cases."

Computer Greetings are the work of Michelle Whitman, a former software salesperson turned entre-

preneur. Although the cards are the same size as 5¼-inch disks, Whitman recommends slipping them into the mail rather than the disk drive. The cards cost \$1.20 each and can be purchased at computer stores. For more information contact Computer Greetings, 2661 Lakeview, San Leandro, CA 94577.

Hallmark hasn't yet come out with its own version of Computer Greetings, but the greeting card giant has added a computer dimension of its own. In a recent television advertisement, a group of women pass a birthday card from desk to desk to be signed. Clearly visible on one woman's desk—a PC.

Recycling Floppies

Our correspondent Patricia Regehr suggests a new *PC World View* pastime for computer users—devising ways to recycle worn-out floppy disks. Patricia gets the competition started with these floppy-saving ideas.

Disk Throw: Place an empty beer or soda bottle in the middle of the room and stand back about 4 feet. Now gently toss the worn-out disk so that its hub settles over the bottle's neck (no easy feat). As a contest, the disk throw could be a good money raiser for your next computer fair or user group gala.

Earrings: Punch a small hole in one corner of the disk and attach an earring wire (available at jewelry or crafts stores) to it. Next affix the wire to your ear (or ears, if you've made a pair). For somewhat less showy disk earrings remove the mylar disk from its jacket and wear it. In either case, watch out for low-flying branches.



Templates: Carefully cut the disk jacket on one side and remove the mylar disk. Use the jacket as a template for drawing two sizes of circles and one oblong shape. You could give computer graphics a new meaning.

Floppy Frisbees: There are two variations on this theme. If you've already removed the mylar disk, you have an almost-lighter-than-air flying saucer. If the disk is still in its jacket, try sailing this square object.

We'd like to hear about other good uses for old floppies—send them along, please (the ideas, not necessarily the floppies). And be sure to back up the data on the obsolete disks before recycling them.

Summer Sports

Yes, even computer junkies take time away from the keyboard, as this report from *PC World* staffer Katie Seger reveals.

The yet-unnamed *PC World* softball team (the PCBs?) defeated its cross-bay rival, computer book publisher Sybex, in a close 15-14 summer battle. The Sybex team fought back from an 8-1 third inning deficit to take a 14-11 lead in the top of the 9th inning. But *PC World*, sending its heavy hitters to the plate, chalked up four runs to win the game in the last half of the inning. (It's just possible that *PC World* was aided in the win by the fact that the game's umpire was Seger herself, who was sidelined with a bum knee.)

Good Licks

A California ice cream maker may be the first to offer a computer age flavor. Old Uncle Gaylord's ice cream parlors in Silicon Valley have been scooping plenty of Computer Chip. This new concoction is apple-flavored ice cream with chocolate chips. Maybe we could get them to make a blue-and-white striped cone to give IBM equal time.

PC World View welcomes contributions from readers, and we'll pay up to \$50 for the items we use. Please include your name, address, and phone number with your contributions. Send them to PC World View, PC World, 555 De Haro St., San Francisco, CA 94107.

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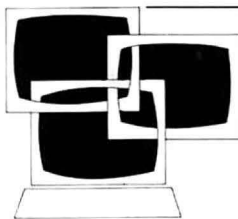
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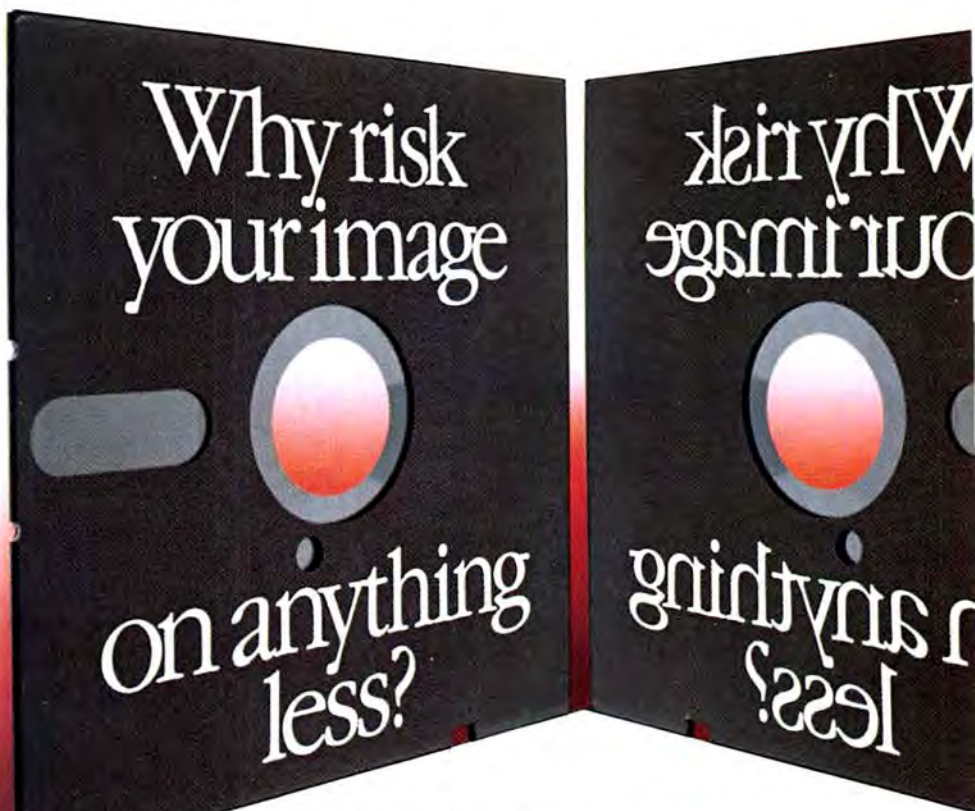
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Reader Service #47

Computer-Aided Design

Davis Straub

The market for drawing processors in 1983 has many similarities to the early battles between manufacturers of dedicated word processors and software firms providing generic word processing packages for a variety of microcomputers. Firms that are currently selling dedicated computer-aided design and drafting (CADD) systems for minicomputers are about to discover that they have a high-powered, low-end contender in the IBM PC. Compared to the minicomputer systems, the PC provides fewer CADD capabilities, but its lower price means widespread affordability.

The IBM PC is the new design standard for other microcomputers. A few farsighted CADD software manufacturers are taking advantage of the PC's higher level of standardization in graphics hardware as well as the advances in memory it offers. The three drawing processors reviewed here demonstrate the PC's impressive new role in computer-aided design.

Drawing processors will change the working styles of designers and draftspersons in the areas of architecture and civil, mechanical, electrical, and electronic engineering. Illustrators and artists will use drawing processors to develop flow charts, organizational diagrams, and other line drawings. In the near future, furniture manufacturers and model makers will show their creations in color and three dimensions on inexpensive computers in their clients' offices.

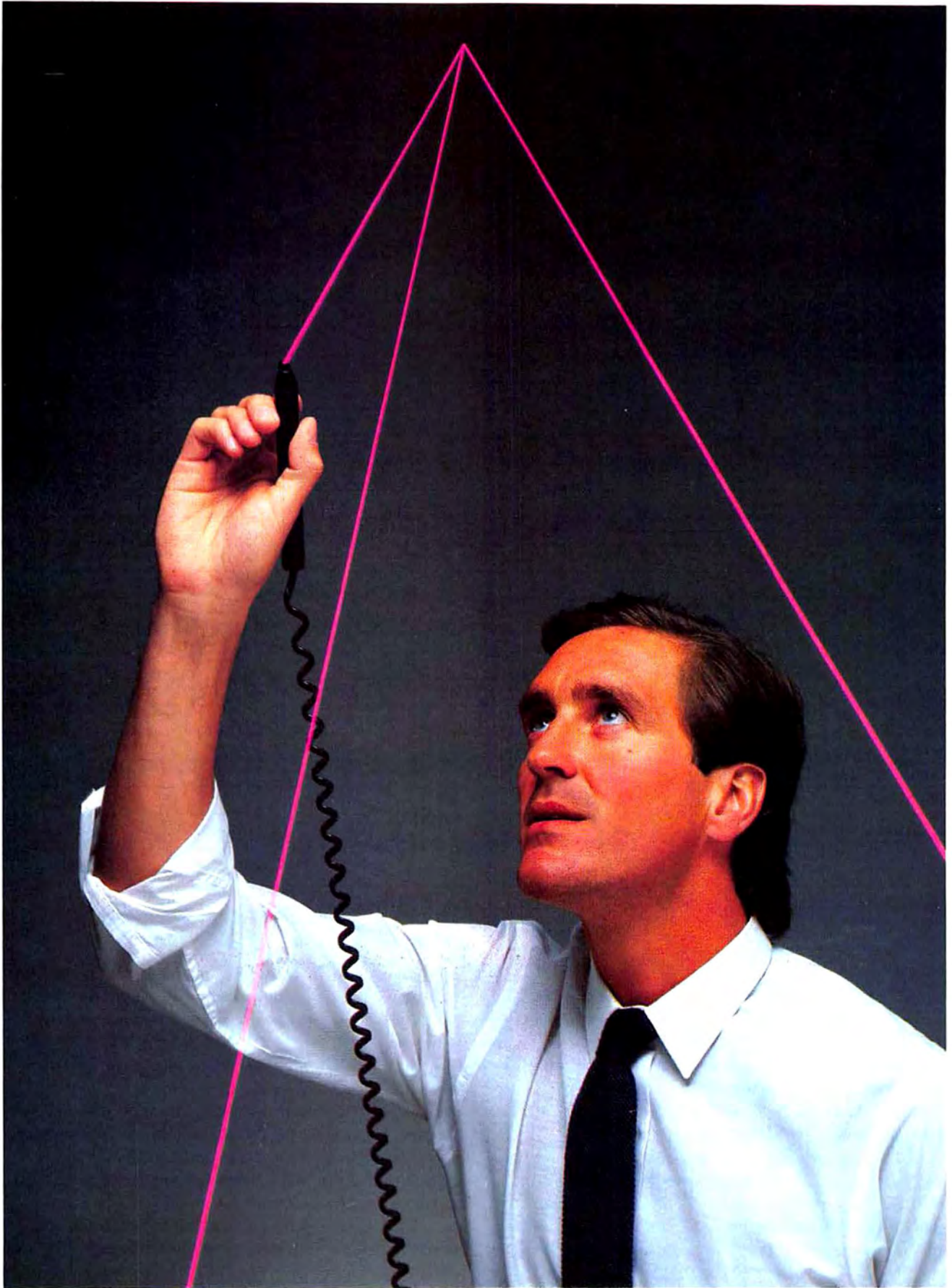
The primary uses of drawing processors are the creation, editing, and plotting of line drawings. Using color and filled-in solid figures allows for a wider range of expression. In some cases, numerical data can be plotted, though not as easily as with business graphics packages. Three-dimensional drawing processors allow perspective viewing of a designer's creation.

History Repeats Itself

The first word processing computers in the early 1970s were dedicated minicomputers with multiple users tied to one processor. Costs for such systems ranged from \$100,000 to \$300,000. Computer technology at that time was not ready to provide stand-alone single-user, single-processor systems. The current generation of CADD systems almost universally uses minicomputer hardware. The high cost of the hardware for these systems has limited their acceptance and thereby increased the software costs per unit delivered. These high initial costs have forced CADD manufacturers to add extensive capabilities to their software to improve marketability, further driving up the costs.

As was the case with word processing technology, the advent of the 8-bit microprocessor allowed some CADD manufacturers to develop lower priced (\$80,000 to \$100,000) dedicated single-user systems. But today you can choose from a few CADD programs running on 16-bit computers for \$1000 or less. The cost of the peripherals required to enter and produce hard copy of the drawings brings the incremental cost above your existing PC to somewhere between \$1000 and \$32,000.

In a field that has seen few technological advances, the use of drawing processors on 16-bit machines will lead to an explosion in computer use similar to the success of word processing programs running on microcomputers. One study has predicted that 40,000 draftspersons will be out of work by the year 2000. On the other hand, some experienced people in the field of high-priced CADD systems believe that the way drafting work is done will change, but many people will still be needed to use the new tools.



	AutoCAD	The Drawing Processor	MicroCAD
Computer			
Columbia	●	—	—
COMPAQ	—	—	●
Compupro 816	●	—	—
DEC Professional	—	—	●
Digital Microsystems 16-bit work station	●	—	—
Eagle PC	●	●	●
Eagle 1600 series	—	●	—
Hewlett-Packard 86	—	—	●
IBM PC	●	●	●
NEC-APC	●	—	—
Texas Instruments PC	●	—	—
Victor 9000	●	—	●
Zenith Z-100	●	—	●
Screen			
color monitor ¹	●	—	●
monochrome monitor ²	—	●	●
two monochrome monitors ²	—	●	—
monochrome and color monitor ¹	●	—	●
Vectrix 384 color graphics board with monitor	●	—	—
Digitizer Pad			
GTCO	—	●	—
Hitachi Tiger	●	—	—
Houston Instruments HI-PAD	●	●	—
Summagraphics	—	—	●
Vectrix 384-1-3	●	—	—
(continues)			

Table 1: Hardware for AutoCAD, The Drawing Processor, and MicroCAD

CADD on the PC

AutoCAD, *The Drawing Processor*, and *MicroCAD* are among the first design and drafting software available on 16-bit computers. With these tools the creation and editing of drawings that previously took weeks to finish by hand with dedicated equipment costing as much as \$300,000 can now be done much faster on work stations costing from under \$10,000 to \$40,000.

The Drawing Processor and *AutoCAD* are similar packages. Both are two-dimensional line drawing and drafting packages that run on the PC and PC-compatible machines, including the Eagle PC and the Eagle 1600 series. They create any type of line drawing and can be

used for architectural sketches and drafting, as well as electrical circuit design, mechanical design, interior design, line art for the fine arts, flow diagrams, and organizational charts.

Both *The Drawing Processor* and *AutoCAD* are generic line processors in the same sense that programs such as *WordStar* and *EasyWriter* are generic word processors. They allow the creation of almost any line representation but have been designed specifically for easy editing of drafting work. These products are less useful as free-form drawing tools for artists.

MicroCAD, on the other hand, is a three-dimensional drawing tool that is more useful for modeling and designing than for drafting. Like *The Drawing Processor* and *AutoCAD* it is a generic line processor, but *Micro-*

	AutoCAD	The Drawing Processor	MicroCAD
Other Input Devices			
keyboard	●	●	●
light pen ³	—	—	●
mouse (USI Optomouse)	●	—	—
Touchpen (Sun-Flex) ⁴	●	—	●
customized	—	—	●
Plotter			
Amdek DXY-100	—	—	●
Bausch & Lomb DMP-7	●	●	—
Bausch & Lomb DMP-8	●	●	—
Bausch & Lomb DMP-29	●	—	—
Bausch & Lomb DMP-40	●	●	●
Bausch & Lomb DMP-41	●	—	●
Bausch & Lomb DMP-42	●	—	●
Data Design Logic Systems	—	●	—
Hewlett-Packard 7220	●	●	—
Hewlett-Packard 7470	●	●	●
Hewlett-Packard 7580	●	●	●
Hewlett-Packard 7585	●	●	●
Sweet Pea	●	—	—
Printer			
Epson FX series	●	—	●
Epson MX series	●	●	●
Customized output device	—	—	●
Graphics Board			
Eagle Graphics Card	—	●	—
Hercules	●	—	●
IBM Color/Graphics Adapter	●	●	●
Orchid	—	—	●

¹The manufacturers of *AutoCAD* and *MicroCAD* recommend using two monitors, though only one is required.

²The manufacturer of *The Drawing Processor* recommends using an Eagle PC with one monochrome monitor. Using an IBM PC requires two monitors.

³*MicroCAD* supports the FTG light pen.

⁴*MicroCAD* supports the Touchpen with the Victor 9000.

CAD also allows line drawings of solid (or *wire frame*) objects to be created, rotated, and viewed from a selected perspective. Line drawings of simple objects can be joined together to create more complex objects. Objects can also be defined by a mathematical function in *VisiCalc* and transferred to *MicroCAD* for plotting.

MicroCAD was available in the spring of 1982 and *AutoCAD* was first announced at the fall 1982 COMDEX show. As of early June 1983, Autodesk, Inc. had shipped 600 copies of *AutoCAD*, and Computer Aided Design had shipped over 350 copies of *MicroCAD*. *The Drawing Processor*, from startup company BG Graphics, was released on August 1, 1983 (a prerelease copy of the program was used for this review).

● Review

Hardware Shopping List

Drawing processors require devices that are beyond the configuration of peripherals normally associated with microcomputers. CADD systems are characterized by user interaction with digitizer pads, mice, light pens, screens, and a plotter. The role of the computer is to integrate all these devices. (See Table 1 for a comparison of hardware supported by the three programs reviewed here.)

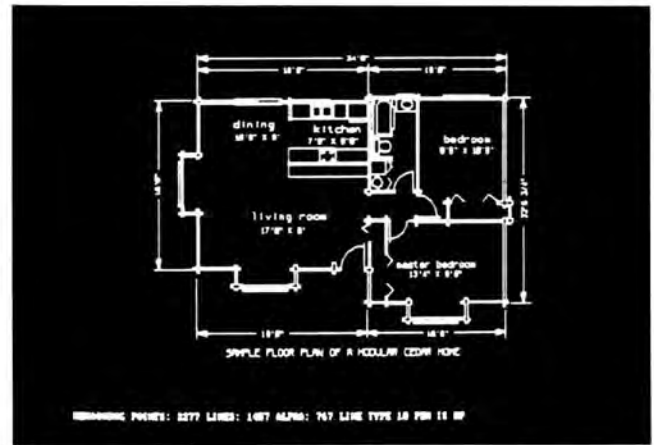
The crucial factors in determining how well users will adapt to the new CADD tools are the performance of the peripherals and how well the CADD software uses them. Performance requirements include being able to draw quickly and accurately. The drawing device should be as transparent as possible, meaning it shouldn't interfere with the job you have to do. The cursor location in the drawing must be clear at all times. Paper copies should be of a quality comparable to hand drawing, if not better. The computer, screen, and input devices must be located so as to provide a large, uncluttered work area.

All three systems encourage the use of two monitors, one for text commands and help messages and the other for graphics display.

All three tools support keyboard input for drawing, editing, and plotting. The prerelease version of *The Drawing Processor* required a digitizer pad for drawing creation, although the production version will also use the screen for drawing and editing. *AutoCAD* supports a Touchpen (Sun-Flex), a mouse (USI Optimouse), or a digitizer pad. *MicroCAD* supports a light pen and will soon support a digitizer pad. In any case, using a digitizer pad is preferable to using the screen as an input device because it provides a larger area for creating drawings.

All three systems encourage the use of two monitors, one for text commands and help messages and the other for graphics display. Single screen configurations are available with all of the systems, although *The Drawing Processor* requires two monochrome monitors with the IBM PC. With the Eagle 1600 or the Eagle PC, however, it requires one monitor. The Eagle PC and the IBM PC support the IBM Color/Graphics Adapter, which offers poor resolution quality.

The Drawing Processor also supports the Eagle board with mixed graphics and text on the same screen and 725- by 352-pixel resolution. *AutoCAD* can be run



Drawings produced with *The Drawing Processor* on the Eagle PC monochrome monitor

on one screen with the IBM Color/Graphics Adapter, but you must switch back and forth between text and graphics modes. *AutoCAD* also supports the Hercules Graphics Card with 640- by 400-pixel resolution. *MicroCAD* provides mixed graphics and text on one screen running on the IBM Color/Graphics Adapter, but two screens are preferable.

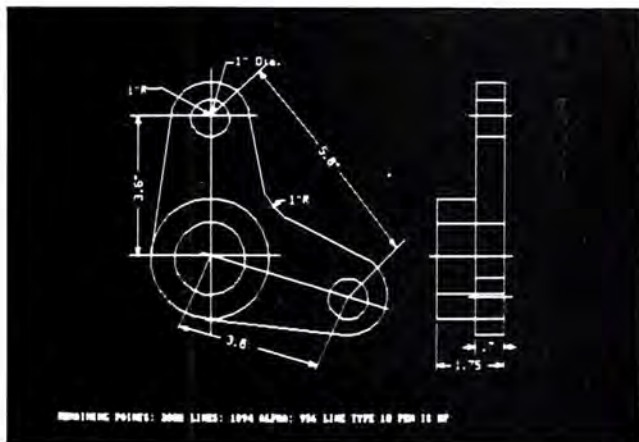
MicroCAD does not require the purchase of any input/output devices in addition to a monitor and a dot matrix printer. *The Drawing Processor* and *AutoCAD* both require the purchase of a plotter. *MicroCAD* supports a plotter as well as Epson MX series compatible printers. Using these printers is an option that allows a trade-off between quality and cost. Both *AutoCAD* and *The Drawing Processor* will soon support the Epson MX printers.

The Drawing Processor Work Station

A typical work station for *The Drawing Processor* includes an Eagle PC with an Eagle Monochrome Monitor and Monochrome Monitor Adapter Board for text and graphics display. Also included are a GTCO Digi-Pad; a 20- by 20-inch high-resolution digitizer pad and cursor



Typical work station for *The Drawing Processor*, which features the Eagle PC



PEN UP		CIRCLE ②		REMOVE LINE	GRID SIZE	DEFINE COMPONENT PLACE	ROTATE COMPONENT SCALE	MEASURE DISTANCE																					
		CIRCLE ③		MOVE POINT	TOLERANCE	COMPONENT	COMPONENT	MEASURE ANGLE																					
		ARC ③		REMOVE LAST LINE	LINE TYPE	STORE COMPONENT	BLOCK COMPONENT	MEASURE AREA																					
		ARC ④		BLOCK ERASE	CHANGE EXISTING LINE TYPE	RETRIEVE COMPONENT	STANDARD COMPONENT, 1" LINE	QUIT																					
		ELLIPSE		BLOCK MOVE	ORIGIN	STRETCH/SHRINK COMPONENT	STANDARD COMPONENT, ARROW	WINDOW																					
FAST LETTERING		ON	OFF	CURVE	SAVE	ALIGN	PLACE COMPONENT ON SCREEN	REMOVE LAST COMPONENT	DRAW PICTURE																				
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	LETTER SIZE	LETTER SLANT	ASPECT RATIO	LETTER DIRECTION
1	2	3	4	5	6	7	8	9	+	-	=	>	<	.	/	{	}	()	±	°	SPACE	BACK SPACE	RETURN	REMOVE SOME LETTERS				

● Review

AutoCAD Work Station

A typical *AutoCAD* work station does not require the use of a digitizer pad, although it can be used with a Houston Instruments HI-PAD or a Hitachi Tiger digitizer. Instead, *AutoCAD* uses the screen as its major drawing input device. Either a mouse, a Sun-Flex Touchpen, or a digitizer pad is used for controlling the on-screen cursor and for selecting commands from a menu appearing on the right side of the graphics screen. You can place the menu on the digitizer pad if you're using one. Drawings are created by moving the cursor on the screen to specify points and then drawing lines between these points.

In using a Touchpen with *AutoCAD*, cross hairs appear on the screen and follow the Touchpen until you lift the pen from the screen surface to enter points or commands. A mouse is rolled around on a horizontal surface (usually a desk top) near the display screen while a cursor on the screen follows the relative movements of the mouse. You press a button on the mouse when you reach the point on the screen that you want to enter into the drawing. The digitizer pad and cursor can also be used as a pointing device (much like a mouse) with *AutoCAD*.

Points and lines can be placed on the screen by pointing with one of the input devices already described, using the keyboard cursor control keys, or by using the Line command with reference to the absolute or relative coordinate of the points and lines within the plane of the display screen. For example, you can draw a line between the lower-left corner of the screen and the middle of the screen by entering two points after the Line command, such as 0,0 and 5,5. If the last point you entered using any of the input devices was 5,5, then entering either 5,10; @ 0,5; or @ 5<90 (less than a 90 degree angle) after the Line command would draw a vertical line 5 units high from the starting point, 5,5.

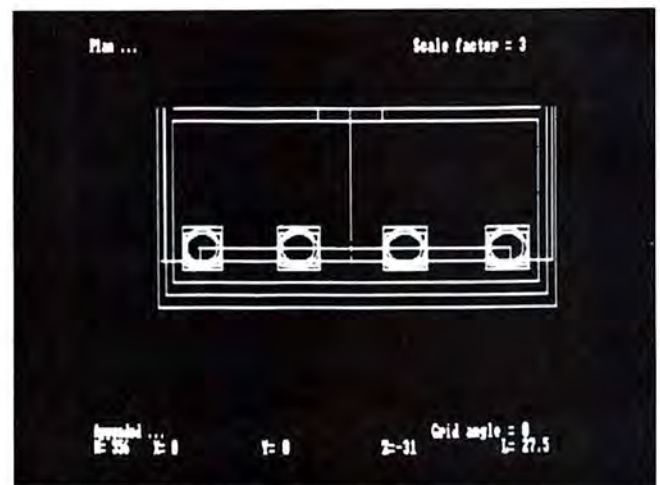
MicroCAD Work Station

MicroCAD uses the screen for drawing and editing, but you can only move the on-screen cursor by using the keyboard cursor keys or a light pen. The cursor is used to position points in a three-dimensional space. You enter points by pushing the period (.) key when the cursor is at the right location; you draw lines from the last point entered by using the backslash (\) key.

MicroCAD has a set of menus: a main menu for beginning new drawings, calling up and saving old drawings, and setting scales; an edit menu for entering lines and points, and rotating and viewing objects; a coordinate menu for entering points numerically (as opposed to spatially); and a plot menu for getting hard copy output. The function keys on the IBM PC or the Eagle PC are used to select menu items.



MicroCAD's elevation view



MicroCAD's plan view



MicroCAD's perspective view

The location of the cursor on the *MicroCAD* display screen is always specified by its X,Y,Z coordinates relative to the center of the screen. *MicroCAD* provides either *plan view* or *elevation view* of a three-dimensional object on a two-dimensional screen. In plan view (as in a floor plan) you view the object as though from above. The Y-axis is vertical and positive up from the center of the screen, and the X-axis is horizontal and positive to the right of the center of the screen. The Z-axis appears to come straight toward the viewer.

In elevation view, in which the object appears as if you were standing in front of it, the Z-axis is vertical, the X-axis is still horizontal and positive to the right of the center of the screen, and the Y-axis points into the plane of the screen, or away from the viewer. You can move the cursor about in either the X,Y plane or the X,Z plane using the cursor keys or the light pen, or you can locate the cursor at an absolute point by directly entering its X,Y,Z coordinates.

To draw a cube using *MicroCAD*, you first draw a square in one X,Y plane using the cursor keys, and the period and slash keys. You then change the Z-axis to the

length of one side of the square and draw an identical square. The next step is to flip to the elevation view (press <F2>) and draw lines connecting the eight corners of the two squares.

Plan and elevation are isometric, not perspective, views of an object. This means that points on the object that are farther away appear to have the same dimensions as closer objects. To get a perspective view (how an object would look if viewed from a particular reference point a given distance away), you would locate the cursor at a given point and press the perspective key, <F3>.

Boilerplating a Drawing

If drawing processors only provided easy erasing and redrawing of lines, they would still be a major advance over the existing pencil-and-paper technology for drafting and sketching. In fact, CADD systems also have a number of other capabilities such as the ability to create, store, and retrieve *components* or *entities* that can be used repeatedly in a drawing. This is known as *boilerplating*. (See Table 2 for a comparison of boilerplating

Feature	AutoCAD	The Drawing Processor	MicroCAD
Applications	2-D architectural drafting; 2-D electrical circuit, mechanical, & interior design; 2-D line art; 2-D flow diagrams & organizational charts	2-D architectural drafting; 2-D electrical circuit, mechanical, & interior design; 2-D line art; 2-D flow diagrams & organizational charts	3-D architectural and interior drawing, modeling, & design
Boilerplating a drawing (creating, storing, & retrieving predefined components)	Line, circle, arc, trace*, solid*	Line, circle, arc, curve*, ellipses*	3-D objects*
Placing, rotating, & scaling components	Yes	Yes	Yes
Cutting and pasting	To move a component, identify it with one adjacent point	To move a component, draw a box around it; can move directly any portion of a drawing*	Can join 3-D objects
Rubber banding	Appended lines automatically stretched when moving a component within a defined window	Option to automatically stretch all appended lines when moving a component*	Can join 3-D objects
Adding text to a drawing (continues)	User chooses height of text	User defines size, slant, aspect ratio, angle, & placement of text	Two labeling modes

Table 2: Features comparison for AutoCAD, The Drawing Processor, and MicroCAD

Feature	AutoCAD	The Drawing Processor	MicroCAD
Multi-layered drawings (2-D function)	Yes*	Define line types	No, but can overlay objects
Dimensions	Reports distance between points and dimensions for rectangular areas; optional semiautomatic capability*	Reports distance between points, dimensions for any closed polygon	Reports end point locations; need calculator to figure distance between points
Grids	Yes	Yes	Rotatable grids: plan and elevation views*
Orthogonal mode (2-D function)	Lines are forced to be vertical or horizontal	Can set tolerance; allows diagonal lines	No
Data storage format for writing auxiliary programs	Yes	No	Yes
Zoom	Yes	Yes	Yes
Foreign language	German; soon French and Swedish	No	No
8087 chip improves speed	Recommended	Required	Recommended
Programming language	C	Pascal MT +	Machine language
*Outstanding feature			

Table 2: Features comparison for AutoCAD, The Drawing Processor, and MicroCAD (*continued*)

and other features of *AutoCAD*, *The Drawing Processor*, and *MicroCAD*.) While the major component of a drawing is a line, there are often other parts that can be defined by symbols and repeated throughout the drawing. For example, an architect can define a door frame or bathtub with an individual symbol and then enter the symbol to repeat this component in the same or future drawings.

AutoCAD provides a number of predefined components. In addition to line, they include circle, arc, trace (a fat line), and solid (a filled-in, closed area). In addition *AutoCAD* gives you the ability to quickly repeat any component as many times as you like in rows and columns.

The Drawing Processor includes lines, arcs, circles, ellipses, and curves (curves fitted to any series of points) as predefined components. Both programs allow you to create your own components from anything that you draw, store those components in a file, and retrieve them for use in a drawing.

Both *AutoCAD* and *The Drawing Processor* allow you to place, stretch, shrink, scale, and rotate any component. *AutoCAD* also gives you the ability to create new menus on the screen that can include the components, while *The Drawing Processor* allows you to add components to its menu strip.

MicroCAD allows you to create and store three-dimensional components, and to rotate, scale, and join them with an object on the screen.

Cutting, Pasting, and Rubber Banding

With all three systems you can move points as well as components, and erase lines and blocks (all the points and lines defined within a specified rectangular area). *AutoCAD* assumes that the components placed in a drawing retain their original identity. Therefore, you cannot remove any lines within a predefined component. To move a component you simply identify it with one adjacent point. *AutoCAD* allows you to move all the components and any lines appended to them within a

Both *AutoCAD* and *The Drawing Processor* allow you to place, stretch, shrink, scale, and rotate any component.

window that is defined by its diagonally opposite corners. However, outside the window you must move separately each line that is attached to the component inside the window.

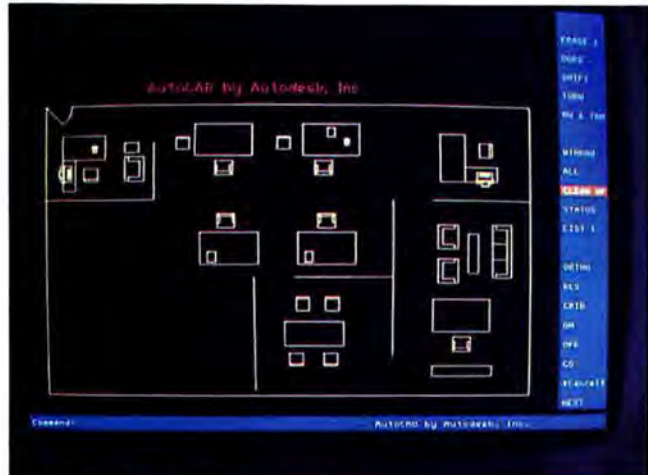
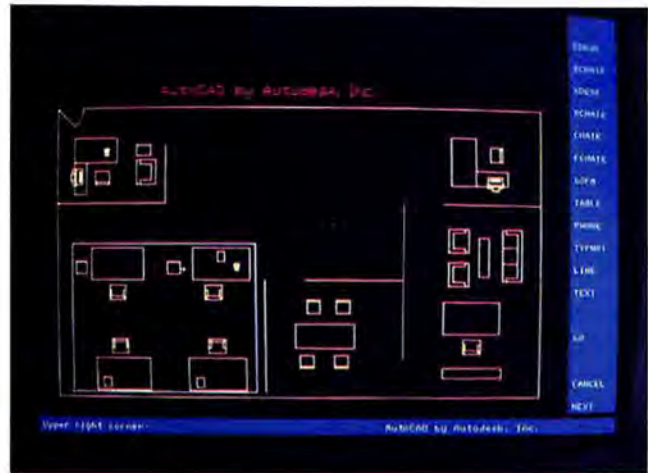
The Drawing Processor merges the points that define a component into the rest of the drawing, so you must draw a box around the area you want to move. As you move components, the program provides the option of having appended lines automatically stretched (*rubber banded*) to meet the components in their new location.

MicroCAD allows you to *paste* by sticking one three-dimensional object onto another, but there's no block move feature. Attached lines must be moved separately.

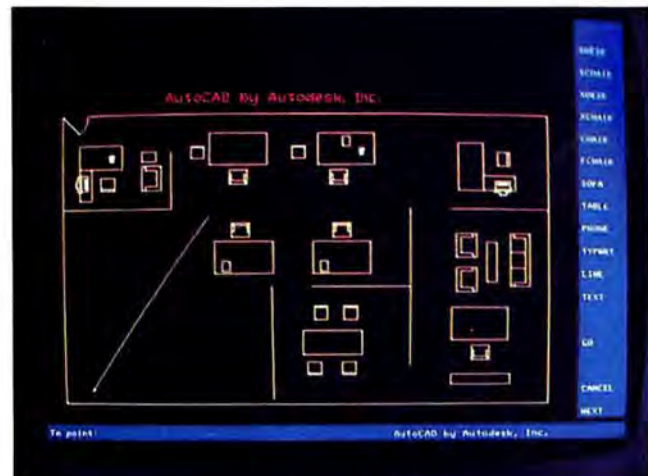
Adding Text Drawing

A drawing does not live by lines alone. If you are creating an architectural drawing, you'll need to put in a few clarifying words such as "living room" and "kitchen." All three programs have a facility for inserting text into a drawing. *AutoCAD* users can indicate the height of the text with the cursor or define the height numerically, angle the text, and create their own fonts (a procedure that requires inserting codes in particular byte locations). Text can be centered at a specified point instead of the normal left alignment.

The Drawing Processor lets you define the size, slant, aspect ratio (ratio of height to width), angle, and placement of the text. *MicroCAD* has two labeling modes. Text can be entered just before a drawing is plot-



AutoCAD allows for moving all objects within the area defined by a window.



When you move objects with *AutoCAD*, the rubber-band cursor appears as a white line stretching from the starting point to the current location of the cursor. The line disappears once the second point is selected.

● Review

red or, using an optional (\$150) rotatable character set, the text can be viewed and plotted along with the image. In other words, in three-dimensional work the text is attached to any of the three planes, so the text will move or tilt as you tilt the image.

Multilayered Drawings

If you're drawing a six-layer circuit board or you want to view the titles separately from the drawing, with *AutoCAD* you can store the different pieces of information with separate layer designations. To get an idea of how

The Drawing Processor has a more limited capability that allows for the definition of different types of lines.

this works, think of layers as sheets of transparent overlays. Colors that could be assigned to different colored pens on the plotter can be assigned to different layers. All of the layers can be plotted on the same drawing, or real transparent overlays can be created when you plot the drawing.

The Drawing Processor has a more limited capability that allows for the definition of different types of lines. Different color pens as well as dashed or other types of nonsolid lines can be designated. The manufacturer plans to provide a layering capability similar to *AutoCAD*'s. *MicroCAD* doesn't have layering or line definition capabilities.

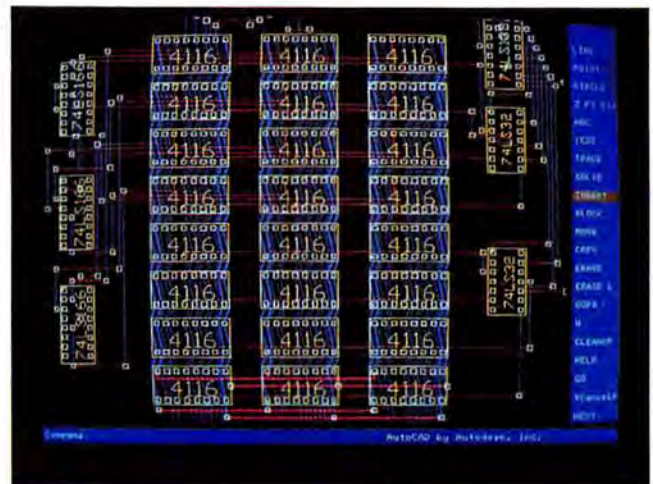
Dimensions

Each of the three programs keeps track of the relative position of points in a drawing. By using this information you can determine the various distances between points.

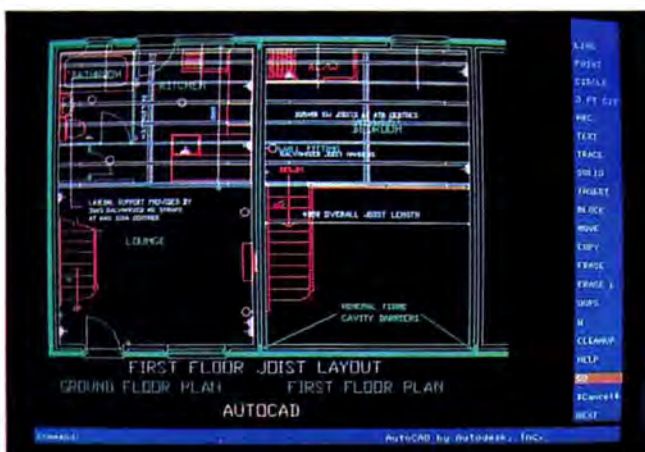
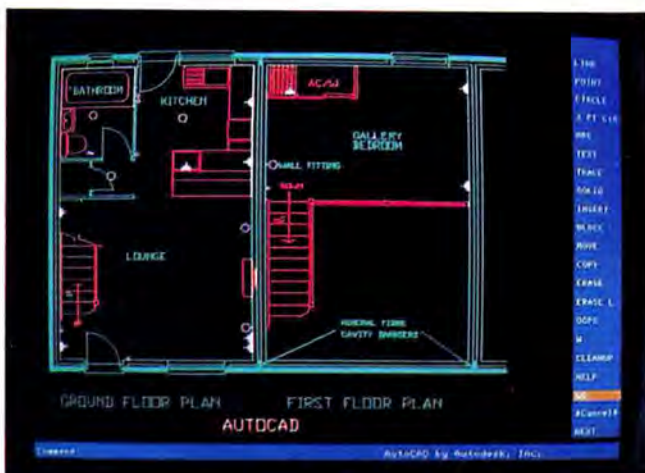
AutoCAD will compute the distance between two points and the area enclosed by a set of points. It also offers a semiautomatic dimensioning capability at additional cost (\$500). You designate where you want the dimension lines and the extension lines (which designate the end points of a dimension line). The distance is then



Using *MicroCAD*'s optional feature, the rotatable character set, text can be viewed and plotted both with and without a three-dimensional image.



AutoCAD's printed circuit board layout



AutoCAD's multilayering feature permits drawing overlays. (Note: The AutoCAD screen photos all show graphics on the Vectrix 384 color monitor. The menu always appears on the right side of the screen.)

determined and appears as a decimal number in its proper place on the dimension line. Arrowheads are automatically drawn on the dimension line and placed inside or outside the extension lines as specified.

The Drawing Processor will report the distance between points or along any set of points, the area enclosed by a set of points, or the angle between two lines.

MicroCAD provides the locations of the end points in your drawing. You can then use a calculator to determine the distances between points.

Grids, Orthogonality, and Tolerance

Even with a grid to mark lines, drawing vertical or horizontal lines is not always easy. By setting the grid size you can make lines snap to the grid if they are less than halfway to the next grid line. Drawing can be done much faster because you don't have to be so careful. *MicroCAD* provides for two rotatable "graph paper" grids on the screen, one in plan view and one in elevation.

While all three programs have a grid capability, *AutoCAD* also has an orthogonal mode. This means that all lines less than a 45-degree angle must be horizontal and lines greater than a 45-degree angle must be vertical. Unlike *AutoCAD*, *The Drawing Processor* allows you to set a tolerance for drawing horizontal and vertical lines.

Data Storage Format

Autodesk (*AutoCAD*) and Computer Aided Design (*MicroCAD*) have published the format for information exchange between their programs and other programs. The format consists of ASCII text files that can be written by other programs or used as the input to customized programs. With *MicroCAD*, for example, you can determine a bill of materials and costing information from the components in a drawing. *MicroCAD* also lets you define an object in a *VisiCalc* worksheet, save it as a DIF (data interchange format) file, and then convert it to a file that *MicroCAD* can read.

Physical Limitations

Without the aid of a drawing processor, you would begin a drawing by deciding what size paper you are going to use. The paper size will help determine the scale of your drawing (what distance in your drawing represents a given distance in the real-world object). After that decision you tape down the paper and get out a T-square, a french curve, a set of triangles, a pencil, and an eraser.

In using a drawing processor, the size of your drawing (the hard copy plot) is not limited by the size of the input device. Whether you use a digitizer pad or the

screen for drawing, you can plot a drawing up to the size of the plotter or divide the drawings up and plot one section at a time. The scale can be determined at the time of plotting. The complexity of a drawing is limited only by the software and hardware memory capabilities.

Although the input devices (graphics screen and digitizer pad) and plotter do not limit the size of the final hard copy of the drawing, the input devices do limit the size of the area in which you create and edit a drawing. For example, *AutoCAD* provides an approximate area of 7 inches horizontally and 4 inches vertically within which you can draw on the screen. If you create a drawing that will be 24 by 36 inches in its final hard copy form, the screen could get somewhat crowded. The same problem applies to *MicroCAD* and *The Drawing Processor* when the screen is used. For large drafting jobs using the screen can be a real drawback because of the small input area and low resolution.

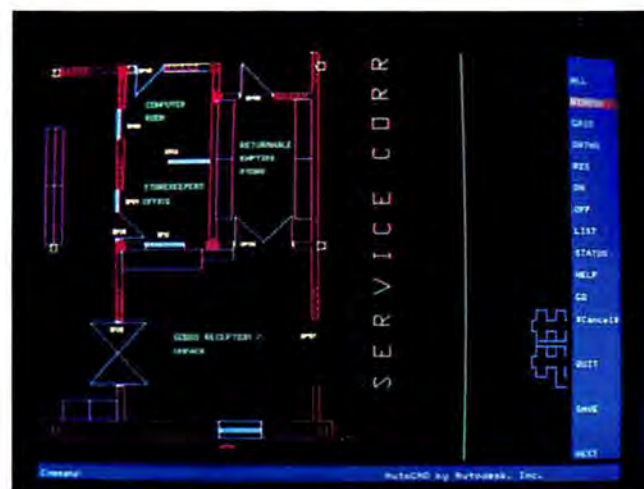
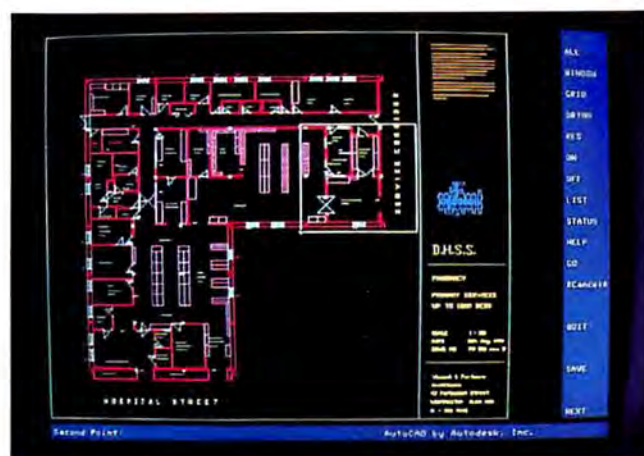
The size of the digitizer pad is also limited, but using this device is preferable to constantly looking at a small screen. The drawback to using the digitizer with *AutoCAD* in Tablet mode is that no reference cursor is on the screen to indicate your location. However, if you use the digitizer as a pointing device instead of in Tablet mode, a reference cursor does appear on screen.

The Drawing Processor's 20-inch square digitizer pad has a menu strip, so you have 20 inches horizontally and 16 inches vertically within which to place your drawing. The size of the digitizer pad is not limited by the size of the screen. Even if the digitizer pad were as large as a standard drawing table—the ideal size—the whole drawing could still fit onto the tiny 8- by 5½-inch screen.

Zoom Feature

The ability to *zoom* (or *window*) in or out from a given part of the drawing area partially overcomes the physical limitations of the screen size. *AutoCAD* initially asks for the size of the drawing in arbitrary units. The drawing then takes up the input area of the screen. If you draw an object within a small section of the input area, you can zoom in on the object and make that section fill the drawing area. This feature allows you to zoom in on the same object several times, increasing the magnification each time.

Alternatively, after drawing an object such as a chair, using the full screen you can zoom out to place the object within a small area of the final drawing on screen. Once the drawing is plotted at a large scale the object will again be viewed easily, even if it only appeared in a



AutoCAD's zoom feature allows enlargement of a selected area of a drawing.

small area while on the screen. The zoom capability is limited only by the precision with which the coordinates of the points within the drawing area are stored. All three programs provide sufficient zooming capability for any practical applications.

In using *The Drawing Processor's* digitizer pad, any section of the active area can be seen on the screen. You specify a lower-left and an upper-right point and then give the window command on the digitizer command menu.

Resolution Quality

Screens, digitizer pads, and plotters are not only limited in their size but also in their resolution (the ability to differentiate between two closely spaced points). Greater resolution on the screen provides more aesthetically pleasing graphics images and more accurate placement of the points within the drawing. Digitizer pads with high resolution allow greater accuracy in placement of points within the drawing and finer drawings on a small surface. Plotters have inherent resolutions determined by the accuracy of their stepper motors, the size of their pens, and the quality of their mechanisms. High-quality plotters can place drawings with more detail in smaller areas.

Although zooming helps to overcome the limitations of screen size, it doesn't eliminate the problem of inadequate screen resolution. Imagine that you want to draw two lines that represent pipes, which are to be $\frac{1}{20}$ inch apart and 18 inches long when finally plotted. Because of the relatively poor screen resolution, the two lines may appear as one line. To correct this problem you can zoom in on a small area and easily separate the two lines on the screen with a window that represents a 5-inch square. However, you would have to repeat this procedure four times to draw lines that are 18 inches long.

The quality of a graphics representation on screen is determined by the density of pixels (the dots on a video screen). The IBM Color/Graphics Adapter, which all three programs support, provides resolution too poor for an adequate graphics display. It supports 640 by 200 pixels on a screen area of $8\frac{3}{4}$ by $6\frac{1}{4}$ inches, for a density of 73 pixels per inch horizontally by 32 pixels per inch vertically. Higher resolution boards can support densities of 85 pixels per inch horizontally by 60 pixels per inch vertically.

AutoCAD also supports the Hercules Graphics Card and the Vectrix 384 color graphics system; both of these provide twice the pixel density (resolution) of the IBM Color/Graphics Adapter. *AutoCAD* overcomes

some of the screen resolution problems by allowing you to specify the absolute coordinates of a point or a line.

The Drawing Processor supports the Eagle monochrome board at twice the density of the IBM Color/Graphics Adapter's resolution. As with *AutoCAD*, you can partially overcome poor screen resolution by specifying the absolute coordinates of a point or line. When used with a high-resolution digitizer pad, *The Drawing Processor* is independent of the screen resolution.

MicroCAD supports the Hercules and Orchid graphics boards. The Hercules board supports 720 by 348 pixels and the Orchid board supports 720 by 350 pixels. The manufacturer points out that from a cost/performance standpoint the IBM board is satisfactory, especially considering its cheaper price.

Evaluation

MicroCAD works well as an inexpensive drawing and design tool, but it has limited applications. I would recommend this program if important criteria for your project are using three dimensions and being able to easily manipulate a drawing for viewing from selected perspec-

The ability to *zoom* (or *window*) in or out from a given part of the drawing area partially overcomes the physical limitations of the screen size.

tives. Consider, though, that *MicroCAD* is not primarily a drafting tool, so it does not have all the easy creating or editing features of *AutoCAD* and *The Drawing Processor*.

Architects may prefer *MicroCAD* to the other two programs specifically for creating and representing their ideas to clients. This is a qualified recommendation, however, because *MicroCAD* provides only wire-frame graphics (line drawings of a solid object) with no hidden-line removal. Without this feature you can't identify whether lines in a three-dimensional drawing are in the foreground or background. The manufacturer plans to provide this feature but has postponed implementation until the quality is assured.

An interior designer might use *MicroCAD* to present more realistic, three-dimensional models to clients. For example, a furniture manufacturer is using *MicroCAD* to send model drawings to customers.

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In summary, *MicroCAD* has advantages for architects and interior designers that the other two programs don't have. These are perspective viewing, the ability to join three-dimensional work objects on the screen, and the support of auxiliary programs that you may write for any purpose, such as figuring a bill of materials. Most importantly, although *MicroCAD* has limited capabilities compared to the minicomputer CADD systems, it is affordable for the average PC user.

My major problem with *MicroCAD* is its reliance on the screen as the sole drawing device. This complaint is aimed more at present technology than at the program itself. For three-dimensional work, the screen is more practical than a digitizer pad as a drawing device. The only cure for eyestrain and poor resolution would be a larger screen and a graphics board better than IBM's. *MicroCAD*'s minor drawback is that it doesn't do solids or shadings for more realistic drawings.

Compared to *AutoCAD*'s many input options, *MicroCAD* supports only two devices: the keyboard and a light pen. Using the keyboard is preferable to using a light pen. Holding a light pen for an extended period is uncomfortable, and entering points with the light pen is less accurate than with the cursor keys because you have to hold the pen steady. The one advantage of the light pen is that it is faster than the cursor keys because you can go from point to point in fewer steps.

AutoCAD and *The Drawing Processor* are similar, both being two-dimensional drafting and design tools, but *AutoCAD* has some unique features. Architects will appreciate its semiautomatic dimensioning capability; interior designers, its ability to draw solids and traces (fat lines); and electronic engineers, its layering capability. Like *MicroCAD*, the data base format is available so you can write your own auxiliary programs. *AutoCAD* supports a mouse, which is an advantage if that's the input device you prefer.

The only limitation of *AutoCAD* is that the screen is the major drawing device. You can probably overcome the problems of poor screen resolution and eyestrain by using a digitizer pad in Tablet mode, a large plotter, and check drawings taped to the digitizer pad.

For drawing and editing, *The Drawing Processor* is as easy to use as *AutoCAD*. Its unique features are complex curves, ellipses, the ability to move any point within a component directly, and the rubber banding of lines to components as these are shifted about the drawing.

The bottom line in evaluating similar products is deciding which product you prefer to use. I would choose *The Drawing Processor* over *AutoCAD* for one

reason: it fully supports a digitizer pad as a drawing device. Although you can use a digitizer pad with *AutoCAD*, it doesn't support all capabilities. As previously discussed, in Tablet mode there is no reference cursor on screen. When the digitizer pad is used as a pointing device, it moves only the on-screen cursor and can't be used as a drawing device.

I only wish *The Drawing Processor* had *AutoCAD*'s ability to draw solids and do semiautomatic dimensioning. But even without this capability I still prefer *The Drawing Processor* over *AutoCAD* because full use of the digitizer pad is a more important feature. ●

Davis Straub is a systems consultant with the First Charter Corporation in Bellevue, Washington. He currently markets a UCSD p-System-based energy analysis program and packages computer systems for architects and engineers.

AutoCAD

Autodesk, Inc.

150 Shoreline Highway #B20

Mill Valley, CA 94941

List Price: \$1000, dimensioning capability \$500, manual and demo disk \$50

Requirements: 192K, two disk drives, color monitor, color graphics board

The Drawing Processor

BG Graphics

824 Stetson Ave.

Kent, WA 98031

206/852-2736

List Price: \$995

Requirements: 256K, two disk drives, 8087 co-processor, two monochrome monitors with the IBM PC, IBM Color/Graphics Adapter

MicroCAD

Computer Aided Design

764 24th Ave.

San Francisco, CA 94121

415/387-0263, 386-7881

List Price: \$500, \$150 rotatable character set, \$160 FT6 light pen

Requirements: 128K (64K disk also included with program), two single-sided disk drives (or one double-sided disk drive), color graphics board

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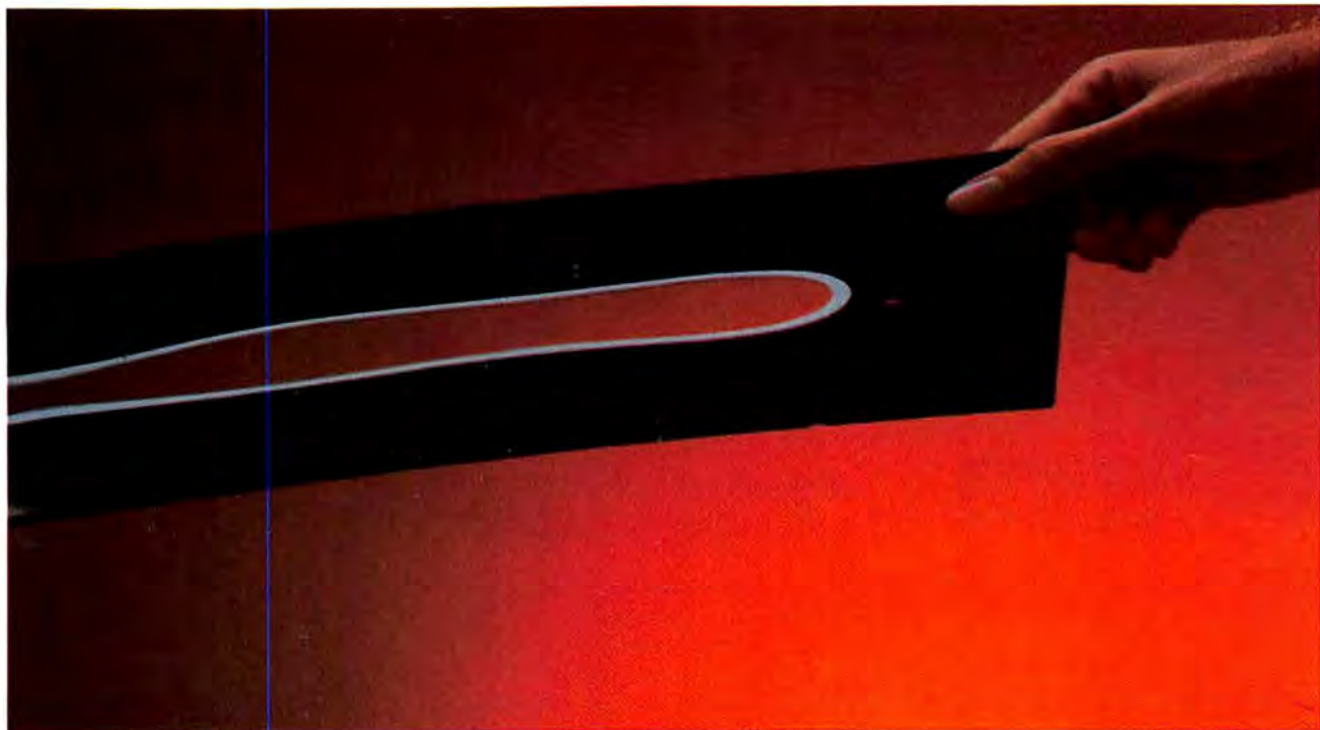
Specifications are subject to change without notice.

WordPlus-PC was designed and written by Andres Escallon.

Stretching VisiCalc

StretchCalc brings a new face to the spreadbase race.

Edwin T. Moore



When Lotus Development Corporation released 1-2-3 in January 1983, it signaled a new level of integration for applications software. 1-2-3 combined spreadsheet, data management, and graphics into a new type of program, a "spreadbase." For several months the trade journals have reported that sales of 1-2-3 have surpassed the industry-standard spreadsheet, VisiCalc from VisiCorp.

Multisoft Corporation, a Beaverton, Oregon, startup company, has made the race much more interesting with the introduction of *StretchCalc*. Described by its developer, Bruce Schaefer, as a "turbocharger" for VisiCalc, *StretchCalc* brings to VisiCalc some of the same graphics, data management, and spreadsheet enhancement features now associated with 1-2-3. This article will try to answer the obvious questions: Is VisiCalc with *StretchCalc* as good as (or

even better than) 1-2-3? Does *StretchCalc* really have all of 1-2-3's data management and graphics features?

Starting Up

One difference between the two systems is obvious from the start: 1-2-3 is a complete program that can be loaded with one simple command. It does require, however, at least two disk drives. Due to the more than

200 help screens that occupy about 177K of disk space, the 1-2-3 system disk must remain in drive A throughout a working session. Release 1 of 1-2-3 together with DOS 1.10 takes only 99K of internal memory. Release 1A with DOS 1.10 uses about 102K, and Release 1A with DOS 2.00 takes 114K. Since *StretchCalc* is an add-on to *VisiCalc*, it requires more disk swapping to load, but the *StretchCalc* disk can be removed from the drive after it has been loaded, freeing the drive for working files. *StretchCalc* combined with *VisiCalc* takes up 103K of internal memory.

1-2-3 is a far more complex program than *VisiCalc* or *StretchCalc*, and considerably more time is required to master all of its features. Previous experience with *VisiCalc* is helpful in getting started, but for people without experience Lotus has provided learning aids.

The fastest way to get acquainted with 1-2-3 is to use the on-screen tutorial. In 2 to 3 hours you can sample many of the program's features. Unfortunately, the language and tone of this tutorial are not in keeping with the high quality of the program.

Pressing <F1> at any time during a 1-2-3 session produces a help screen related to the current position in the program. The cursor can be moved within a help screen to select other help screens or to select the help index. The <Esc> key returns control to the program.

The 1-2-3 *User's Manual* is well written and organized. Despite many other learning aids, studying the manual is still the best way to gain an understanding of the program. In many instances the manual may be faster than the help screens for finding references.

The *StretchCalc Reference Manual* is clearly written and is intended to be used as a supplement to the *VisiCalc User's Guide*. Because the heading on each page indicates the command being discussed, information on any specific command is easy to locate. Every command descrip-

tion includes a flow chart describing how the command is used and detailing the available options. Following the flow chart is a discussion of how to specify the values of the cell ranges or options. The final section for each command provides an example of how to use it.

StretchCalc's documentation is readable and well laid out, despite the fact that it was created on an Epson dot matrix printer and photographically reduced. Although *StretchCalc* itself is easy to understand and use, it doesn't add help screens or improve *VisiCalc's* bare-bones command menu line. 1-2-3 is easier for a spreadsheet novice to learn, but for an experienced *VisiCalc* user, *StretchCalc* will provide no obstacles.

Command Structure

1-2-3 uses a complicated, multilevel command structure. Seven pages of the 1-2-3 *User's Manual* index are devoted to listing more than 200 command possibilities; these are arranged in command trees with as many as six levels. Some of the commands on the main menu lead to submenus, which may in turn lead to other submenus, and so forth. While this tree structure provides the key to utilizing many additional features, it also means that in many cases more keystrokes are needed to accomplish a given function. For example, to clear a *VisiCalc* or *StretchCalc* worksheet you type /CY. To clear a 1-2-3 worksheet you type /WEY. However, some operations, such as /Range Move, can be accomplished with fewer keystrokes in 1-2-3.

The two-line control panel of 1-2-3 contains more useful information than does *VisiCalc's* single command line. In 1-2-3's Menu mode the cursor appears in the first line of the control panel, which lists a number of key words. Pointing the cursor at the key word selects a command. Once the user becomes familiar with the commands, one can be selected by typing its initial letter. It is easier to select a command by pointing. The information contained in

the second line elaborates the selection possibilities indicated in the first line. This approach represents a step forward in enabling the user to manage more complex programs.

StretchCalc's command structure is a natural extension of *VisiCalc's*, and *VisiCalc* users will have little dif-

StretchCalc's command structure is a natural extension of *VisiCalc's*.

ficulty understanding *StretchCalc's* new features. All *VisiCalc* commands are accessed by pressing the '/' key and choosing from the mnemonic command line, BCDEFGIMPRSTVW

Once you've memorized the commands, the operation of the program is straightforward. All the *VisiCalc* commands behave exactly the same with *StretchCalc*, and *StretchCalc* adds two more letters to *VisiCalc's* command menu (A and U).

Typing /A opens the door to all of *StretchCalc's* Graph, Move, and User functions. Since *StretchCalc* adds more than 20 commands to *VisiCalc's* repertoire, this mnemonic is only a symbolic entry point to the use of any command. Most commands are specified by two or three letters. For example, one of the most useful additions that *StretchCalc* offers is the ability to sort the rows of the worksheet by the data in one column. The command to perform that feat is /AMS (Advanced Move Sort).

The other new *StretchCalc* command is /U, which lists user-defined keys. The /U command is not really necessary for the full utilization of *StretchCalc*, but it saves two keystrokes when invoking some of the user-defined keys.

StretchCalc's command menu adds extra features to *VisiCalc's* simple but uninformative command menu,

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without complicating or improving it. *1-2-3*'s command structure is more complex, but it allows access to a wide range of commands and features, and the second line of the command menu provides information about subsequent levels of available commands.

Keyboard Convenience

Lotus predefines the use of the ten special function keys under *1-2-3* as follows: <F1> Help, <F2> Edit, <F3> Name (create a range name), <F4> Abs (absolute cell reference), <F5> GoTo, <F6> Window (split the screen and create a window), <F7> Query (repeat last data query operation), <F8> Table (run the currently defined data table), <F9> Calc (force a calculation), <F10> Graph (view the currently defined graph). These assignments cannot be changed.

VisiCalc does not use the function keys at all, but with *StretchCalc* the function keys can be assigned up to 40 new meanings when used singly or in combination with the <Ctrl>, <Alt>, and <Shift> keys. The end user is free to define these new meanings in any manner.

Anyone who has used spreadsheets for repetitive work knows that typing the same keys over and over can lead to mistakes that cause wasted time and even loss of data. Until now repetitive typing was a necessary evil. *StretchCalc* and *1-2-3* have features that help to eliminate unnecessary typing by defining long strings of characters with short keystroke combinations.

Both *StretchCalc* and *1-2-3* allow programming of the keyboard's 26 alphabetic keys when they are pressed in combination with the <Alt> key. In other words, *StretchCalc* has a total of 66 (40 function and 26 alphabetic) programmable keys, each of which can hold up to 80 characters. *1-2-3* allows programming of only the 26 alphabetic keys, but each one can hold up

	StretchCalc	1-2-3
	Keysavers	Macros
Use of function keys	Yes (40 uses)	No
Use of 26 alpha keys	Yes	Yes
Keystrokes per key	Up to 80	Up to 256
Loops and IF... THENs	No	Yes
Run-time options	Yes	Require additional programming
How stored	Separate file	With the worksheet
Single-stroke operation	Yes	No

Figure 1: Keyboard macro features

	StretchCalc	1-2-3
Sizes	Small (¼ page) Large (full page)	Full (page) Half (page) Manual adjustments of height, width, left margin, top margin, rotation
Grid	Reference dots	Horizontal lines, vertical lines, or both horizontal and vertical lines
Shading	Three types	Six types
Reverse printing	Yes	No
Choice of fonts	No	Four different fonts—two weights each

Figure 2: Graph features

	StretchCalc	1-2-3
Area	Yes	No
Bar	Yes	Yes
Component or stacked bar	Yes	Yes
Dot	Yes	*
Line	Yes	Yes
High-low-close	Yes	No
Pie	Yes	Yes
(offset slice)	Yes	No
Scatter or XY	Yes	Yes

* Although *1-2-3* does not specifically offer a dot graph, it has variations on the line graph with symbols and/or labels with or without connecting lines.

Figure 3: Graph types

to 256 characters—1-2-3's limit for any type of characters stored in a single cell. Figure 1 summarizes the keyboard macro features of each program. Macros are strings of commands, each accessed by a single letter.

Perhaps the most useful feature added by *StretchCalc* is Keysaver, which allows a long, repetitive group of keystrokes to be assigned to one or more function keys with the /AUD (Advanced User Define) command. A single keystroke can thus accomplish in seconds tasks that previously took minutes. For example, a weekly payroll and accounts receivable for a small construction business requires the following operations: load the control program, load the customer backlogs, arrange the columns, insert new customers, update the labor backlog, update the receivables, save the active customer names, load the payroll program, load the cumulative labor figures, enter the week-ending date, enter the employee hours worked, recalculate, print the labor backlog, print the labor log, print the payroll report, save the cumulative labor figures, and back up customer backlogs.

Normally, *VisiCalc* takes about 1½ to 2 hours to finish this procedure. Using Keysaver to program the keys, the entire job can be done in under 10 minutes. For applications such as this, the superiority of Keysaver is a payoff item of far greater significance than the ability to recalculate (which takes less than half a minute) ten times faster.

In addition, *StretchCalc* has a single-step mode that helps to debug a Keysaver program and an impressive recall method of creating those programs. To write a Keysaver program, type the steps as if you were operating in the spreadsheet; then use *StretchCalc*'s recall function to "remember" the keystrokes you wanted in the program.

VisiCorp reports that its upgraded product, *VisiCalc*, *Advanced Version*, includes a "keystroke memory" feature similar to *StretchCalc*'s Key-

savers. However, the *Advanced Version* was not released in time for this review.

Since 1-2-3 macros can be more complex, they may require considerably more effort to program than *StretchCalc*'s Keysavers. In 1-2-3, for example, to make the macro move the cursor down one cell, you have to type Down ; using *StretchCalc*'s Keysaver, you simply press <Cursor-Down>. Each 1-2-3 macro must also be assigned a range name, an operation not required with *StretchCalc*.

In 1-2-3 macros are entered as labels and cannot have their cell references adjusted automatically. Therefore, if they are extracted from one worksheet and combined with another, they must be edited.

1-2-3's macro commands can include IF...THEN, GOTO, and QUIT commands, which make 1-2-3's macros more fully programmable. Furthermore, release 1A of 1-2-3 includes an autoexecution feature, which automatically executes macros when a file is retrieved. None of these programming or execution features are available with *StretchCalc*.

Graphics

Bringing a spreadsheet graphically to life is the most dramatic capability of both *StretchCalc* and 1-2-3. Of greater importance than drama is the new power brought to the user by this "thinking tool" for analyzing numerical data. Figures 2 and 3 summarize the significant graph features and capabilities of the two programs. The figures show that although *StretchCalc* offers more types of graphs, 1-2-3 has many more features that can help tailor a graph to the user's specific needs. If graphics are not required, a stripped-down version of *StretchCalc* is available at half the price of the full program.

Viewing Graphs

With a two-monitor system *StretchCalc* requires an /AA command to tell the program that a graphics adapter is in use. No such command

is necessary with 1-2-3. If both monochrome and color graphics display monitors are available, 1-2-3 will display the worksheet on the monochrome monitor while it shows the graph on the graphics monitor. Although 1-2-3 can create graphs that are not seen on the monitor but can be printed later, this is certainly the least desirable way to create graphs. More insight into the data is possible when the numbers and the accompanying graphs can be seen and manipulated simultaneously.

Creating Graphs

Making graphs is not difficult with either of the two programs, though it is easier to get the hang of it with *StretchCalc*. Cell A1 must be left open to contain the title of the graph. Parts of column A and row 1 are also reserved for information to be used as labels in the graph. The /AM (Advanced Move) command can be used to arrange data for graphing from different areas of the worksheet. Column A must be included as the first in the list of columns for the Move command so that it is not wiped out when the selected columns arrive in order at the left side of the worksheet. After the graph has been created, the columns can be returned to their original places with the /AMU (Undo) command.

Although many graphs can be made from data in its original location on the worksheet, picking columns of data from several places is sometimes useful. You may experience some unexpected results from first attempts at rearranging columns, so the admonition in the *StretchCalc* manual to save a copy of the worksheet before rearranging anything is well taken.

Learning the default settings in *StretchCalc* takes a little experience. The manual has no central discussion of the defaults. For example, the default setting of the /Move command is to make the move permanent.

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Therefore, a move cannot be undone without first changing this option. Once you've prepared the worksheet as described earlier (title in A1, labels opposite their respective data in row 1 and column A), graphing and printing are easy. Place the cursor on the upper-left cell of the data, select the type of graph desired using the /AG command, indicate the lower-right cell of the data range, indicate whether the data is by row or by column, and watch the result appear on the screen. Once the graph is on screen you can modify it as desired (within the range of possibilities offered by *StretchCalc*). To make hard copy on the printer simply press the letter P. It takes an Epson MX-80 (or IBM Graphics) printer 1 or 2 minutes to finish one small-sized graph. On an 8½- by 11-inch page a large graph must be printed sideways. This procedure takes about 10 minutes.

Preparing 1-2-3 graphs for viewing is not difficult and is quite similar to using *StretchCalc*. However, when it comes to printing the graphs, 1-2-3 takes more time and effort. First, you must save the image of the graph in a file that is automatically given the extension .PIC. Then you insert a separate disk containing the Print Graph program in drive A. Once the program is invoked, you must select the proper graph (.PIC) file. Next, you select the graph-formatting options for font, page width, page length, top of page, size, pause, eject, and color (if you have a color graphics device, such as a Prism printer or an HP 7470 plotter). After the necessary commands are given, type G0 to start the printer. On the MX-80 printer with Grafrax, a simple bar chart takes approximately 5 minutes to produce. The script and italic font options provided by 1-2-3 impressively show off some of the capability of the dot-addressable graphics of the MX-80; as a practical matter, however, the script is extremely difficult to read.

	StretchCalc	1-2-3
Sort from ascending to descending	2 seconds	4½ seconds
Undo (re-sort back to original state)	Blink of an eye	4½ seconds

Figure 4: Data sorting speeds (for a column of 250 numbers)

	VisiCalc	1-2-3
Columns down	63	256
Rows across	254	2048
Total cells	16,002	524,288

Figure 5: Worksheet size comparison

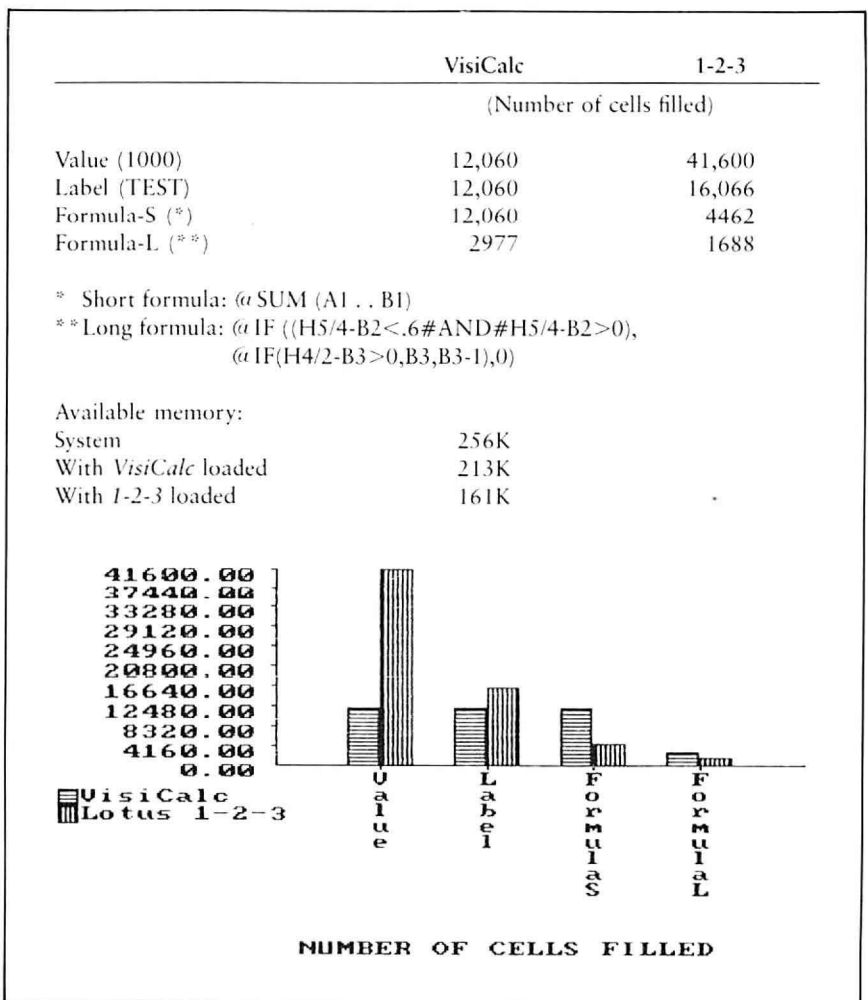


Figure 6: VisiCalc vs. 1-2-3: results of a test of useful capacity, in which as many cells were filled as memory would permit. The graph illustrating the test results was produced using VisiCalc.

The /Graph Name Use command provides the capability for naming each graph as it is created and then later recalling it by name. With *StretchCalc* this power is limited to recalling only the most recently defined graph. The <F10> key is a handy way to view a graph immediately after modifying data. You just change the numbers, press <F10>, and the new graph appears—rescaled and reformatted, if necessary.

Another handy feature of *1-2-3* is the /Reset Graph command, which clears the graphics monitor. No such feature is found in *StretchCalc*.

StretchCalc will sort formulas as easily as it sorts values or labels.

The printed graphs produced by each program are quite different in appearance (as Figures 6 and 7 illustrate). In general, the graphs printed by *StretchCalc* appear much as they do on the monitor. In contrast, the printed *1-2-3* graphs are more stylized, revealing details not displayed on the monitor.

On *StretchCalc* graphs the scale numbering on the y-axis is somewhat unusual. The top value is the largest number in the field of data to be plotted, unless the multiple option has been specified. The other values decrease in increments of $\frac{1}{10}$ the top value. All values on the scale are shown with two decimal places. One advantage of this method of scale numbering is that the maximum value can be seen at a glance.

1-2-3 numbers the y-axis in a more conventional manner and makes the graph appear neater. Graph titles in the two programs are also quite different. *1-2-3* titles its graphs at the top, while *StretchCalc*'s titles appear at the bottom of the graph. If several *StretchCalc* graphs are printed on one page without much space in be-

tween, it is difficult to tell which title belongs to which graph.

Reverse printing of graphs (white lines on a black background) is a feature of *StretchCalc* not found in *1-2-3*. It makes a small graph stand out, but takes more time and ink to produce. Unless heavy bond paper is used, wrinkles will appear within the body of the graph.

Pie charts are a problem for both programs. Until there is some standardization in aspect ratios, pies will frequently be elliptical, with either the x-diameter or the y-diameter shortened. On an NEC JB1201 graphics monitor, *StretchCalc* pie charts are symmetrical, but *1-2-3* pie charts are elliptical with the x-diameter shortened. On the Epson MX-80 printer, *StretchCalc*'s small pie charts are elliptical with the y-diameter shortened, but the large pie charts printed sideways are appropriately round. *StretchCalc* provides an "offset slice" feature that can be used easily for emphasizing one portion of a pie chart. Leave the cursor on the cell containing the data you want to stand out and that slice will be offset.

For working analytically with numerical data, both programs offer excellent graphics facilities, especially when two monitors are used. *StretchCalc* will more quickly produce printed graphs that do not require great refinement or a special font. On the other hand, given more demanding requirements and more time to experiment, *1-2-3* will produce a finer quality product.

Data Handling

Both *1-2-3* and *StretchCalc* provide limited data management functions for spreadsheet users. *StretchCalc*'s data management is limited to simple (single key) sorting. The length of the *VisiCalc* or *StretchCalc* worksheet restricts its number of records to 254. *1-2-3*'s longer worksheet can contain over 2000 records. However, a system with 256K can hold only a limited amount of data for each of those records. For example, such a system

can only contain name, address, city, state, and zip code data for a data base that is 1852 records long.

In some data management applications the speed of operation may be as important as the capacity of the worksheet. A column of 250 numbers (the odd numbers from 1 to 499) was used to test the relative sorting speeds of *1-2-3* and *StretchCalc*. The numbers were first arranged in ascending order starting with 1 (i.e., 1,3,5,...,499), then sorted in descending order, and finally re-sorted back to their original state. As Figure 4 shows, *StretchCalc* can sort a column of 250 numbers faster than *1-2-3*.

1-2-3 sorts a single column (1,3,5,...,3999) of 2000 records in 40 seconds. For some users the capability to handle more records, regardless of the time it takes, means that *1-2-3* has greater potential and usefulness for data management applications than *StretchCalc*.

For *1-2-3* to perform any of its data operations, the data range of fields must be formatted as values or labels, not formulas. *StretchCalc* will sort formulas as easily as it sorts values or labels and if necessary will automatically adjust formulas for their new cell locations. This makes *StretchCalc* useful for sorting within the body of a worksheet.

On the other hand, *1-2-3* has several useful data commands not available in *StretchCalc*, including primary and secondary key sorts, data query (searching or extracting), data frequency distribution, data fill, and data table. These features are impressive in a spreadsheet program, but they hardly qualify to make it into a true data base manager. The data table is *1-2-3*'s most interesting data command. It permits iterative calculations of a formula that depends on up to two variables, each of which can be assigned several values. After formatting a table for the results, the command will apply each value of each variable in turn, producing a table of the results. In this way the results of several "what if" calculations can be tabulated and compared.

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Spreadsheet Capabilities

Since *StretchCalc* builds on the base of the *VisiCalc* worksheet, the relevant comparisons of size and capacity are between *VisiCalc* and *1-2-3*. Unless otherwise indicated, references to *VisiCalc* also apply to *StretchCalc*.

1-2-3's worksheet is 32 times the size of *VisiCalc*'s. At first introduction to *1-2-3*, a *VisiCalc* user is impressed by the sheer size of the worksheet. Figure 5 indicates the size differences. However, in any practical application the capacity of a worksheet is a function not only of the number of cells available to fill but also of the amount of memory in the system. In a 256K system, only 8 percent (41,000) of the cells in a *1-2-3* worksheet can be filled.

The results of a test performed to determine the useful capacity of both programs are summarized in Figures 6 and 7. The test was conducted on a 256K system by filling as many cells as memory would permit with a value, a label, a short formula, and a longer formula in succession. Release 1 of *1-2-3* was used for the test. Release 1A, which came out too late to test, requires more RAM (192K instead of 128K) and will therefore probably not fill as many cells on a computer with 256K as the tested version.

In the test the number of cells filled and the time required to fill them were recorded. That is, the worksheet was first loaded with a value (1000), using the total 256K memory capacity; next the data was recorded; and finally the worksheet was cleared. The process was repeated using a label (TEST), a short formula, and a longer formula. In all test runs, both programs' worksheets were loaded to a depth of 250 rows.

With a 256K system nearly all of *VisiCalc*'s 16,002 cells can be filled with values, labels, or short formulas. Although fewer than 8 percent (41,000) of *1-2-3*'s cells can be filled with values and fewer than 1 percent

(4400) of its cells can be filled with short formulas, the usable worksheet area is still quite a bit larger than what *VisiCalc* offers. It will take considerably more than 256K of system memory to begin to take full advantage of *1-2-3*'s grid size.

Figure 8 shows the results of two calculations made on the data from these tests. These calculations compare the efficiency with which each program uses memory (number of bytes per cell) and the generalized loading speed (seconds per cell).

In efficiency of memory use, *1-2-3* performed better with labels and astonishingly well with values. *VisiCalc* was better with both long and short formulas. *VisiCalc* loaded labels faster, but *1-2-3* excelled in the other three loading speed categories. Values take longer to load than labels with either program. Formulas take longer to load than either values or labels, and, as you would expect, long formulas take up more space than short ones.

1-2-3 offers two important features that enhance user control of calculations: natural calculation and iteration. Natural calculation practically eliminates forward references on the worksheet and represents a definite improvement over *VisiCalc*. Iteration provides a means to specify the number of times a worksheet cycles through all its formulas. This feature can be particularly useful in solving problems that require repetitive calculation.

1-2-3 provides many formatting features not found in *VisiCalc*, including the variation of individual column widths from 1 to 72 characters. *1-2-3* allows writing over cell boundaries, provided the cell to the right is empty. Labels can be centered in the cells, as well as right or left justified. Formatting allows 0 to 15 decimal places to be fixed, and large numbers can be displayed with commas to make them more readable. The currency format adds a dollar sign before each entry, inserts com-

mas in large numbers, and places negative values in parentheses. The percent format multiplies a value by 100 and appends a percent sign to the result. Cell protection prevents designated cells from being changed by other cells. The text format shows formulas as they were entered. (By copying a range of cells and splitting the screen into two windows, the program can display formulas in one window and the numerical results of those formulas in the other.) The date format stores dates as number of days since the beginning of the century. Since *StretchCalc* does not expand on *VisiCalc*'s range of formatting options, the features listed above make *1-2-3* clearly superior in this regard.

VisiCalc incorporates 31 @ functions that can be used as parts of formulas. These functions specify the logical, mathematical, financial, trigonometric, search, and other numerical operations that make the program flexible. *StretchCalc* utilizes all of these functions but does not add to them. *1-2-3*, on the other hand, adds 23 more functions to the list as shown in Figure 9.

Although some of the functions listed will be attractive to certain users, few of them add fundamentally new calculation capabilities to the worksheet. The date functions will be a welcome addition for dating the worksheet and for doing financial work that requires figuring days between dates.

Rearranging columns on *VisiCalc* worksheets can be painfully slow. They must be done one at a time, and the syntax is awkward and thus hard to remember. To move a column to the right in *VisiCalc* you specify the destination column as the one to the right of the intended location; to move a column to the left you specify the destination exactly. With *StretchCalc*'s /AM (Advanced Move) command you list the order in which the columns are to appear, and they are rearranged at one time and appear at the left side of the worksheet. The columns can be returned to their

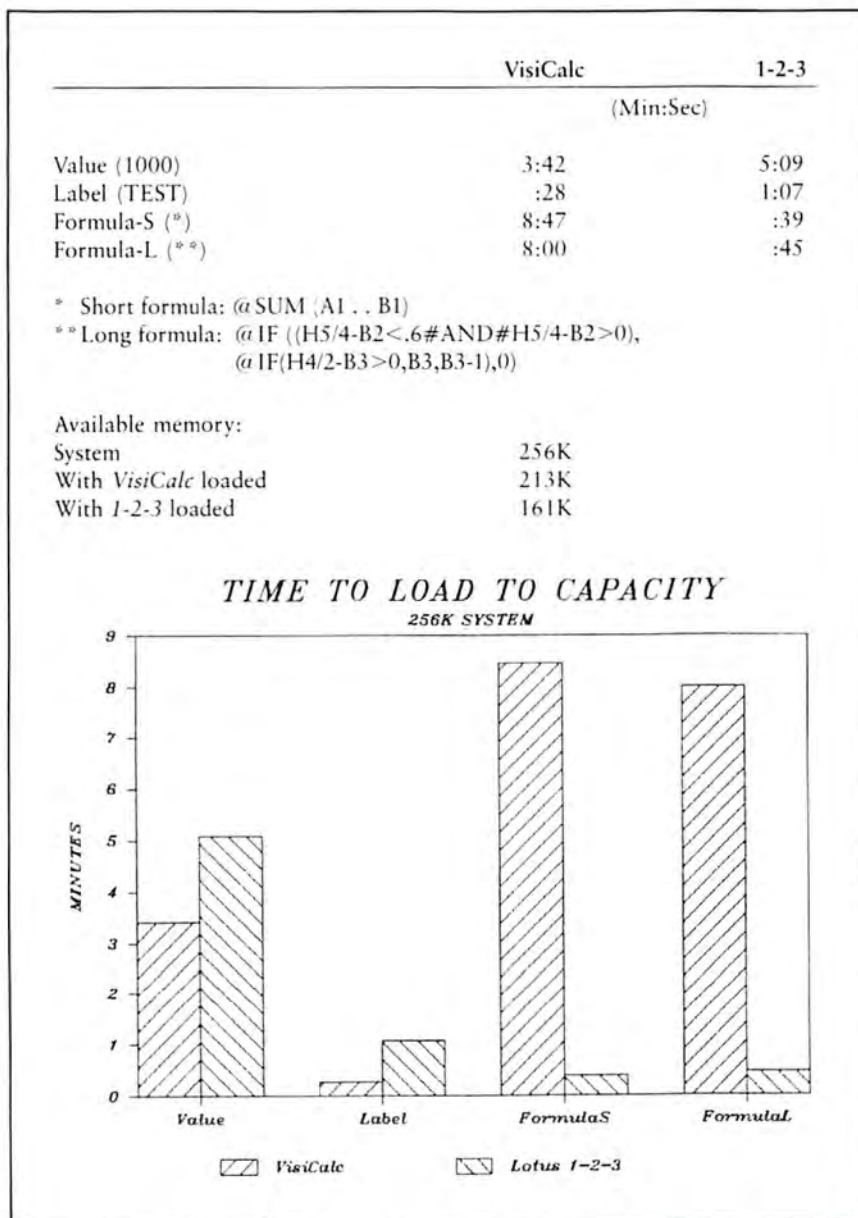


Figure 7: VisiCalc vs. 1-2-3: results of a test of useful capacity showing the time needed to fill as many cells as memory would permit. The graph illustrating the results was produced using 1-2-3.

original positions just as easily using the /AMU (Advanced Move Undo) command.

The /AM command is fast: a column of 254 numbers that takes VisiCalc 10 seconds to move is done in 1 second with StretchCalc. StretchCalc also allows a combination of cell blocks including single columns and ranges of columns to be moved at the same time. This feature is not available in 1-2-3.

1-2-3 provides flexible features for moving the cursor around the work-

sheet and for moving and adjusting data and formulas. In this regard it is superior to the VisiCalc/StretchCalc combination. Pressing the <End> key and then one of the cursor keys will cause the cursor to jump quickly to the appropriate corner of the work area or worksheet. The <End>-<Home> key combination takes the cursor to the lower-right corner of the active area. <PgUp>, <PgDn>, <Tab>, and <BackTab> enable full

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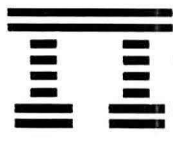
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screen shifts in all four directions. The <F5> key is dedicated as a GOTO, allowing cursor jumps to specified cells.

The most important 1-2-3 feature for rearranging data on the worksheet is the /Range command. For example, the /Range Move command enables the relocation of data within a specified rectangular area to any other rectangular area of the same size. When this command is executed, the data is moved, formulas are adjusted (if desired), and the old data is erased from its original location. With *VisiCalc*, data must be replicated in one step and blanked out in a second step.

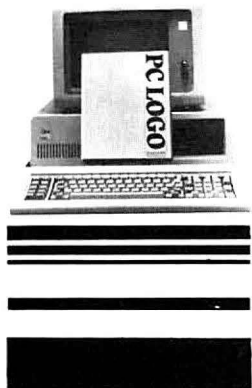
With the /Range commands, as with many other commands in 1-2-3, three options specify the range: point, type, and name. Pointing the cursor to indicate the desired cell or typing its designation are familiar procedures to *VisiCalc* users. However, 1-2-3 places a restriction on the use of these procedures. In *VisiCalc*, if you start specifying a range by pointing to the original cell, you have the option of either pointing to or typing in the end cell. In 1-2-3, if you type the first one in, you must also type the next one in; that's not quite as convenient as *VisiCalc*'s procedure in some cases.

The need to point, type, or even remember cell locations is eliminated by 1-2-3's ability to name ranges. Once a range is named, the worksheet remembers the name and its location. No equivalent of the /Range Name command is found in *VisiCalc* or *StretchCalc*.

1-2-3 offers additional printer controls for producing useful output from the worksheet, such as printing today's date, paper advance and alignment, page numbering, headers, footers, and page length. None of these are provided by *VisiCalc*. *StretchCalc* offers a line-feed and form-feed feature at the touch of one key after printing graphs.

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File Swapping

Since *StretchCalc* essentially adds features to *VisiCalc*, their files are interchangeable. *VisiCalc* has been adapted from 8-bit systems to the IBM PC. DIF (Data Interchange Format) files provide the standard file format to facilitate the exchange of *VisiCalc* data files. No translation is needed.

VisiCalc or *StretchCalc* files must be translated before they will run on 1-2-3. Included with the Lotus 1-2-3 package are translation programs that will convert *VisiCalc* and *StretchCalc* files to 1-2-3 files, DIF files to 1-2-3 files, or 1-2-3 files to DIF files. There is no provision for translating 1-2-3 files directly to the *VisiCalc* format.

In translation, *VisiCalc* files become considerably larger and thus require more disk space. For example, a 156,800-byte *VisiCalc* file took 12½ minutes to translate and increased in size to 255,278 bytes. The larger size meant that the file no longer fit on a single-sided disk. However, the greater penalty is that the larger file requires more system memory. On the other hand, performance of *VisiCalc* files can be dramatically improved by translating them to run with 1-2-3. For example, a *VisiCalc* surveying program, which when translated expanded from 49K to 72K, originally took 5½ minutes to load and 5 minutes to run. The translated version of the same program on 1-2-3 took under 1 minute to load and 25 seconds to run.

Other results of translation may be somewhat unexpected. Cells originally formatted as '\$' in *VisiCalc* come out with dollar signs in 1-2-3, even though the originals did not have dollar signs. This phenomenon is caused by 1-2-3's default currency mode. To display the data as it appeared in *VisiCalc* you would have to reformat the range to ';' (the comma format).

Seeing the 'Formula error at X2' message appear during the translation can also be disconcerting. This is apparently due to the way that 1-2-3 handles AND, NOT, and OR in its formulas. It treats these as logical

Efficiency of Use of Memory		
	VisiCalc	1-2-3
	(bytes per cell)	
Labels	18	10
Values	18	4
Short formulas	18	36
Long formulas	72	96
Loading Speed		
	VisiCalc	1-2-3
	(seconds per cell × 1000)	
Labels	2	4
Values	18	7
Short formulas	44	9
Long formulas	162	28

Figure 8: Loading efficiency and speed

Mathematical: @ATAN2, @MOD, @RAND, @ROUND
 Financial: @IRR, @FV, @PV, @PMT
 Date: @DATE, @DAY, @MONTH, @YEAR, @TODAY
 Statistical: @STD, @VAR
 Data base: @DCOUNT, @DSUM, @DAVG, @DMIN, @DMAX, @DSTD,
 @DVAR
 Search: @HLOOKUP

Figure 9: 1-2-3 @ functions not found in VisiCalc

	StretchCalc	1-2-3
Disk drives	1 single-sided	2 double-sided
RAM	128K	128K*
Memory available for worksheet space in a 128K system	25K	31K
Other software required	VisiCorp's <i>VisiCalc</i> , extended memory versions, or IBM's <i>VisiCalc</i> , version 1.1 or greater	None required
Printer	Desirable	Desirable for graphics
Graphics board	Yes	Yes
Graphics monitor (B&W or color)	Yes	Can print graphs without monitor
*(Release 1A requires 192K)		

Table 1: Requirements of StretchCalc and 1-2-3

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operators, rather than as @ functions the way *VisiCalc* does. When the translation program sees one of these, it gives the formula a label-prefix so that it will show up on the worksheet. The fix can be time consuming, though it is not difficult: remove the label prefix, delete the @ followed by the logical, and then reinsert #AND#, #NOT#, or #OR# in the appropriate position between, rather than ahead of, the arguments.

King of Spreadbase

The electronic worksheet is the foundation upon which the rapid growth of microcomputer business applications has been built. Until a few months ago *VisiCalc* was the cornerstone of such applications. In the process of challenging *VisiCalc*'s supremacy 1-2-3 has opened new horizons for the microcomputer.

StretchCalc provides innovations that ensure the continued use of *VisiCalc* in a broader market than it has previously known. For a *VisiCalc* user *StretchCalc* offers a considerable enhancement in features and functions for a modest investment in software and effort.

For the user with sufficient disk drive capacity and the willingness to invest a little more money and time, 1-2-3 offers capabilities not available with *StretchCalc*. These include the larger worksheet, additional formatting possibilities, more @ formula functions, better ability to move the cursor and data around the worksheet, and natural calculation.

Both programs provide ways to eliminate keystrokes. These facilities are easier to program and use with *StretchCalc*, but they can be made to perform more complicated operations with 1-2-3.

StretchCalc's ability to produce many types of graphs easily—and to print them just as easily—is outstanding. Although printing graphs with 1-2-3 takes more time, they can be beautiful.

Neither 1-2-3 nor *StretchCalc* provides elaborate data management functions. *StretchCalc* is limited to

sorting the worksheet on one key, but it performs this function extremely well. 1-2-3 can perform many more operations on a longer data base than *StretchCalc*. In fact, its data management capabilities are remarkable in a spreadsheet program.

It boils down to a matter of needs and style. If you already have *VisiCalc* and need integrated graphics and keyboard macros more than data management, a small investment in *StretchCalc* will bring great returns. That's also true if you don't have *VisiCalc* and are on a tight budget, but the choice isn't quite as clear. However, if you're most interested in pushing the performance limits of your computer, and especially if you think help screens are important, 1-2-3 is the current King of Spreadbase. ●

Edwin T. Moore is an engineer/builder living in Underhill Center, Vermont, and a consultant in the use of the IBM PC for small business and community government applications.

StretchCalc

Multisoft Corp.

14025 S.W. Farmington Rd.

Beaverton, OR 97005

800/322-4110, 503/626-4727

List Price: \$99, *Little StretchCalc* (without graphics—mail order only) \$49

Requirements: see Table 1

VisiCalc

VisiCorp

2895 Zanker Rd.

San Jose, CA 95134

408/946-9000

List Price: \$250; *VisiCalc, Advanced Version* not announced

Requirements: 64K, one disk drive

1-2-3

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Requirements: see Table 1

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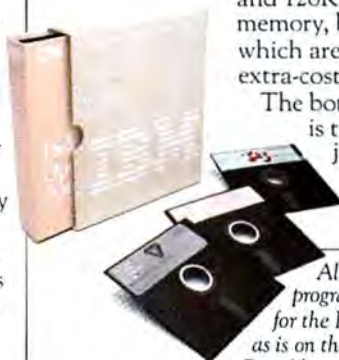
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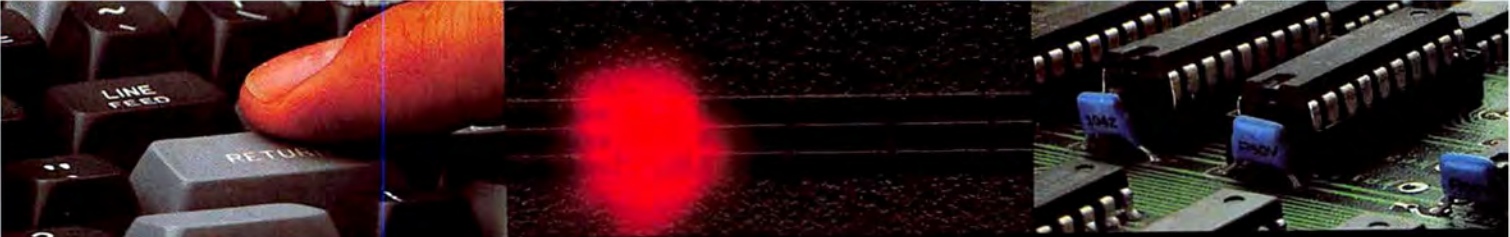


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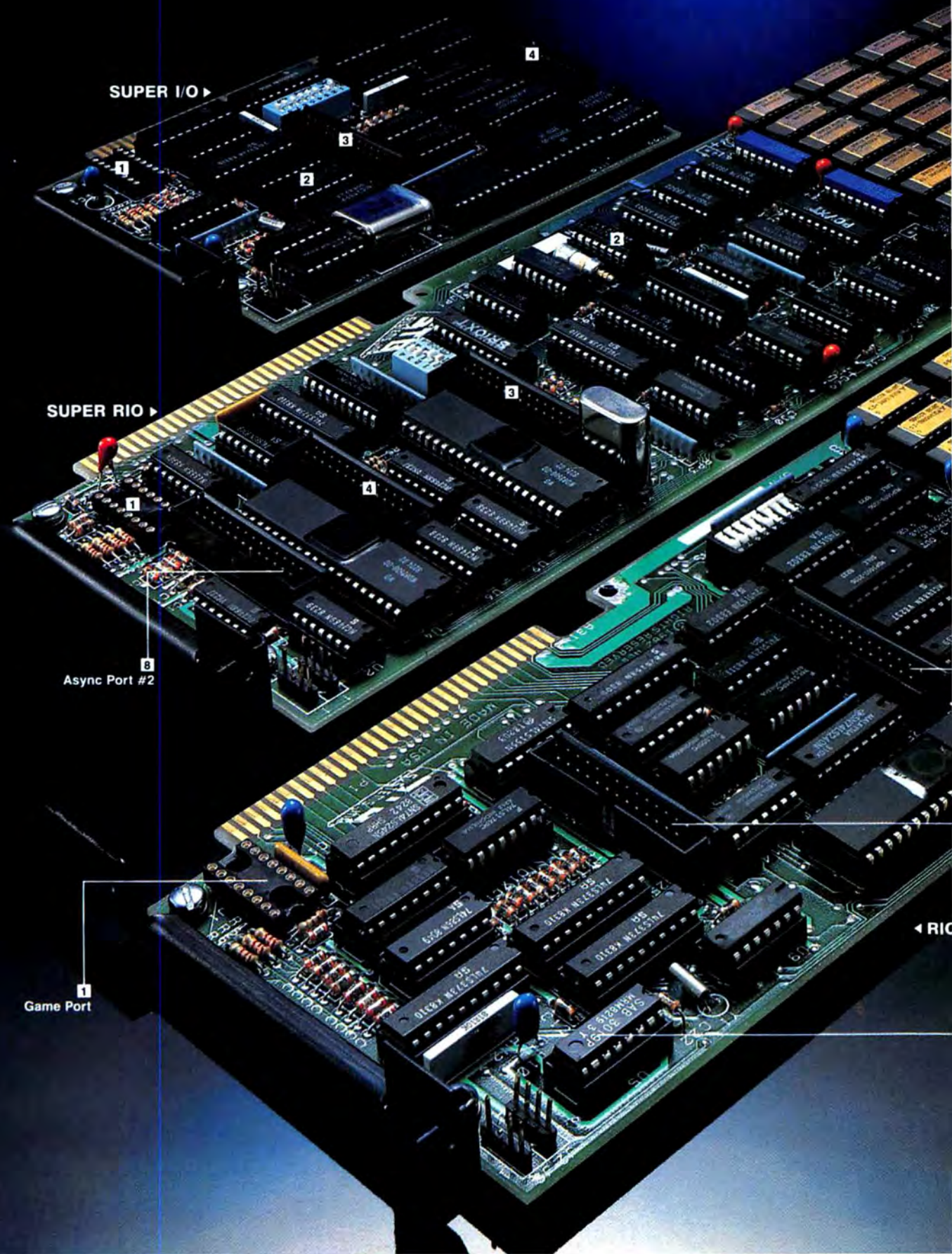
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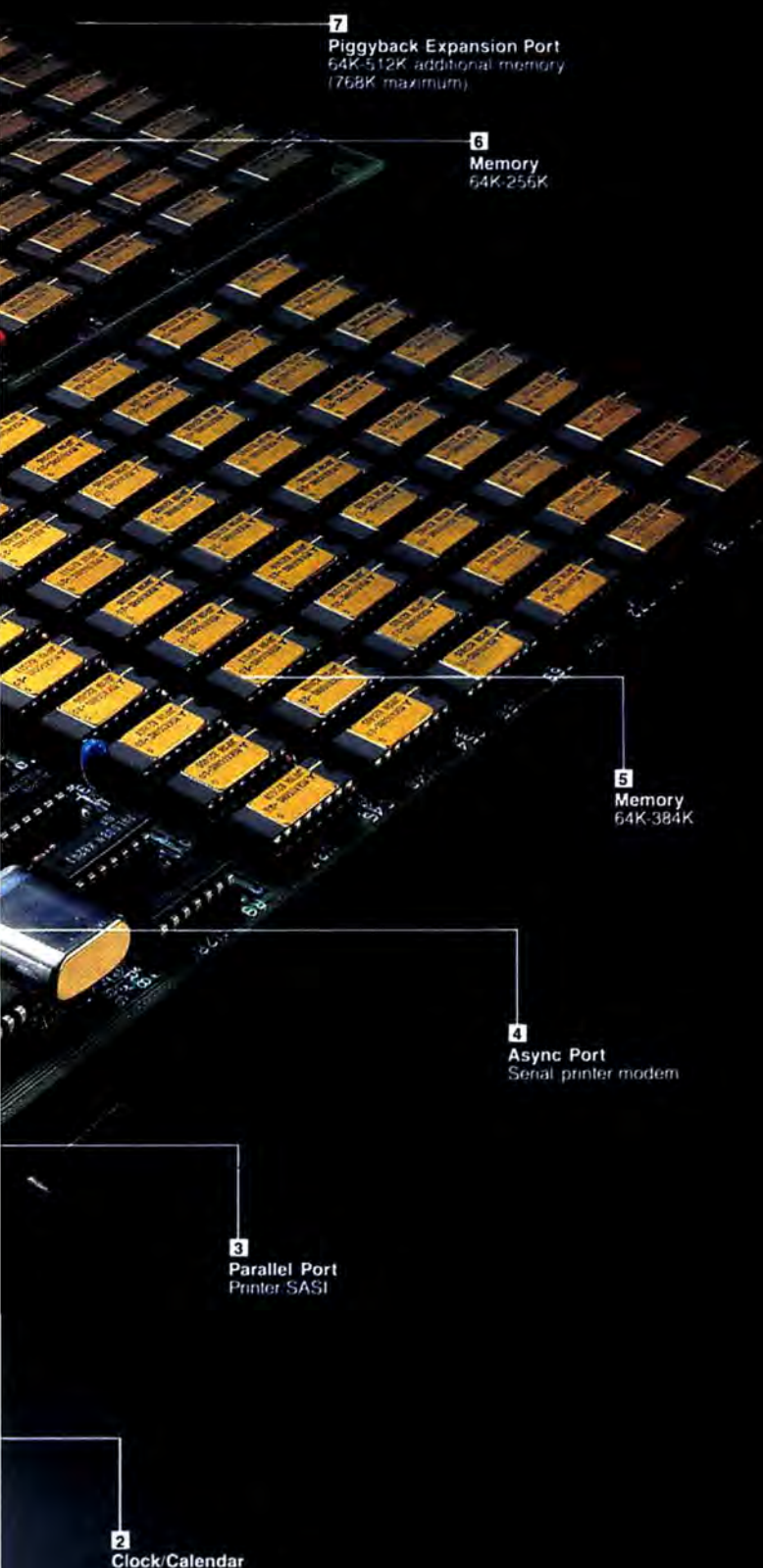
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Reader Service #254



Corona: For Here or to Go

Corona offers a pair of IBM PC compatibles: a desktop and a portable model.

David C. Keith

What does it take to challenge the IBM PC? More to the point, why would a prospective buyer want to buy a compatible computer instead of the real thing? This examination of two of the most serious challengers—the Corona PC and the Corona Portable PC—seeks the answers to these questions.

The primary reasons for considering an IBM PC-compatible computer instead of the original are motherboard RAM expansion capability, user-friendliness, additional hardware

The portable is ruggedly constructed.

features, bundled software (applications software included in the purchase price of the computer), and perhaps most importantly, price. Corona has admirably addressed these issues with two new computers.

Corona has wisely chosen to profit from IBM's experience. IBM had originally intended to attack the Apple market head-on by offering a basic system that retailed for about

\$1295, only to find that people were not buying that unit. They were instead buying an upgraded unit, usually with two disk drives and more memory. Corona has tailored its system specifically to this upgraded, business-oriented market.

The Desktop Corona

The desktop Corona PC has an obvious resemblance to the IBM PC. The Corona chassis offers several improvements, however, including double rows of slots along both sides to provide improved cooling capabilities. This, along with the necessary but very noisy fan, should provide more than adequate cooling even if all four expansion slots are filled.

By taking out four screws, the top of the computer can be removed in well under a minute, providing easy access to the four available expansion slots and the memory sockets. To provide additional support Corona has provided adjustable, vertical rear guide slots for the expansion boards. The Corona comes standard with 128K RAM and is expandable to a full 512K RAM on motherboard sockets located directly beneath the expansion slots. The IBM PC offers a maximum of 256K RAM on the motherboard before the user must add memory expansion boards.

While Corona does supply a socket for inclusion of the Intel 8087 floating-point math co-processor, it is located under the left disk drive. After eight screws have been removed, the entire disk drive, power supply, and inner framework release and swing back as a unit, permitting access to the motherboard. The expansion boards must be removed, however, before the disk drive and power supply assembly can be safely moved back.

The Corona motherboard includes DMA (direct memory access) floppy disk controllers, one parallel and one serial (RS-232C) I/O port, and a video monitor controller (monochrome). This leaves all four expansion slots available for the addition of any IBM PC-compatible expansion boards. By comparison, a similarly configured IBM PC will have only one expansion slot free.

The Corona PC comes standard with one MPI double-sided floppy disk drive; an additional double-sided floppy drive or an internally mounted 10M Winchester drive is optional. The floppy drives on two of the four computers I tried were annoyingly loud when transferring data; the drives of two others were relatively quiet. As soon as half-height floppy drives become more readily available, Corona will offer two in the space normally occupied by one full-height



The Corona family: Portable PC and desktop Corona PC

drive. This will permit you to add a hard disk without sacrificing one of the floppy disk drives.

The Corona power supply is a 110-watt unit (almost twice the 63 watts provided by the IBM PC but not quite as large as the IBM PC XT's 130-watt unit), and it can be switched from 110 volts to 220 volts to permit operation almost anywhere in the world.

Keyboard and Monitor

The Corona features the Key Tronic copy of the IBM PC keyboard, which has a different feel, a very light touch that can promote rapid typing, although some users may find it disconcertingly "soft." It also offers LED indicators on the <CapsLock> and <NumLock> keys to provide a quick indication of when these keys are activated. The keyboard has two position adjuster feet in the back to adjust its angle.

On the negative side, the Key Tronic keyboard retains some of the shortcomings of the IBM PC keyboard: the strange positioning of the left <Shift> key and the <ENTER> key, along with symbols instead of words for Tab, ENTER, Shift, and Backspace. Changing the keyboard layout to match that of the IBM Selectric typewriter would be welcome, and it might also help to have the F, the J, and the numeric keypad 5 more deeply indented to assist the touch typist in finding the home position.

Hopefully, both IBM and the companies making compatibles will soon opt for the more logical horizontal layout of the function keys utilized by most of the new 16-bit microcomputers. Horizontal layout makes it easier to display the definitions of all the function keys on the screen. But

until IBM makes that change, Corona will probably keep the IBM-style keyboard to retain maximum compatibility. This layout is at least easy and comfortable to work with for extended periods.

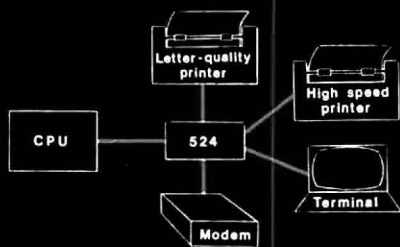
The keyboard attaches below the front of the chassis via a coiled 6-foot cord, an arrangement that allows greater separation between the keyboard and the main processing unit than is possible with the IBM PC rear keyboard attachment system.

Perhaps the Corona PC's most noteworthy feature is its monitor, with its advanced graphics and character resolution capability. The 8- by 8-dot character resolution of the monochrome monitor driven by the IBM Color/Graphics Adapter is difficult to look at for any length of time. By comparison, Corona has chosen to provide particularly high-quality characters on a high-contrast, high-

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Review

resolution, nonglare, P-31 phosphor screen (the type with the fastest refresh). With a character font of 14-by 13-dot resolution in a 16 by 13 matrix, Corona surpasses virtually all other currently available personal computers with the possible exception of the more expensive NEC Advanced Personal Computer. I found the Corona monitor easy to read and have not experienced eye fatigue, even after extended periods of use.

To accommodate such high-character resolution, Corona simply uses a larger ROM, allowing actual control over every dot within the 16 by 13 matrix. By always lighting up two adjacent dots, the vertical and horizontal strokes of the characters can be balanced, thus allowing a gradual shifting of dots and very smoothly sloping characters. This high resolution is particularly evident in the smooth, tight curves of the lowercase characters. Corona has also eliminated conflicts between various character attributes, thus enabling characters to be displayed in any combination of attributes including underlining, blinking, high intensity, and reverse video.

As much an improvement as the character resolution is the enhanced graphics of the standard 12-inch Corona CRT. Corona permits graphics and text to be displayed on the screen at the same time, and it permits very fine resolution of images, including representations of photographs. With Corona's graphics storage in main memory instead of an RS-232C serial port, several images can be stored at the same time, and those images can be swapped rapidly on the screen.

It is currently necessary to install an IBM PC-compatible color board to connect a color monitor. Of course, the same is true for an IBM PC equipped with a monochrome monitor.

Portable PC—to Go

Corona is taking a jump on the market by offering both a tabletop and a portable model with virtually the same features and capabilities. The

portable, which is heavy enough at 28 pounds to more properly be called a "transportable computer," differs from the tabletop model only in its smaller (9-inch) monitor and in its inability to mount the Corona full-height hard disk internally. In all other respects it matches its desktop brother feature for feature, including its 512K maximum RAM capability and space for four full-sized IBM PC-compatible expansion boards. With the same graphics and character resolution on the slightly smaller screen, the characters look a little better than those on the monitor of the desktop model.

Corona has chosen an unusual approach to dealing with the keyboard of its portable. Instead of designing a special keyboard that would act as the front cover, it has used the same slender keyboard as the tabletop model, which may be enclosed, along with a number of floppy disks, within a detachable 3.81-inch-thick cover. The entire unit is then transportable.

The portable is ruggedly constructed; the CRT and the disk drives are shielded from one another by metal partitions. The molded plastic outer chassis is split horizontally, and the top portion can be removed by loosening the two screws that attach it to the front piece and the two screws that attach it to the rear panel. To gain access to the expansion slots and the memory sockets, you must remove the six sheet-metal screws that attach the left side cover of the internal metal chassis. While this whole process will take much longer than with the tabletop model, it can be done easily and relatively quickly.

The expansion slots in the Corona portable are arranged front to back as in the desktop model and are located directly over the memory sockets. The portable is also equipped with adjustable, vertical rear card supports. Slots in the plastic front piece provide efficient cooling by allowing air to be drawn into and around the expansion cards and then out the rear, past the mounting brackets.

The portable uses a different type

How Compatible Is This Compatible?

Perhaps the biggest question facing a prospective IBM PC-compatible computer buyer is that of software and hardware compatibility. The Corona is designed to run the software available for the IBM PC from third-party vendors. In fact, Corona is committed to full compatibility with the Documented IBM PC Standard.

In its premier issue (see "How Compatible is Compatible?" Vol. 1, No. 1) *PC World* developed the following classification scheme to rate computers on their compatibility with the IBM PC.

Level 1: Media compatible. Machines that have the ability to read and possibly to write disks in the format used by the PC.

Level 2: Processor compatible. Machines that use an 8088 microprocessor or an 8086. While the two microprocessors are functionally identical, the 8086 can perform some operations more rapidly, which may cause problems for timing-sensitive programs.

Level 3: Operating system compatible. Computers that support MS-DOS, CP/M-86, or some other popular PC operating system.

Level 4: Component compatible. Machines that can use plug-in circuit boards designed for the PC.

Level 5: Character set and keyboard compatible. Machines that display the same characters as the PC for each of the 256 character

codes and that have keyboards that include all the same keys as the PC's.

Level 6: Video compatible. Machines that use the same video interface as the PC. The video must be memory mapped and located at the same memory addresses used in the PC.

Level 7: System compatible. Machines that duplicate the PC's entire architecture. RAM, ROM, I/O, and all other addresses reside in the same locations as those in the PC, including the routines in the BIOS ROM.

The Corona PC and Portable PC come close to attaining Level 7 compatibility, but due to the BIOS ROM, they must be rated at Level 6. In fact, the Level 6 rating is absolutely valid in monochrome mode but requires an IBM-compatible color graphics board to be at Level 6 in the graphics display mode.

The Corona offers improved monitor resolution of 640 by 325 pixels (versus 640 by 200 for the IBM PC). To accommodate the same memory-mapped locations as the IBM PC, the Corona simply multiplies the Y-axis of the point to be plotted by 1.6, which is done through one instruction for the 8088 CPU.

Another important area that must be supported without impinging on IBM copyrights is the contents of the ROM BIOS. One

of the problems here is that the version of MS-DOS supplied by Microsoft to manufacturers other than IBM is assembled to run in a slightly different location from IBM BIOS. Corona had to make modifications in DOS in order to preserve a compatible ROM communications area. It has also supplied equivalent functions for disk copy utilities, disk compare utilities, and mode utilities.

In fact, the only basic point of operational variance from the IBM PC is that Corona can't offer the IBM-copyrighted ROMs. But by preserving the same entry points into DOS, it is able to preserve compatibility with most third-party software.

Still, not all IBM PC software will run on the Corona without modification. A few software publishers have brought out their initial offerings for the IBM PC without accurately following the Documented IBM PC Standard. One such example is the first version of Lotus 1-2-3. Running this program on the Corona requires a copy of PC-DOS. (Also, at this time an IBM PC-compatible color graphics board is required to view the graphics output of 1-2-3.) Future versions of 1-2-3 should correct this situation, as Lotus, like most manufacturers of 16-bit software, is making special efforts to ensure that its products will run on the widest possible range of 16-bit computers.

of monitor with an etched antiglare screen, although it still has a P-31 phosphor. Like its larger brother, it is very readable, with 14 by 13 characters in a 16 by 13 matrix.

The 9.6- by 18.8- by 19.8-inch dimensions are par for the course in

this stage of development for full-featured transportable computers, and you should be able to take it on the plane with you—if you're persuasive. Being able to take the computer home from the office should soon

convince many users to opt for the portable model. Corona also offers a nylon tote bag to make carrying the Portable PC a little easier and to provide a little additional protection.

At \$2545 with one double-sided floppy drive (\$2945 with two drives),

● Review

128K memory, MS-DOS, GW BASIC, *PC Tutor*, and the *MultiMate* word processing program, the Corona Portable PC is a cost-effective alternative to the IBM PC or the COMPAQ (which costs \$2995 with one disk drive and no bundled software).

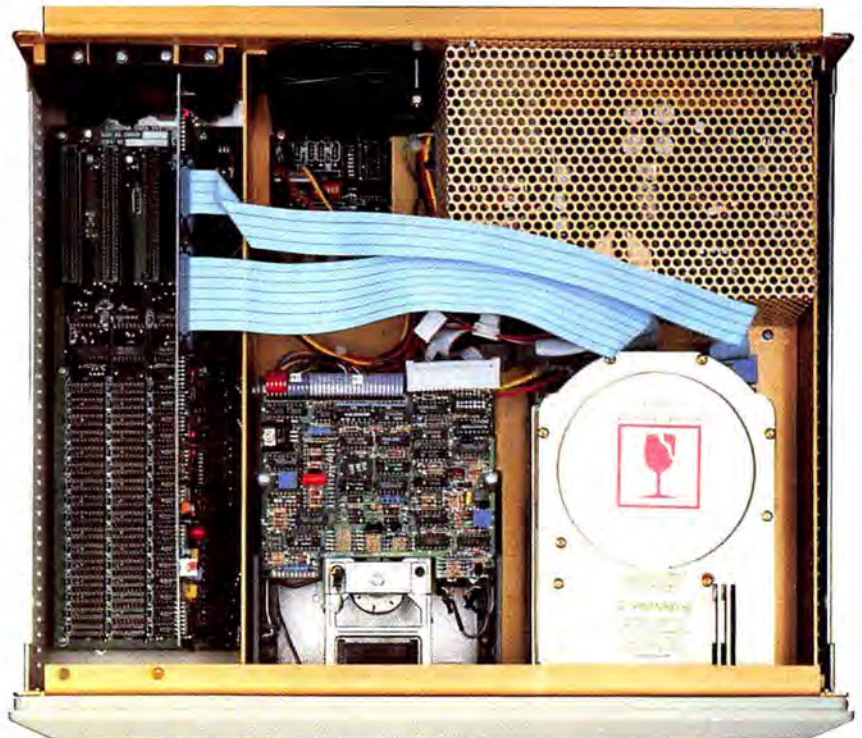
Bundled Software

Corona has modified MS-DOS, as mentioned previously in this review, to correspond more closely to PC-DOS. The distribution disk that contains MS-DOS (called Corona-DOS in this case) also includes several interesting utilities that extend beyond the capabilities of MS-DOS version 1.25 (equivalent to PC-DOS 1.10). For example, the CONFIG utility can set up the computer to utilize either one or two floppy disk drives, up to four virtual disk drives on the hard disk, and a user-definable RAM disk. Normally, drives A and B are configured for floppies, C through F as virtual drives on the Winchester, and G as a RAM disk. This configuration is not mandatory, however, and CONFIG can even set up the hard disk drive as A through D. The addition of the RAM disk is a real plus, particularly with the 512K memory expansion capability. However, if the RAM disk configuration is used in a 128K system, *MultiMate* won't run, since it requires the entire 128K.

One interesting utility shows rows of memory chips on the screen and goes through a process of checking the individual chips for errors. If errors are found, the bad chip or chips and their exact position in the motherboard RAM array are graphically illustrated on the monitor.

The EQUIP utility provides a summary of system configuration. Other utilities streamline hard disk usage; some of these change the size of the hard disk partitions and back up data to floppies by date, subject, or disk partition.

Corona has also included some demonstrations of its improved graphics capabilities, an adventure



Internal view of the desktop Corona PC's mechanical assembly

Hardware and Software	IBM PC ¹	Corona
System unit with keyboard, 64K memory, ² and two double-sided disk drives	\$2633	\$2995
Additional 64K memory ²	165	included
Monochrome monitor	345	"
Monochrome adapter and parallel port	335	"
Serial port	120	"
DOS and BASIC ³	60	"
Electronic disk drive emulator	30	"
Total cost of standard Corona vs. an equivalent IBM PC	3688	2995
Additional 384K memory ⁴	1175	885

¹ Prices for IBM PC hardware and software are IBM Product Center prices.

² The Corona does not use parity check bit in memory.

³ Corona supplies MS-DOS 1.25 and GW BASIC.

⁴ The Corona system board will hold 128K to 512K memory in 128K increments. The new IBM PC system board will hold 64K to 256K memory in 64K increments (except for the electronic disk drive emulator, which is not supplied by IBM but is often free with a memory expansion board). Additional memory requires a memory expansion board and use of one expansion slot.

IBM PC and Corona PC hardware and software price comparison

game, a strategy game, and some other simple diversions. There is even a program that turns your Corona into a simplified synthesizer, although the speakers are not loud enough to take full advantage of this feature.

The *PC Tutor* program included with the system guides first-time users through the intricacies of using the Corona [see "Self-Training on the PC," *PCW*, Vol. 1, No. 3]. This instructional program is particularly helpful since the documentation explaining MS-DOS and the various offered utilities, though quite complete, is printed in small type and is difficult to wade through. In the MS-DOS documentation each command is on a separate page arranged in alphabetical order. While that order is good for referencing commands, it is not the logical order for the first-time user learning about MS-DOS.

The Corona PC user guide, on the other hand, is in bigger print and is easier and more logical to use.

For the BASIC programmer, there is a separate package containing the disk and the documentation for Microsoft's GW BASIC (graphics included), which will allow programmers to use Corona's improved graphics capabilities. At this time it is necessary to use an IBM PC-compatible graphics board to view IBM graphics programs on screen; however, all graphics programs written in GW BASIC should be able to run without a hitch and should make full use of Corona's improved graphics.

The *MultiMate* word processor bundled with the Corona was designed to duplicate the features and ease of use of the dedicated Wang word processor. *MultiMate* is easy to learn and is quite powerful, with a full helping of worthwhile bells and whistles [see "The PC's Perfect Mate," *PCW*, Vol. 1, No. 6 for an in-depth review].

Sales and Service

Corona markets its products through a network of regional full-service distributors who in turn retail the products through a network of

authorized Corona dealers (qualified by both the distributors and Corona). This approach is unusual: most other manufacturers sell directly to authorized dealers or sell to distributors who supply the product to an uncontrolled marketplace. Corona hopes that the distributors will be able to provide close regional support and stocking, allowing the dealers to do an effective job of supporting the product.

Once the warranty period has run out, Corona owners may use the Xerox Corporation service organization, which currently includes 82 nationwide Xerox Computer Centers for walk-in service, on-site service, or pickup and delivery.

Except for the excessively noisy disk drives and fan, a different keyboard feel, and a small degree of incompatibility, Corona presents a convincing argument for purchasing an IBM PC-compatible computer instead of the original. The combination of greater power and expandability, improved character resolution and graphics, bundled software, and most important, the low price, is likely to persuade many prospective buyers to turn their eyes away from the giant and toward computers like the Corona PC and the Corona Portable PC. ☉

David Keith is a freelance journalist and microcomputer consultant.

Corona PC, Corona Portable PC
Corona Data Systems
31324 Via Colinas #110
Westlake Village, CA 91361
800/621-6746

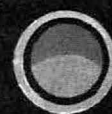
List price including bundled software: Corona PC, \$2595 with one double-sided floppy drive, \$2995 with two drives, \$4495 with one drive and one 10M Winchester. Corona Portable PC, \$2545 with one double-sided drive, \$2945 with two drives.

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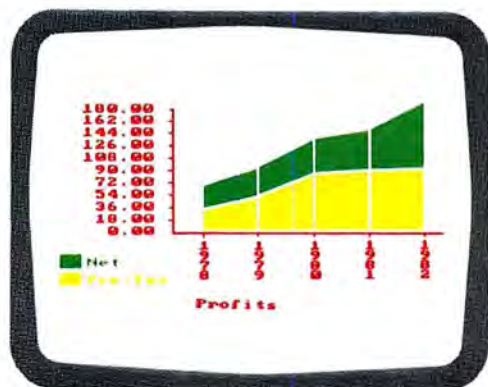
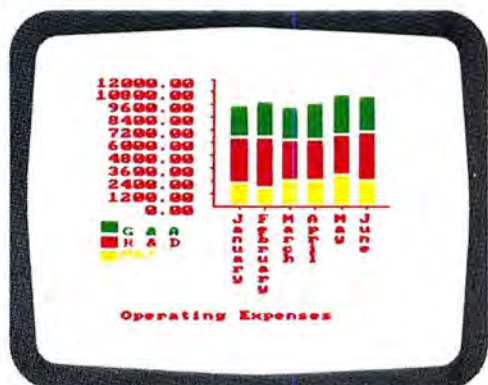
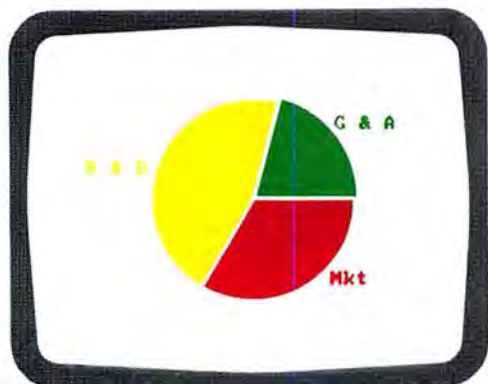
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Required hardware: IBM or COMPAQ P.C. with 128K RAM and at least one 5-1/4" diskette drive. For screen graphics: IBM Color/Graphics Adapter and compatible color or monochrome display. For printer graphics: IBM or Epson printer with GRAFTRAX option and IBM Color/Graphics Adapter.

Required software: IBM DOS, Version 1.1 or Version 2.00; VisiCorp VisiCalc, Extended Memory ("256K" or "512K") Versions, or IBM VisiCalc, Version 1.10 or greater.





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Reader Service #278

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A woman with blonde hair, wearing a colorful striped short-sleeved shirt and a white knee-length skirt, is sitting on a large, dark wood-grain computer tower. She is holding a brown folder and looking towards the camera. In the background, a man with grey hair, wearing a light blue shirt and a dark vest, is sitting at a desk, looking at a computer monitor. The setting is an office with dark wood paneling and curtains.

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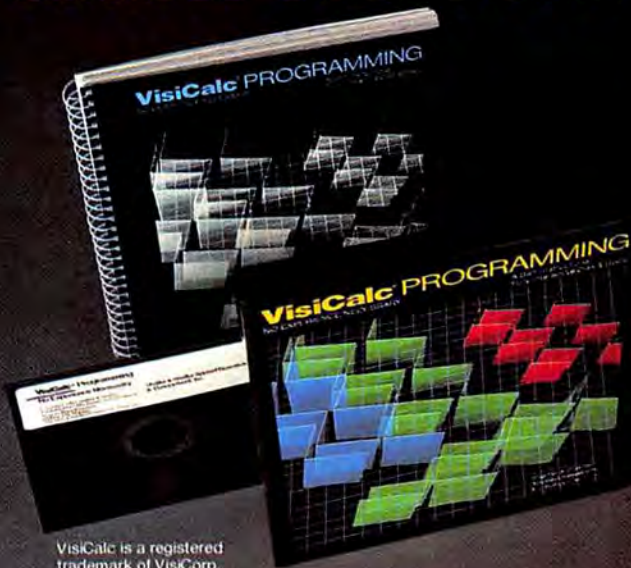


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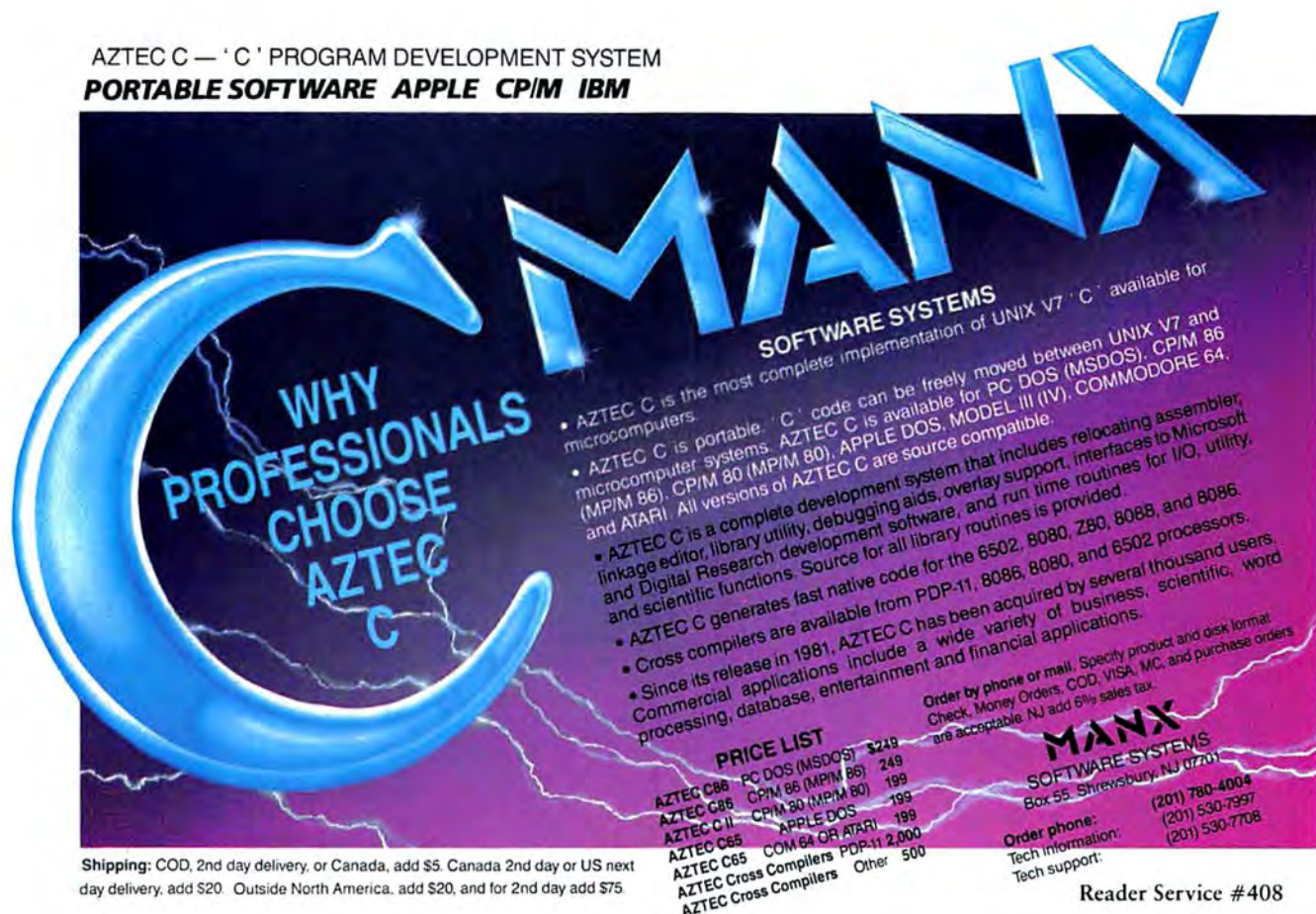
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Reader Service #318

Easy Writing

A look at Information Unlimited Software's professional word processing program, EasyWriter II

Andrew T. Williams

If you want to know what it's like to climb a mountain, ask a Sherpa; if you want to know what it's like to use a word processing program, ask someone who used it to write a book. As far as mountains go, I'm from Kansas. But I'm Sir Edmund Hillary himself when it comes to talking about *EasyWriter II*.

I just finished writing a 750-page manuscript with *EasyWriter II*, and climbing Mount Everest couldn't have been more challenging—or rewarding. I've used just about every feature the program has to offer, so I know the locations of the dangerous cliffs as well as the safe route to the clear and cold air at the top.

Features

Detailing all features of *EasyWriter II* would be impossible, but you should know that it is a menu-driven, full-featured, page-oriented word processing program. The program has two main sections, System and Housekeeping. Housekeeping performs several functions necessary for running the program. Figure 1 shows the System (or main) menu from which you move directly to word processing tasks. To make a selection from the menu, type the number of your choice and follow the directions as they appear. If at least one of your



disk drives is double-sided you can store both the System and the House-keeping programs or the System and *EasySpeller II* programs on the same disk. If you have only single-sided drives, the programs must be stored on separate disks.

EasyWriter II is page oriented. You work on a single page at a time, and when you want to work on another page, you move there by using the Next or Previous commands or by entering the number of the page you want and issuing the Goto command. Page orientation means you'll never have to scroll through a long document again. When drafting a manuscript, you can put more than 100 lines on a page before you have to move to another page. Once you've completed the draft, you run the manuscript through the pagination function to arrange everything into page-long units.

EasyWriter II lets you choose the "mode" in which to operate: character, word, line, sentence, paragraph, block, or page. Whichever mode you're in (its name is displayed in the upper-left corner of the screen), the Copy, Delete, Insert, Cut, Next, and Previous commands work at the level of that mode. If you're in paragraph mode, the Next command, <F10>, takes you to the beginning of the next paragraph. In sentence mode, <F10> moves the cursor to the beginning of the next sentence.

An important feature of *EasyWriter II* is that the text you see on the screen is the same as the text that prints out on the page. Underlined text is underlined, boldface text is displayed in double-strength video, and headers and footers appear on the page. If you've chosen to justify both the right and left margins, the text is justified on the screen.

Robust Ruler

EasyWriter II allows you to store format specifications in a file called a ruler. When you press <Shift>-<F1> the ruler appears, ready for editing (see Figure 2). You can name rulers so that they can be

called from anywhere in a document or from other documents in the same folder. You can use the ruler to set the right and left margins or justify the right margin. Pages can be up to 256 characters wide, and you can set regular and decimal tabs. *EasyWriter II* sets the C that indicates the center line automatically, but you can position the C where you wish. You can choose the character pitch (10 for pica, 13 for condensed, and 6 for enlarged) and the number of lines per inch (3 lines per inch for double spacing and 6 for single spacing).

You can also declare the ruler non-adjusting: with a nonadjusting ruler everything is printed as typed; text is unaffected even when the Adjustment command is given.

I modified the default ruler to reflect the type of work I do. I always use <Shift>-<F1> to create a ruler named *d*, for default. Whenever I want to go back to my original margins, tabs, line spacing, and character size, all I need to do is press <Shift>-<F1> and *d*, and the ruler is reset. You can leave a ruler unnamed, but I name every ruler I think I might have any reason to use again. To get a listing of all the named rulers in a document, use the main menu's option 7, Print Document List.

Functional Function Keys

EasyWriter II uses the IBM PC function keys extensively, giving the program the ease of use of a dedicated word processor (see Table 1 for a list of the key assignments). The program comes with a sticker to attach to the keyboard that explains how the keys are used, but memorizing the more frequently used keystrokes is not difficult.

You can adjust text from the cursor position to the end of the current paragraph with <F8> or you can adjust an entire document with the Adjust option of the pagination function. Adjustment eliminates unneces-

sary spaces between words and prevents words from hanging over the right margin. If there is some part of the text that you don't want adjusted (a sonnet for example), use the nonadjusting ruler.

In some situations you may want to override the Adjustment program on a character-by-character basis. This is done by specifying "nontrivial blanks," or necessary spaces such as paragraph indentations. To indicate

The text you see on the screen is the same as the text that prints out on the page.

these blanks you can use the tilde (*EasyWriter II*'s default character) or specify your own symbol. I use the reverse single quote because it's a lowercase letter and because several of the programs I write about require the tilde. The nontrivial blank symbol shows on the screen, but it doesn't appear in a printout. With this feature you can indent paragraphs or center material and have the indentation and the centering remain after adjustment.

Like most professional word processing programs, *EasyWriter II* has a set of tools for moving text from one place to another in a document. It has the standard cut and paste features found on most programs, and in addition it allows you to copy a section of text as many times as you wish. For example, I typed "*EasyWriter II*" once at the beginning of this article, copied it, and then inserted it by pressing <Alt>-<F5> wherever I needed it throughout the document.

EasyWriter II has a "tagging" feature that lets you mark segments of text for modification. Once text (up to 4000 characters) is tagged,

● Review

you can merge it from one part of a document to another or from one document to an entirely different one that isn't even on the same disk. When writing my book, I used one document for the text in a chapter and another for the tables. I tagged the tables, and when I needed to assemble the two documents into a single chapter, only a few minutes of merging were necessary.

Easy Indeed

Information Unlimited Software has made every effort to make *EasyWriter II* an easy-to-learn, easy-to-use program. I've already spoken about the menus and the ease with which you can make choices or change parameters, but the program has other easy features as well.

Document names can be up to 30 characters long, for example, and they can be very descriptive. You no longer need C-3PO, the gold-plated robot from *Star Wars* who knows 6 million languages, to translate your file names. But easy doesn't stop there. You don't need to type document names because you refer to doc-

uments by number. And complicated keystrokes are a thing of the past; invoking functions is as simple as <F1> for Help and <F6> for Adjust. Underlining is done with the <Alt>-_ combination, and boldface is accomplished with <Alt>-B.

Finally, *EasyWriter II* is part of a larger family of programs that in-

Document names can be up to 30 characters long.

cludes *EasyPlanner*, *EasyFiler*, *EasySpeller II*, and the soon-to-be-introduced *EasyMailer II*. Each program is designed to work with the others, and each has the same general structure, to make learning a program's special features easier.

EasySpeller II

EasySpeller II deserves special mention. It's an 80,000-word spelling checker that can be loaded onto the system disk and used anytime you

use *EasyWriter II*. You can check the spelling of a single word, a single page, or an entire document. The spelling checker tries to match words from the document against the contents of its word list. If a word you have typed isn't in *EasySpeller*'s lexicon, it stops to ask whether to accept the word as correct for this document, accept it as correct in this one instance, or correct the word. You can exit *EasySpeller II* at any time by pressing <Esc>.

One shortcoming of *EasySpeller II* is that unlike some spelling checkers it can't learn special vocabulary. *EasySpeller II* stubbornly refuses to recognize the havoc computers have played with the King's English. Every time I checked a chapter of my book, I had to tell it that *spreadsheet*, *worksheet*, and *VisiCalc* were correct words. *EasySpeller II* doesn't even think *EasySpeller* or *EasyWriter* are words.

Dangerous Outcroppings

While I'm impressed by *EasyWriter II*, a long writing project has suggested a few warnings I would like to pass along. The first is to keep an eye on the "% full" indicator at the top

10% full 06/04/83

Main Menu

EW II DOS System 96K 2.0 Dec 11 82

Select Activity

1. Edit

4. Print

7. Print Document List

2. Open File Folder

5. Paginate Document

8. System Functions

3. Delete Document

6. Set Date

Doc

Page

Name

Auth

Op

Active Document: 5

1

EASYWRITER II REVIEW, PCW # 6

List of Documents in Folder LETTERS, MEMOS, ETC.

Doc

Page

Name

Auth

Op

Created

Edited

2

1

Let. Nurock

05/06/83

05/06/83

3

3

Off Shore Banking Program 1983

05/10/83

05/10/83

4

3

Curriculum Vita

05/10/83

05/10/83

5

22

EasyWriter II, Review, PCW #6

05/29/83

06/02/83

6

1

Letter: Paul Chaison, IUS

04/20/83

04/20/83

7

1

J. Blumenthal, Microsoft

02/20/83

04/20/83

8

1

L: D. Littwin/1st draft of ms

05/25/83

05/25/83

9

1

Tables for EasyWriter II Art.

06/01/83

06/02/83

10

1

Theron: Equipment Letter

05/31/83

05/31/83

11

1

L. Press: Cover for MS

06/01/83

06/01/83

12

1

Final things to do to WHAT IF

05/25/83

05/25/83

Figure 1: EasyWriter II main menu

The Cancel command, <Shift>-<F2>, must be used with caution. It cancels all changes that you've made to a page since the page was last called from the data disk. This feature works fine if the change you wish to cancel is the only one you've made since loading the page. But if

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Review

you've typed good material as well as bad, remember not to use the Cancel command.

Another complaint I have has to do with the modes. As noted, many *EasyWriter II* functions perform differently in different modes. Usually this is a convenient feature, but a problem arises if you press when you think you're in the word mode but are really in the line mode. Zap—there goes the whole line. I try to stay in word mode (I feel it is the most useful), but on more than one occasion I've zapped a line when I intended to zap a word. I know this

is *EasyWriter II*'s way of telling me that I'm getting tired and should walk the dog, but it's still frustrating. *EasyWriter II* asks you to confirm a deletion when in page and paragraph mode, so you can't zap large blocks of text.

My last quibble has to do with the Previous and Next features in page mode. Pressing <F10> in page mode takes you to the next page. This method is fine if you remember to switch back to word mode once you're on the page you want. But if you don't remember, the next time you press <F10> to move to the next word, you'll find yourself moving to the next page. If you have pushed

DOS-based EasyWriter II

Information Unlimited Software (IUS) has introduced a major revision of *EasyWriter II* in which the program has been converted to a DOS-based system from ASP (Application Support Program), the company's private formatting system. The upgrade costs \$25 and includes four disks and a completely rewritten and expanded manual. Send a check, your original program disks, and the pages from the original manual (keep the binder), and IUS will send you the upgrade.

The upgraded program and the original program are functionally identical; you can almost make the transition to the upgrade without having to learn anything new. But the revision provides a number of additional advantages: it uses all the DOS commands for file management, and you can use double-sided disks instead of the single-sided ones required with the previous version. Double-sided disks effectively double the number of pages you can place on each data disk. The larger disk ca-

capacity also makes it possible to have the System and Housekeeping programs or the System and spelling checker programs on the same disk. Larger capacities reduce the amount of disk switching necessary, making the program easier to use.

Finally, with the DOS version IUS introduced a Folder Name function. With this feature you name the folder you wish to work with, and a menu displays the documents in that folder. This feature is necessary when you are working with the larger number of documents possible on a hard disk.

If you have *EasyWriter II* documents created under the original ASP format, you can obtain a utility from IUS to translate ASP disks into DOS disks. Note, however, that you must transfer from a single-sided ASP disk to a DOS disk that has been formatted as a single-sided disk. You can then copy the file onto a double-sided disk if you want to.

<F10> several times to move ahead several words, you must wait while *EasyWriter II* pages along. Having the program ask you to confirm that you want the page mode when you use the Next and Previous commands would be helpful.

Hardware

EasyWriter II requires an IBM PC with two disk drives and at least 64K of RAM, although you're also given a faster version of the program that needs 96K. The program works well with hard disks and disk emulators and it can be configured to work with just about any printer (dot matrix or letter quality) available on the market. It supports proportional spacing and a larger number of type fonts than *EasyWriter*.

EasyWriter II is available on many personal computers besides the IBM, but each implementation is virtually identical to the PC's. If you know how to use *EasyWriter II* on the PC, you can, for example, use it immediately on the Texas Instruments Professional Computer.

Information Unlimited has a phone support program. If you want this feature, you pay an additional yearly subscription fee. If you don't want it, take your problems to your dealer (who can then use the phone support program).

Communication is one of humankind's oldest and most pleasant activities. In some ways, word processing is just another development along the path of the better chisel, the more efficient quill pen, and the more dependable typewriter. My goal as a writer is to have as little as possible stand between my thoughts and the printed page. *EasyWriter II* has helped me come very close to my ideal. ●

EasyWriter II
Information Unlimited Software, Inc.
2401 Marinship Way
Sausalito, CA 94965
415/331-6700
List Price: \$350
Requirements: 64K, two disk drives



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"Worldwide Widgets, Williams here."

"Walla Walla Widget Works," came the reply. "One of our widgets went."

"What type?"

"Wingtip."

Williams winced. Worldwide hadn't made a wingtip widget since way back when.

"We wouldn't have a wingtip widget at Worldwide, Sir. They're obsolete."

"If we don't get one by Wednesday," the voice wailed, "we're wiped out."

There was one chance. The RL-1 Database Management System. If he could track down the last time a Washington dealer had ordered a wingtip widget...

Williams was no programmer, but that didn't matter. Turning to the computer, he put the question to RL-1 in simple English:

```
Select DEALER, QUANTITY, DATE
from INVOICES
where PART EQ "WINGTIP WIDGET"
and STATE EQ "WASHINGTON"
```

Within seconds, Williams had his answer. A dozen wingtips went to Wally's Widgets 6 years ago. But would Wally have any left?

Yes! Waking Wally was well worth it. The last wingtip widget

in Wally's warehouse was on its way to Walla Walla.

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So easy, the butler could do it.
It's a different case with RL-1. You'll DEFINE exactly how you

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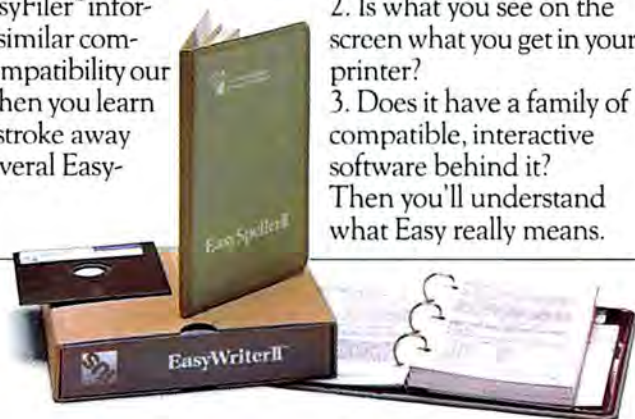
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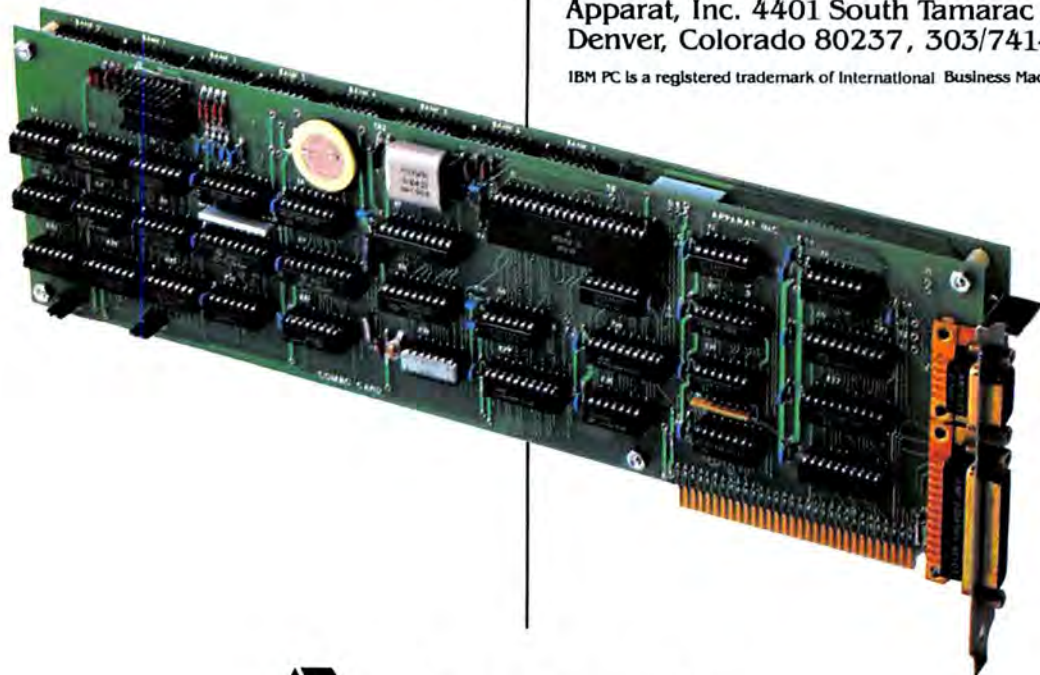
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Dedicated to Word Processing

The NBI co-processor expansion and software bring the time-tested features of a dedicated word processor to the PC.

Merrily Shinyeda

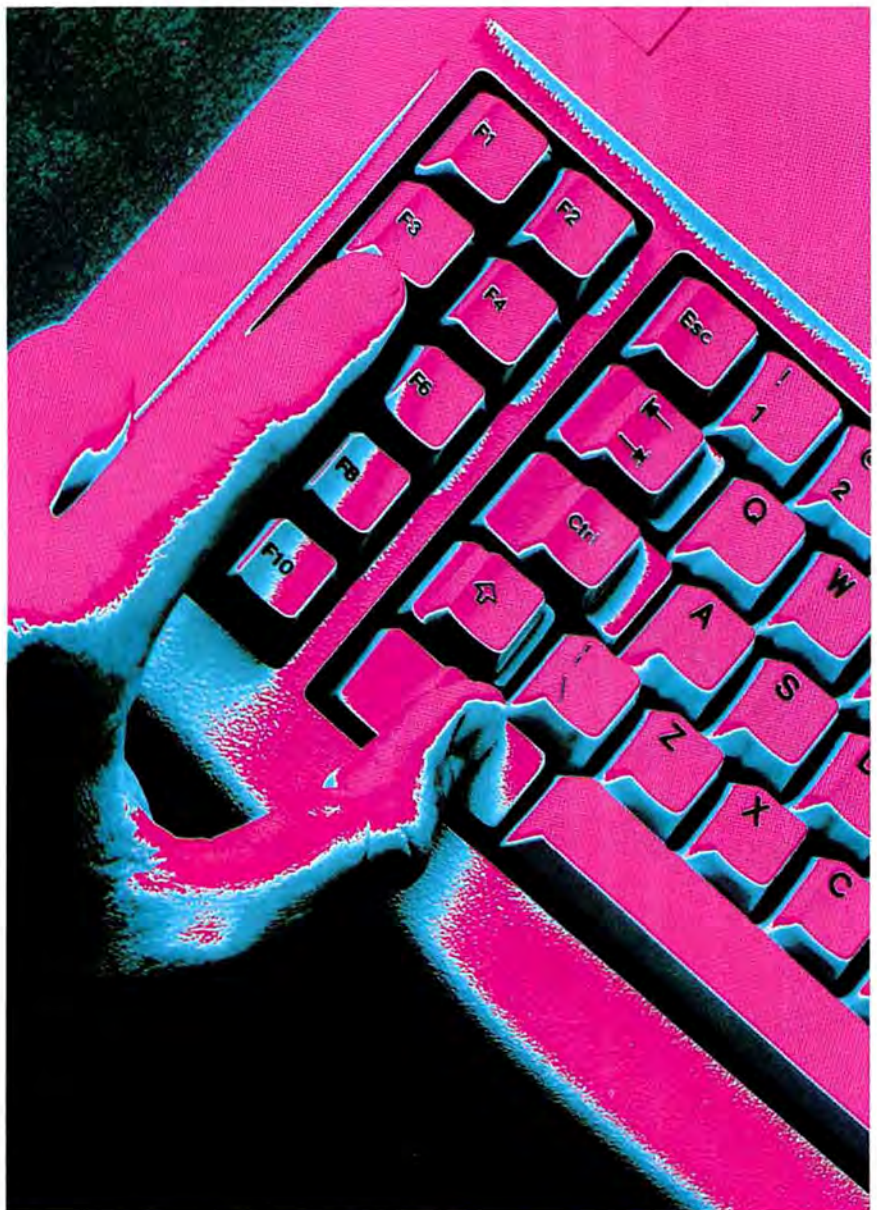
Hope is on the horizon for managers who want to combine the computational power inherent in the IBM PC with the capabilities of a dedicated word processor. NBI, the Boulder, Colorado, manufacturer of stand-alone word processing equipment, has adapted its popular word processing software to the IBM PC.

For users who have integrated needs, this release is significant for the following reasons:

- It is the first word processing software product for personal computers available from a dedicated word processing vendor.
- It is the first word processing package with a pedigree. It has been tested in thousands of high-volume word processing installations—it was not written or designed for casual personal computer users.
- The package makes good use of the PC keyboard, enhancing the program's ease of use and logical approach to text processing needs.

Getting Started

Along with the software and the training and reference manuals, the NBI Word Processing package includes a printed circuit board based on Motorola's 6800 processor. (Even though the NBI program is designed to run under the 6800 processor, documents created with NBI can be converted for use with PC-DOS.) The program works in conjunction with a



PC configured with a minimum of 64K and one disk drive. The board has 64K of random access memory that can be expanded to 192K.

Diagrams and step-by-step instructions covering installation accompany the NBI board. At first glance it looks as if any nontechnical person equipped with a screwdriver could insert the board in an available expansion slot and be off and running. The instructions call for reconfiguring easy-to-locate switches on the IBM motherboard and the NBI board to reflect the total amount of IBM and NBI memory in the system and then inserting the NBI board into any available expansion slot. Sounds easy enough, but if your PC already has added expansion cards, the fun is just beginning.

What the instructions don't tell you is that the positions of the memory expansion boards determine the proper switch configuration. If you have already installed boards between the IBM motherboard and NBI's board, you have to add the total amount of memory to the amount on the boards in place and then reset the switches accordingly. For a technician this situation would be immediately apparent and easily resolved. But this detail can cause novices a great deal of frustration (not to mention expense if the electronics are damaged) and a trip back to the place of purchase.

Menus and Prompts

When you start up the system, the program displays the main menu (see Figure 1). The list of operations to choose from includes Directory, Record, Edit, Print, Copy, Delete, Activate A drive, and Remove (or change) disks. (The NBI Remove or change disks operation is an important one. When you want to turn off the PC with disks inside the drives, you have to be sure to type the letter O for Remove disk. If you don't do this, you have to go through a long data recovery procedure the next time you want

to use the disk.) While you cannot bypass the main menu, once you are familiar with the eight options, you can save time by entering your commands before the prompts appear on the screen.

The Directory option displays an alphabetized list of documents stored on the data disk. The list shows the date each document was last edited,

NBI has trimmed the number of keystrokes to the bone.

its length in pages, and a document description (up to 38 characters long). The main menu options are listed below the directory, making it unnecessary for you to return to the main menu to select an operation. You can also select a document from the main menu without displaying the directory. These shortcuts save time, especially in the early stages of learning before you have memorized the letters assigned to each operation. The last line of the screen always displays messages such as the file/document name and the current page number and line position.

Moving through Text

NBI has taken full advantage of IBM's well-designed keyboard by using the function keys extensively. This type of design minimizes the need to memorize the control-alpha-numeric key combinations that make most other popular word processing packages difficult to learn and use. As a general rule, NBI has followed a logical approach in designating the operation of each function key. For example, frequently used operations such as indent, center, or menu require a single keystroke. Function keys used with the <Ctrl> key handle formatting for such things as tabs, page endings, headers, and footers. Function keys combined with the <Alt> key handle deletions, such as

erasing lines or words or clearing tab settings.

In addition to making the most of the function keys, NBI puts the PC's cursor keys to good use. Using the right and left directional arrows with the <Ctrl> key moves the cursor through a line of text a word at a time. The <Home> and <End> keys instantly move the cursor to the left margin or to the last character of a line. Though the operation is slow, the <PgUp> key moves the cursor to the top of the previous page and <PgDn> positions the cursor at the top of the next page. <Ctrl>-<Home> moves the cursor to the top of the screen.

If you type long documents, you can send the cursor to a specific page by typing two commands and the number of the page you want to reach. When the desired page is located, the cursor goes to the first character on the first line of the page. This locate-page function is useful, but it has some peculiar limitations. Once the program has advanced to a specified page, it will not scroll backward above that page. In order to view a paragraph that is split between two pages, you have to search to the preceding page and advance the cursor manually down to the desired location. I found this awkward procedure irritating, both because it is unnecessary and because it isn't detailed in the manual.

Editing a Document

NBI has taken a unique approach to inserting and deleting text in documents. While I found the procedure somewhat awkward to use at first, I quickly adapted. The system automatically changes its typing default to strikeover or insert mode, depending on the location of the cursor. When the cursor is positioned under a character, you need only press a key to type over the character. But if the cursor is at a space, the system automatically goes into insert mode and continues in that mode until the cursor is repositioned. I was impressed with this feature because it makes

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losing more than one word by typing over it impossible. If an incorrect key is typed, the <Backspace> key can be used to correct any mistakes immediately without canceling the insert function. If you want to insert characters within a word, you can use the <Ins> key.

NBI uses two primary methods for deleting information. The <Backspace> key erases characters to the left of the cursor, and the key erases characters to the right of the cursor. Words and lines can also be deleted by using function keys in conjunction with the <Ctrl> key. To prevent the accidental loss of special codes and preserve line/paragraph integrity, the and <Backspace> keys do not affect returns, format instructions, or special commands. These elements can be deleted only by using the special delete instruction, <Alt>-<F5>.

Formatting

Format is the way a page looks when it is printed—right and left margins, number of lines per page, spacing between lines, and pitch. Since most people produce a variety of document types, a good word processing package should include many formatting options that are easy to change.

NBI's standard format assumes you are using 8½- by 11-inch paper. Standard margins are 1 inch at the right, left, top, and bottom of the page; the standard pitch setting is 10; and the standard line spacing is single. If you like these format parameters, no format setup is necessary when you begin to type a page of text.

NBI lets you choose an unlimited number of line formats for line spacing, line length, and justification within a single document. The program allows only one format per document, however, for pitch, left margin, text length, top margin, and paper length. Formatting instructions for documents are stored as separate files attached to the main document.

WORD PROCESSING OPERATIONS

<u>D</u>	DIRECTORY DISPLAY
<u>R</u>	RECORD A NEW DOCUMENT
<u>E</u>	EDIT A DOCUMENT
<u>P</u>	PRINT A DOCUMENT
<u>C</u>	COPY A DOCUMENT
<u>L</u>	DELETE A DOCUMENT
<u>A</u>	ACTIVATE/DEACTIVATE A DRIVE
<u>O</u>	REMOVE OR CHANGE DISKETTE(S)

TYPE THE UNDERScoreD CHARACTER TO SELECT OPTION.
PRESS THE ESC KEY TO CANCEL ANY INSTRUCTION.

Figure 1: Main menu

The instructions are represented on the display as squares embedded in the text. Squares are also used in place of special printing instructions such as characters for underscoring, boldfacing, and overstriking. When the cursor is positioned under a square, the message line at the bottom of the screen tells you what instructions the square represents.

Though less obtrusive than multiple-character symbols, the instruction squares tend to clutter up the screen. For people who get confused by busy screens, the NBI screen can easily be converted to Proofreading Display mode, in which text appears as it will when printed. If you prefer the uncluttered screen, you can do all your editing in the proofreading mode.

People who use word processing infrequently as well as those of us who use it daily can appreciate the simplicity of NBI's reformatting process. Reformatting occurs automatically when you advance the cursor through the document after adding or deleting text or changing formats. The cursor moves freely across page boundaries, reformatting and repaginating as it goes.

Adjusting a paragraph by moving the cursor down through text is a fast and simple method. The fact that NBI is document oriented makes it possible to readjust an entire docu-

ment simply and easily. In addition, repagination occurs simultaneously when you adjust text. If you want, you can also include a hyphenation pass, creating a more even right margin for multipage documents, and the widow/orphan line control may be used to prevent lines at the beginning or end of paragraphs from being separated from the rest of the paragraph.

Moving and Copying Blocks

For people who have trouble deciding whether a paragraph would work better on page 3 or page 12, the ability to move blocks of text within the same document is an absolute necessity. The NBI software handles this function well. You simply press <F3> at the beginning of the block to be moved and again at the end of the block. This action highlights the text to be moved. Next, position the cursor at the desired destination and press <F5>. Even better, you can mark the block, continue editing other text, and then insert the block when you are ready. Although NBI block moves are somewhat slow compared to the same procedure on a dedicated word processor, their simplicity makes up for their lack of speed.

I was satisfied with the NBI block move procedure, but I was somewhat annoyed to find no provision for making direct copies of information in a document. Rather than provid-

ing a direct copy key, NBI's method is to have you highlight the block of text (using the same procedure as that for moving text) and assign it a document name. When this is done, the program automatically erases the block from its original position and stores it as a document on the disk. To copy, the block must be reinserted into its original position as well as inserted at its new position. In addition to its requiring extra keystrokes, the real aggravation with this procedure comes when you are finished with the block. To avoid having these temporary documents permanently taking up space on your disk, you must go to the directory and delete them.

I must mention that although it is cumbersome for editing, the copy feature does have one redeeming aspect. The same operation can be used in a document/paragraph assembly application. Paragraphs stored as documents can be appended quickly into a document with a command made up of the paragraph's name and <F7>.

Tabs and Decimal Alignment

The NBI screen scrolls horizontally to accommodate up to a 13-inch writing line, enabling you to create and edit wide charts. Both regular and decimal tab stops can be set at any point on the format line anywhere in the document. The decimal tab instructs the system to align numbers at a decimal point and can also be used to align text at the right edge of columns.

Accountants and others who type lots of statistical data may not find NBI word processing to their liking. NBI does not offer any math calculations or the ability to automatically move columns horizontally or lines vertically on a page, although columns may be moved, inserted, or deleted manually. Using the move and copy features of the NBI, it is possible to move entire tables or make separate documents out of them to use as insertions in other documents.

Search and Replace

Once considered a feature limited to dedicated word processors, search and replace has become a mainstay on virtually all word processing packages. NBI is credited with introducing this feature to the word processing community on the dedicated system 3000, and they have incorporated the speedy and efficient approach into the PC version.

Text searching occurs in a forward direction only, and a search can be initiated for a string of up to 77 characters. Because the program is not case sensitive, it locates all occurrences of a word regardless of whether the word is upper- or lowercase, underscored, or hyphenated and broken at the end of a line. After locating the first match, finding subsequent occurrences of the desired string requires only a 2-keystroke command.

In addition to finding and replacing words throughout a document, you can tell the system to search for a word and then stop for verification before it replaces the word. Replacement text matches the upper- or lowercase characteristics of the original character string.

Headers and Footers

Headers and footers are terms for document titles and page numbers printed in a document's top and bottom margins. With NBI, headers and footers are recorded as subdocuments attached at the beginning of the main document. Headers and footers may contain any number of lines and include underscored and boldfaced text. You can position page numbers in either the header or the footer and instruct the program to begin numbering at any page in the document, which is a nice feature if you don't want page numbering to start on the first page.

I found two flaws in the NBI header and footer feature. The program doesn't produce footnotes, and it doesn't handle alternate left and right page numbering for book format.

Creating Outlines

If you are a teacher who writes course outlines, a writer outlining your next novel, or an architect who prepares architectural specifications, NBI's unique outlining feature by itself will make the program worth its price. The feature allows you to type an outline with up to six indentation levels. The program automatically indents the text for you according to the appropriate outline level you have reached and inserts the right numbers. If you remove or insert an item, the remaining items are automatically renumbered when you scroll through the text. The program offers three outline format options.

Document Merge

NBI's approach to document merging parallels the approach taken by most dedicated word processors. The merge function, while most commonly associated with form letter production, can be used whenever variable information must be inserted in a document. To use this function,

Text searching occurs in a forward direction only, and a search can be initiated for a string of up to 77 characters.

you create a main document with a "switch code" recorded at each position where you want to insert information. The switch code is inserted by pressing <Ctrl>-S and choosing an identifying name of up to 10 characters for the variable. The switch code is displayed on the screen as an instruction square. When you want to identify the variable (such as the name, address, or amount), you position the cursor under the square to display a message at the bottom of the screen.

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Variables are recorded as separate documents, with each variable followed by a variable mark, <Ctrl>-V, and each group of variables divided by a "group code," <Ctrl>-G. The main document and the variables are merged during the print operation, enabling you to continue to edit or record another document during printing. Merged documents are not stored on disk, so they don't take up valuable space.

Printing

In addition to the IBM 80 cps Matrix Printer, NBI supports the QUME Sprint 9/11, Diablo 630, and NEC Spinwriter 3500Q letter quality printers and the Epson MX-80 and MX-100, Okidata Microline 84, and NEC 8023 dot matrix printers. Like the merge feature, NBI printing is designed to let you edit and print at the same time.

You can print selected pages of a document in any order. When you stop the printer, printing ceases immediately; you can then choose to resume where you left off, or you can start with the current page or reprint the entire document.

NBI provides underlining, boldfacing, strikeover, super- and subscripting capabilities, and the ability to print documents with different type styles. Type styles are designated in a document as, for example, type style #1 and type style #2. The first printing pass prints the text in the first type style only, leaving blanks where a change in style is indicated. After the first pass, you reinsert the paper and the printer fills in the blanks with the second type style.

Documentation

NBI's training guide and reference manual are exceptionally well written. Intended for the novice to word processing, the documentation presents concepts and discusses applications for each feature. The training guide provides easy-to-follow exercises prerecorded on a training disk that comes with the book. If you

have experience with word processing, you can skip the preliminaries in each training section and go straight to the exercises. Each new lesson and exercise reinforces what you have learned in previous lessons.

The NBI reference guide presents all features and functions of the system in alphabetical order and includes a description of each, with the keystrokes necessary to perform the operation. The Message section provides a quick reference list of screen messages, with explanations about what they mean and how to respond to them. The Troubleshooting section lists common problems and suggests possible solutions.

NBI provides four levels of help screens that can be accessed at any stage of producing a document except the header or footer stages. The first help level displays the function key operations. The second level displays unshifted function key operations. The third level displays the uses of the function keys when they are shifted with the <Ctrl> key, and the fourth level displays the uses of the function keys when they are shifted with the <Alt> key.

The professionalism of NBI's training guide and the helpfulness of the reference guide deserve high marks. I was impressed by the authors' ability to present difficult concepts in easy-to-understand terms. The quality of the documentation is a tribute to NBI's many years of experience in office environments.

No Disappointment

Known throughout the industry for the outstanding quality of its dedicated word processing systems, NBI has not disappointed anyone with this version for the PC. Although not as powerful as NBI dedicated systems, the PC version has more features than many currently available word processing programs and is easy to learn and use. From basic editing to sophisticated applications, NBI has trimmed the number of keystrokes to the bone. The system is

highly reliable; through all the destructive maneuvers I attempted, NBI could not be brought down. The system is responsive. A professional typist capable of "bottlenecking" the system will not be able to out-type it—this program plays catch-up extremely well.

The functions available on the NBI have been designed with their intended applications in mind, unlike many programs that supply the solution and leave it to you to figure out the problem.

The question remains, is the program worth its \$695 price? I believe that this program is better than the number-one-selling word processing software, priced at \$500. In addition, the NBI circuit board that comes with the software provides you with an additional 64K of memory, allowing you to expand the memory of your PC. Certainly anyone who handles long documents or prepares mass mailings using mailing lists considers installing additional memory early in the game. The cost of an expansion board plus word processing software will come close to the price of the NBI Word Processing package. In this respect, it's either pay now or pay later.

Tapping into the market mania for the IBM PC, NBI has effectively signaled a new era in personal computer word processing. The first of a new generation of word processing packages, this program should up the ante, forcing competition to introduce more professional-quality word processing packages. ●

Merrily Shinyeda is the Director of The Sierra Group, a Tempe, Arizona, based office automation marketing research and consulting company.

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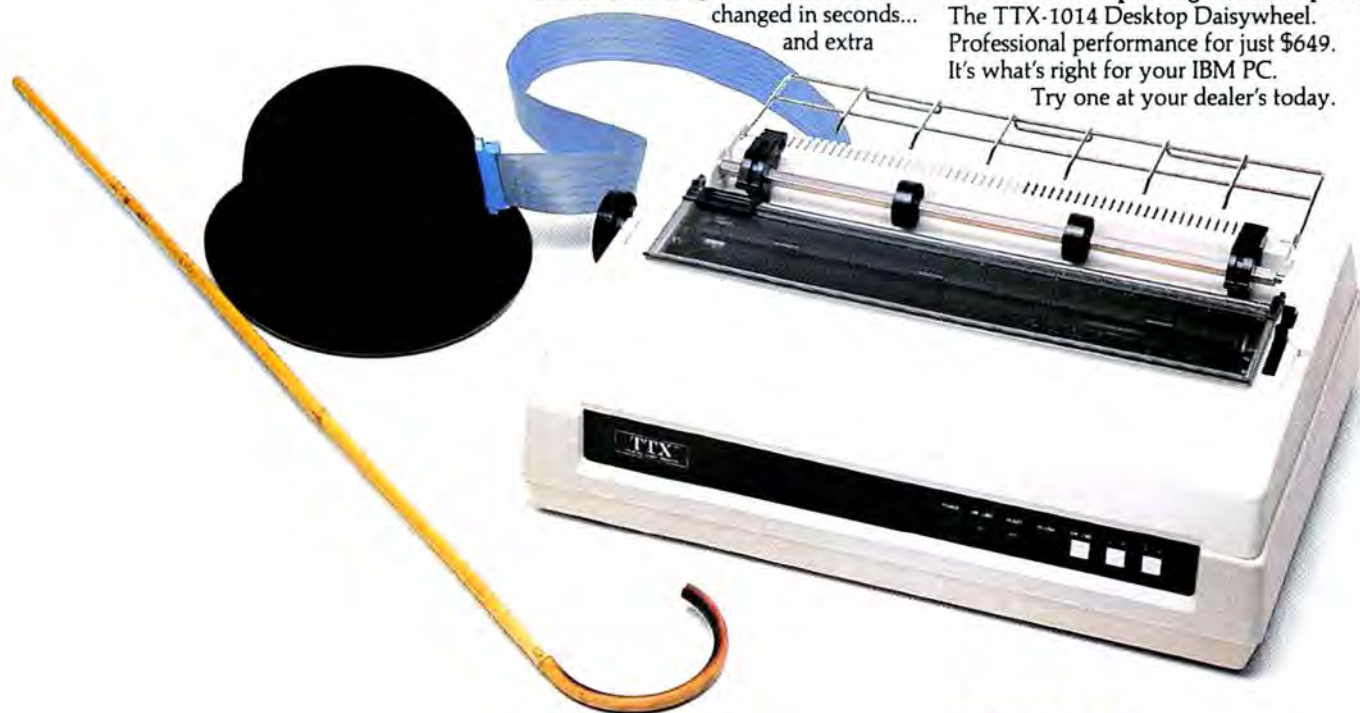
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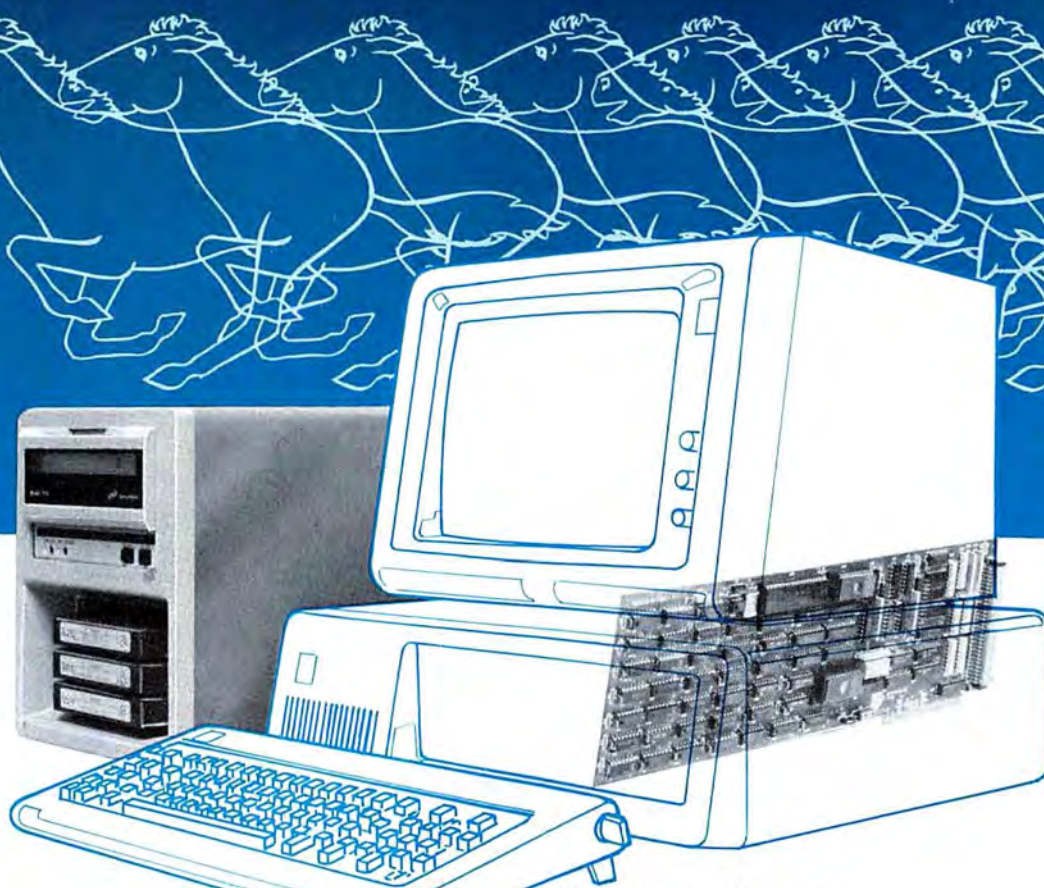
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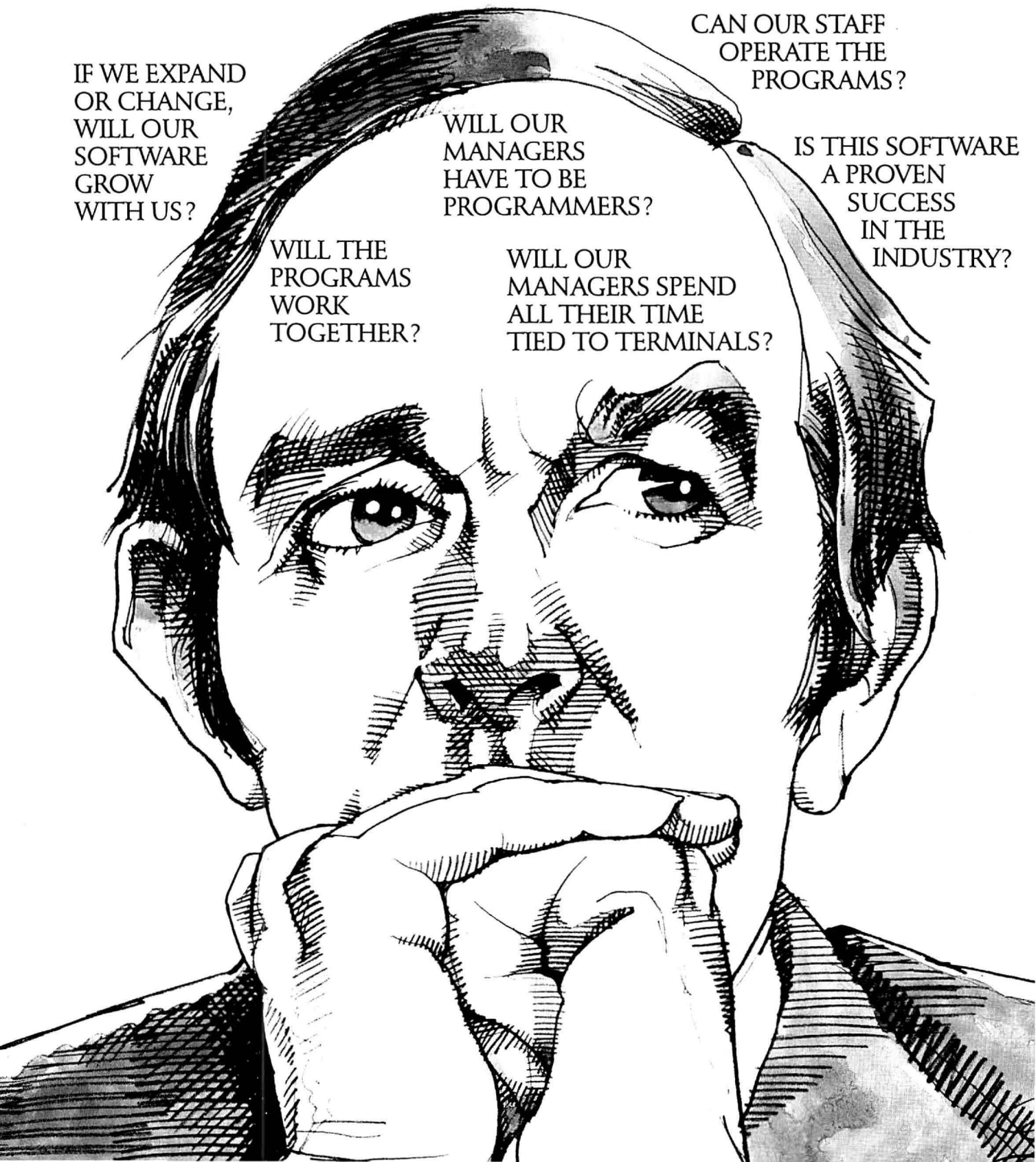
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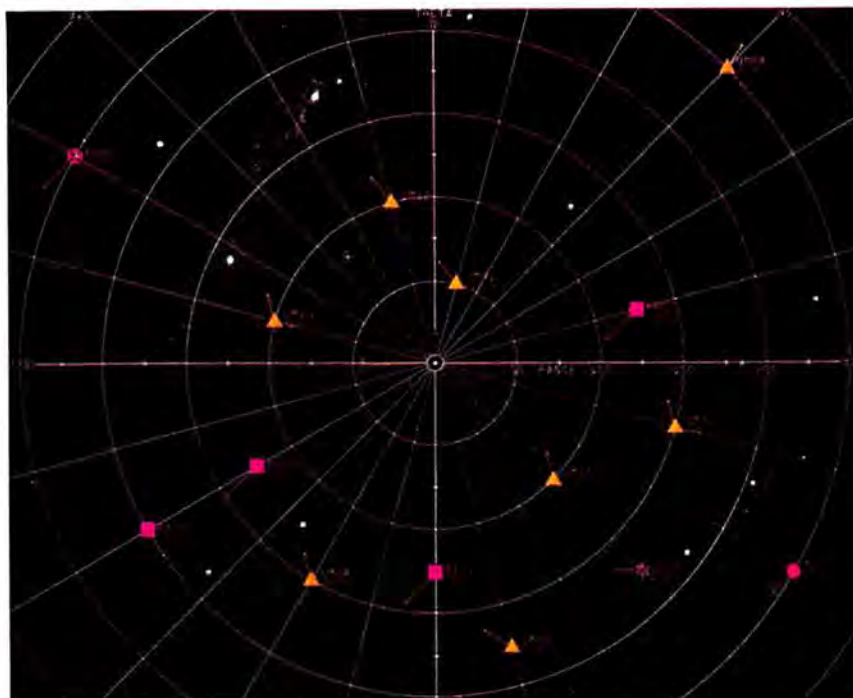
Richard Cook

Two games reviewed in this issue are *Zork III*, the last in the famous *Zork* trilogy, and *Starcross*, a science fiction adventure game. Both are prose games that have the intellectual challenge and zany imagination you've come to expect from their manufacturer, Infocom. The third game, *Snipes*, is probably the most consistently entertaining and addictive computer game invented. All three games place you in the middle of long, dark corridors and twisting passageways where you can run but you can't hide....

Zork III

Sequels always make me suspicious. These days anyone with an even marginally successful movie or novel follows up with numerous encores. Often the sequel is nothing more than a shallow rehash of the original work, but exceptions do exist: *The Godfather II* and *III* were actually better movies than the original; science fiction writer Frank Herbert's *Dune* sequels have all been fine books; and in computer games *Zork III* is just as exciting and puzzling as *Zork I* and *II*.

Zork III—The Dungeon Master is the final chapter in the tale of the Great Underground Empire. The land of Zork is littered with the bodies of



Starcross star map

all those who dared to risk *Zork's* countless dangers and who paid the price with their lives, usually many times over, through reincarnation.

Maybe your corpse has been left at the base of a cliff or deep within the bowels of an endless maze as food for the trolls and dragons of *Zork I* and *II*. Or perhaps you've never ven-

tured into the Great Underground Empire and wonder if you have the nerve to challenge *Zork III* when more experienced players have failed at *Zork I* and *II*. But never fear, you don't need previous knowledge of *Zork's* dangers to do well at *Zork III*. It's no more difficult than the other *Zork* games.

The setting for each game is the same, but the themes are different.

Your goal in *Zork III* is, as the playing manual ominously puts it, "to discover the secret purpose of the Dungeon Master, who will oversee your ultimate triumph—or destruction—in the realm of Zork." If that doesn't curdle your cheese, nothing will.

Zork III seems to have borrowed from the movie *The Empire Strikes Back* for some of its characters. The Dungeon Master sounds like a cross between Obe Wan Kenobi and Yoda. There is also a fight scene with a hooded figure who looks very familiar. But then, where are Han Solo, Chewbacca, and Princess Leia?

All the familiar *Zork* elements are present: endless passageways leading to conflict, treasure, and adventure; baffling secrets, puzzles, and paradoxes; and the ever-present threat of death with the concomitant promise of reincarnation, which will cost you ten points, of course.

Playing the Game

Starting *Zork III* is as easy as inserting the disk and pressing ENTER. Instantly you find yourself in a strange place filled with mysterious shapes and shadowy danger—no, it's not the men's room at the bus depot. *Zork III* starts you off at the bottom of an endless staircase; from there it's business as usual as you crawl, climb, fight, and blunder with abandon. (Hmm...maybe it is the men's room at the bus depot.)

You can move in any of the eight compass directions plus up, down, in, and out, unless you are prevented from doing so by a wall, an ogre, or other obstacles. You must fight your way through the Great Underground Empire using tools and weapons found along the way to conquer obstacles, fearsome enemies, and endless confusion. Eventually, you will piece together the puzzle that is *Zork III*—if you succeed in your quest.

Evaluation

Zork III, like its brothers, is entertaining, but it can also be frustrating. Many of the puzzles you must figure out are not solvable except through trial and error or blind luck. In addition, *Zork III* often tells you it doesn't know or can't understand something, or it says you are standing next to an object that it then claims isn't there. At these times you realize that *Zork III* has its limitations.

Card or board games have their own limitations—they can't talk to you or compete against you. Although you can interact with a prose game like *Zork III*, its conversational

Instantly you find yourself in a strange place filled with mysterious shapes and shadowy danger.

skill is limited to that of a well-trained parrot. Someday we may see a prose adventure game from Infocom that can converse intelligently, but *Zork III* isn't it.

Like all Infocom games, *Zork III* has been thoroughly tested; it's a polished, smooth-running program that has some sort of reply for anything you say. In fact, part of the game's attraction is its humorous responses to your often-desperate instructions. After giving the command Get sword you're told, "Who do you think you are, Arthur?" Eat sword draws the response, "I don't think that the sword would agree with you."

Besides supplying a light touch, *Zork III*'s responses often give valuable hints about the answer to a particular enigma. A wild guess may turn out to be the correct answer, or it may kill you. Either way, it's great entertainment.

Documentation and Warranty

Don't ever try to play an Infocom game without reading the manual. If you do you will get snagged by some minor problem you could have easily avoided by reading the instructions. You'll probably get snagged anyway by something else, so why double your trouble?

Luckily, Infocom's documentation is complete, easy to understand, and includes handy tips for playing the game without giving away too many secrets. The disk—not the program—has a warranty for 90 days.

The Final Reward

Although all the *Zork* games take place in the land of Zork, each has a special personality. *Zork III* feels like the end of the series. It has a mystical, walking-through-limbo-on-the-road-to-eternity feeling, as if the prize were not 20 treasures but nirvana. Nothing is what it seems.

Zork III is a fine sequel, but you may not want to buy it if you already own *Zork I* or *II*. Many other prose games are available, and you might prefer something different. If you don't have a *Zork* game already, any one of the three would be a good introduction to the series.

Starcross

Another name for *Starcross* might be *Zork Goes to the Stars*. In *Zork III* you run amok in an ancient empire deep underground, but in *Starcross* you run amok in an alien spacecraft in outer space. Like Infocom's other games, *Starcross* dares you to match wits with the computer on a voyage into the unknown, where befuddlement and death lurk every step of the way.

All the ingredients of a good Robert A. Heinlein sci-fi novel are here: the wildcat prospector (that's you), the sassy ship computer, and a lucky find that could be too hot to handle.

Review

Playing the Game

The year is 2186 and you are somewhere in the asteroid belt between Mars and Jupiter searching for a black hole, any black hole. You want to haul it back to civilization where it can supply humankind with an inexhaustible source of energy, and you with a rich retirement. Don't ask me how anything with the massive gravitational field of a black hole could float about in our solar system without disrupting the orbits of all the planets, or how any spaceship could tow it around like a broken-down Chevy.

What's important is that instead of finding a black hole, you stumble onto a gigantic spaceship from another galaxy. How do you know it's from another galaxy? Because it doesn't say made in Japan, that's how.

Once you land on the alien spaceship, you have to find a way inside and then begin to explore in earnest.

Starcross has all the ingredients of a good Robert A. Heinlein sci-fi novel.

You can move in several directions: port or starboard, fore or aft, up or down, in or out. You move freely about the vessel until you encounter an obstacle.

When this happens the first thing to ask yourself is, "Should I attack this thing?" If you don't immediately feel danger, try to take it along. If that is impossible, figure out what it is and does, and then try to find a way to use it or get it to do something. Or leave it alone; I don't care.

Unlike Infocom's other games, *Starcross* lacks a clearly defined object; if the game has one, the docu-



Snipes screen graphics

mentation doesn't explain it. All you know is that your mission is to explore the alien ship. If a larger purpose exists, it may become clear only after you have spent a few hours stumbling and bumbling about the ship.

Although your ultimate goal is a mystery, your immediate concerns are thwarting dangers and solving puzzles, which get you points up to a maximum of 400. One such puzzle presents itself when you find yourself in a large forest (that's right, in the middle of the spaceship) at the base of a huge tree. You climb the tree and discover a hatch to a dome that lies just beyond your reach. You want to climb inside that dome, but how will you do it? Solving each puzzle is an essential part of solving the larger mystery of the alien ship.

Evaluation

The single most important thing to know about playing *Starcross* is how to save a game position. Saving a game means you can pull out the disk, switch off your PC, and go to bed. This becomes important when you realize that *Starcross* can take several days or even weeks to play.

Not only that, *Starcross* is impossible to play without making at least one fatal error. Dying is inconvenient—you lose points, your belongings are scattered, often irretrievably, and you have to retrace every step from the bunk in your cabin on the *Starcross*. If you die more than three times, you stay dead. Sorry, but that's life.

Fortunately, you can learn to anticipate the times during a game when you are about to enter a dangerous situation and then save the game up to that point. Even if you croak you can smugly restore your prefatal position and continue the game, wiser and no worse for wear. (Sorry, but that's not life.)

The opening part of the game that leads to your landing on the alien spaceship plays the way a science fiction adventure novel reads. The action is fast and exciting and hints at strange and terrifying nightmares to come. Once you are aboard the alien vessel, things slow down as you are called upon to solve various problems while you explore every corner of the huge ship.

Infocom has chosen to design *Starcross* and *Zork III* in such a way that no one path works through all the obstacles. Infocom could have made the games more linear, as in the

opening sequence of *Starcross* when you must solve all the problems in one area before you can graduate to the next. In the games as designed, if you are stuck on one problem you can go somewhere else to tackle another one.

In *Starcross*, as you explore the alien ship you discover an overwhelming number of traps, puzzles, and paradoxes. My advice is to play the game using an organized approach, exploring one area at a time. Using the SCRIPT command to make a printout of the game as you play will prevent you from walking in circles.

Starcross is a tough, time-consuming game, so be sure you like a brow-beating challenge before you buy it. It is a great game in which to lose yourself for a few hours. The problems may be tough, but deducing—or lucking onto—the answers offers a sense of accomplishment.

Documentation

Starcross is imaginatively packaged in a thin, white plastic shell molded into the shape of a flying saucer. At first glance it looks like a large frisbee, but one toss across the room reveals that it doesn't fly like one. Flip it over, and inside the saucer you find the disk, instruction manual, star map, and other documentation.

Although it bears more than a passing resemblance to *Zork III*, *Starcross* has much to offer of its own, particularly if you are an avid science fiction fan. It is a well-made, engrossing game that might give you a new perspective the next time you gaze at the evening sky.

Snipes

For those who like the fast, cheap thrills that only a good zap 'n dodge game can deliver, *Snipes* is highly recommended. *Snipes* combines a *Pac-Man*-like maze with the hunt and search intensity of *Zork III* and the shooting action of *Berserk*.

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● Review

Playing the Game

Snipes are bloodthirsty little spheroids whose *raison d'être* is to hunt you down and either shoot you or blow you to pieces. They can't move very fast, but they are numerous, persistent, and effective.

The chase takes place in an exitless maze about one-fifth of which you can see on your screen at any one time. Your player is a pair of eyes equipped with flashing eyebrows over what appears to be either a bushy mustache or a mouth gaping in astonishment at all the snipes. Unlike *PacMan*, in which the maze is fixed and the player moves through it, in *Snipes* the player is fixed in the center of the screen and the maze moves.

The snipes merge one at a time into the maze through portals scattered throughout. They can reappear through the portals almost as fast as you can blast them, so the only way you can win is to find and destroy all the portals and then destroy all the snipes.

Meanwhile, the snipes are hunting you. They get your coordinates from the maze itself and shoot spears at you whenever you get within range, even if walls, other snipes, or portals are in the way. Their mindless attacks can work to your advantage: if you maneuver to a position close to a group of snipes but stay safe behind a wall, they will zap each other while shooting at you. Be alert when snipes shoot at you diagonally; their spears travel fastest that way.

Your weapons are speed, maneuverability, and your gun, which can fire a continuous salvo. Pressing the Space bar makes your player move at double speed—fast enough to outrun the snipes' spears. By comparison, the snipes are slow moving, but they make up in numbers and suicidal determination what they lack in quickness.

You move your player by using the numeric keypad: four keys move you right, left, up, or down. Your player can also move diagonally if you press any two adjacent keys. For example, pressing 8 and 4 moves you up and to the left. You can shoot in four directions as well as diagonally by using any of five selected letter keys.

Twenty-six play levels are available, from A to Z, each with increasingly hazardous features. For instance, level A provides an easy game with snipes that shoot infrequently, no exploding snipes (a nas-

Snipes combines a *Pac-Man*-like maze with the hunt and search intensity of *Zork III* and the shooting action of *Berserk*.

tier version of the shooting snipes), no bouncing bullets, and walls that aren't electrified. And of course, as you progress toward level Z everything gets tougher.

The bouncing bullets are an outstanding feature. On the more advanced play levels, all bullets fired diagonally can ricochet up to eight times. This feature provides an enjoyable, imaginative way to destroy snipes that are lurking around corners or in passageways you need to go through without exposing yourself to danger. But be careful; the bullets can ricochet back and take you out too.

In addition to 26 play levels, you can choose from 9 skill levels to determine the maximum number of access portals and snipes you must face and the number of players with which to face them. At level 1 you face ten snipes and three portals with

five players. At level 9 you face 150 snipes and ten portals with only two players. Staying alive for more than one minute, let alone winning, is almost impossible at level 9.

Evaluation

Snipes can be played on either a color or a monochrome monitor, but it is more attractive and easier on the eyes in color. The maze is blue, the snipes are green and brown, and the portals shimmer in alternating shades of red, gold, purple, yellow, and white. They are so pretty that you almost hate to destroy them.

The sound effects are nearly as entertaining as the graphics. Separate beeps, toots, and chirps indicate the sounds of bullets and spears being fired and snipes and portals being destroyed. Function key <F2> toggles the sound of your blaster only, while <F1> toggles all sounds.

A scoreboard at the top of the screen keeps a running total of the number of portals, shooting snipes, and exploding snipes you have blasted as well as the total of each remaining. It also indicates the level at which you are playing, the elapsed time, the number of players you have left, and the score. Five hundred points are awarded for each portal you destroy and ten points for each snipe, although that isn't mentioned in the manual.

SuperSet Software has done an excellent job of testing and refining *Snipes*. The action is very fast and the screen instantaneously reflects keyboard input. The arrangement of the controls is logical and easy to use; in fact, this is one game that you could not play with a joystick because you need almost all your fingers to punch commands.

SuperSet designed *Snipes* so that it randomly creates a new maze and places the portals for each new game.

This thoughtful touch ensures that you won't face the boredom of picking your way through the same maze game after game.

Throughout many hours of serious testing *Snipes* never missed a command or cost me any points from programming errors, except in one case: the score does not always increment 500 points each time you shoot a portal. Big deal—you play *Snipes* more to win than to accumulate points.

Documentation and Warranty

The care that went into *Snipes* is apparent from the moment you pick up the attractive, durable, burgundy vinyl folder that holds the disk and playing manual. Inside, the 12-page manual offers strong evidence that at least some software manufacturers are hiring writers who can write simple declarative sentences. The instructions are not only easy to follow but were written with a sense of humor and are actually fun to read.

The warranty is virtually identical to Infocom's warranties for the *Zork* games and *Starcross*. The disk but not the program is guaranteed defect free for 90 days.

Snipes has everything you could want in a zap 'n dodge video game: it is original, well designed, and—best of all—the most enjoyable new game I've played on the IBM PC. ☺

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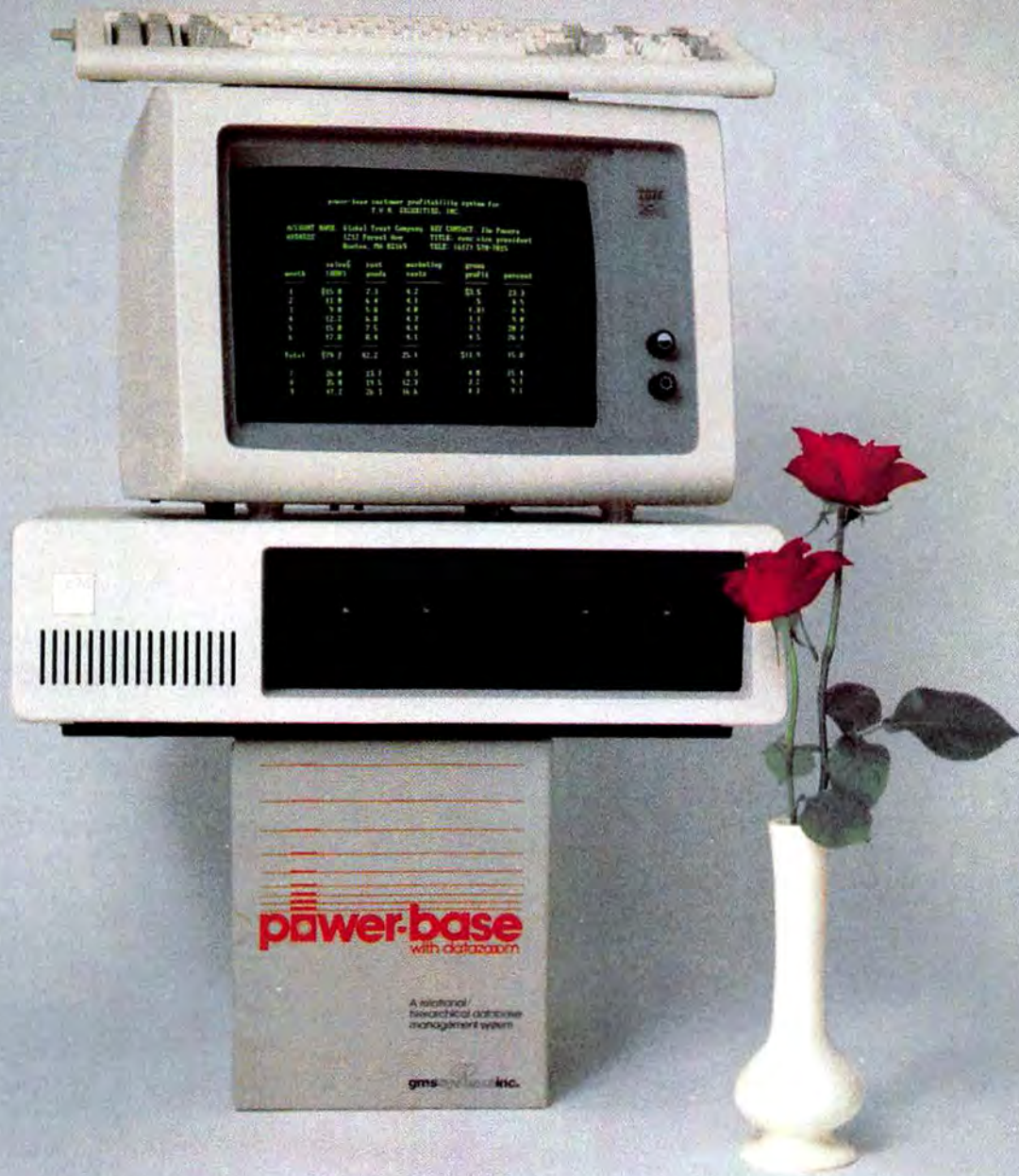
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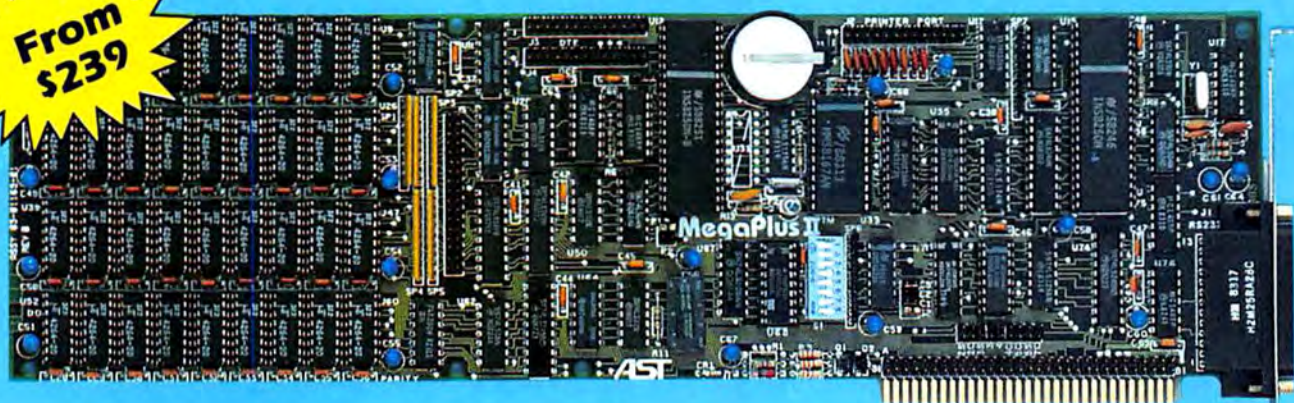
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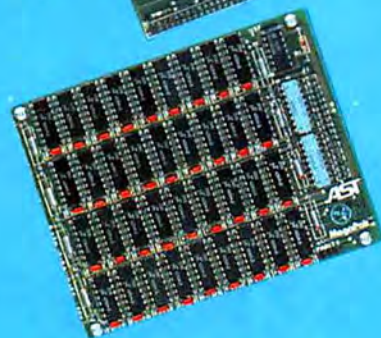
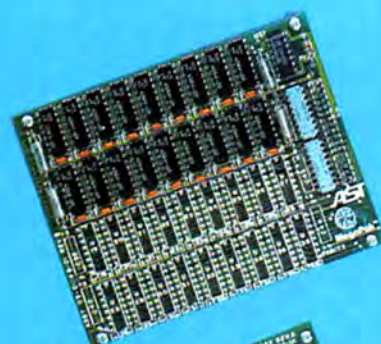
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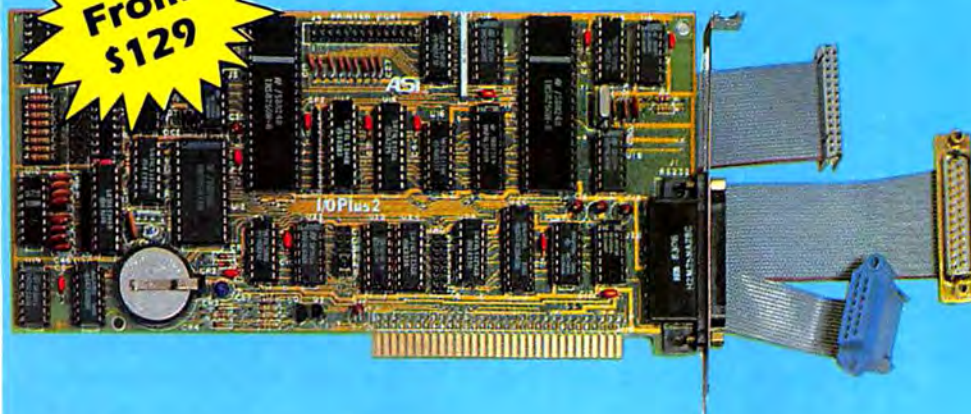
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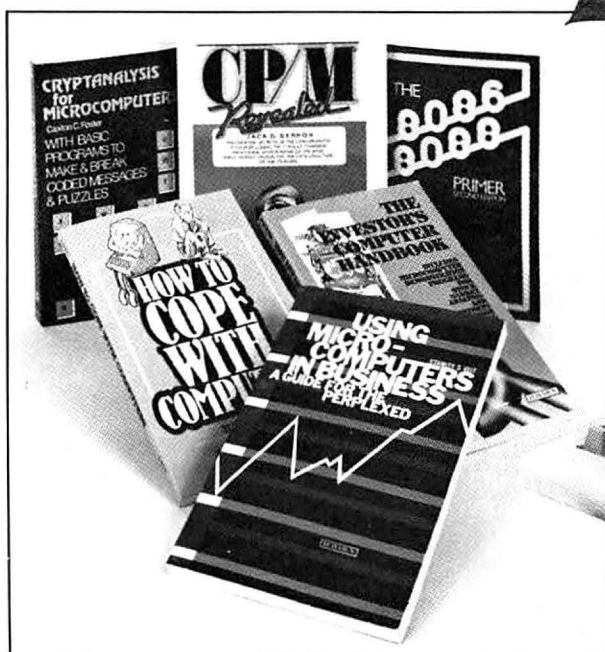
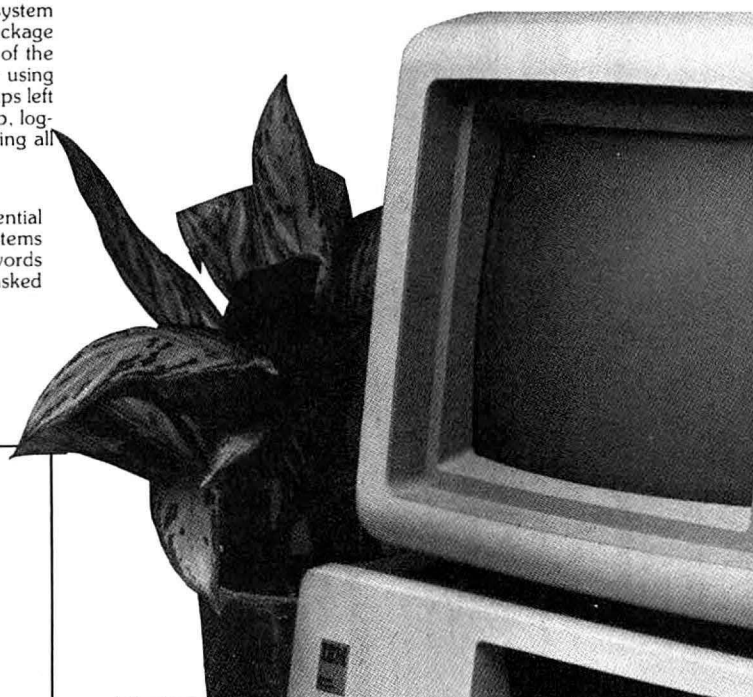
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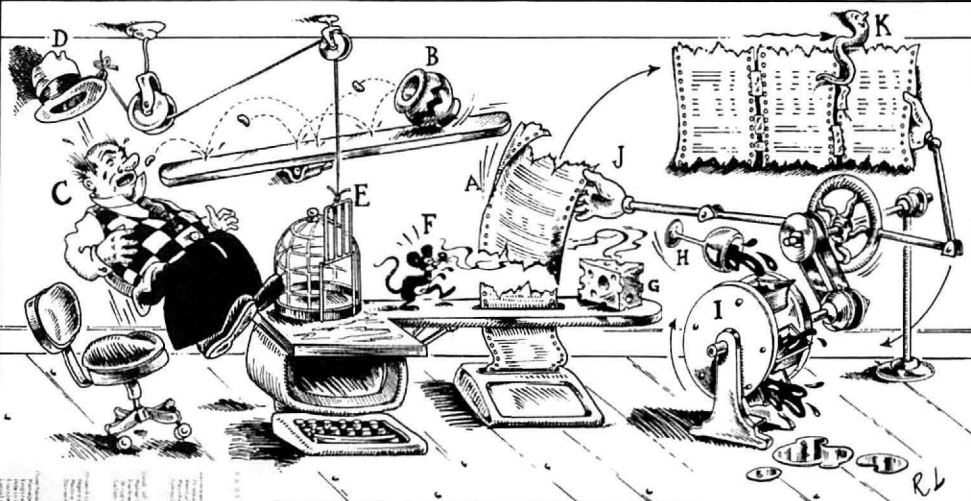
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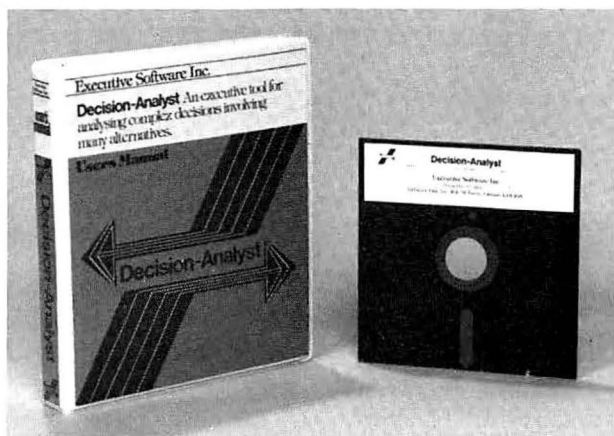
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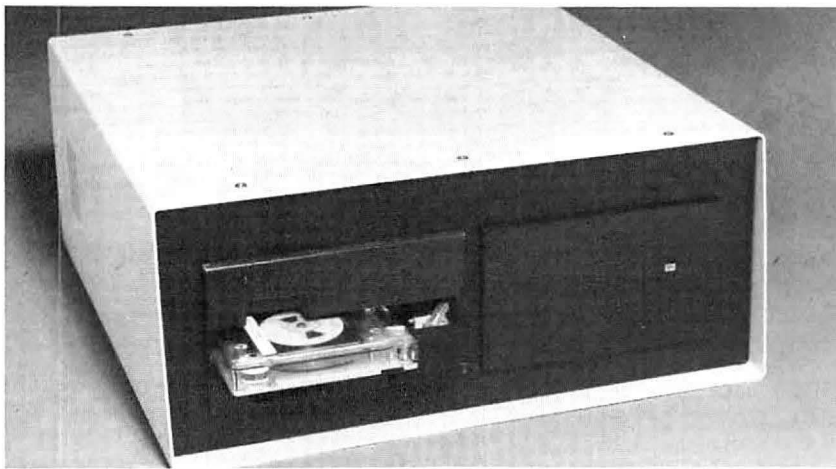
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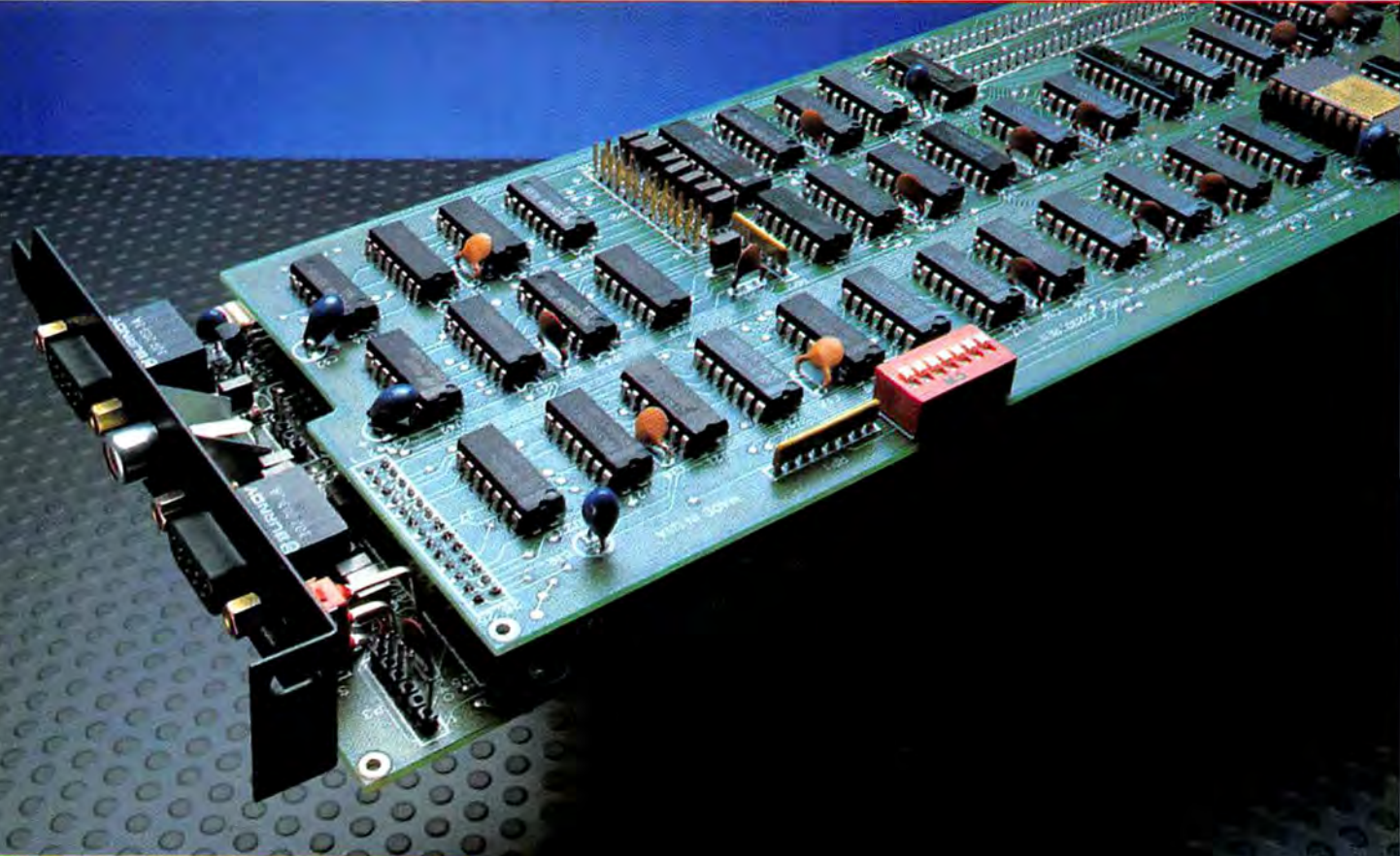


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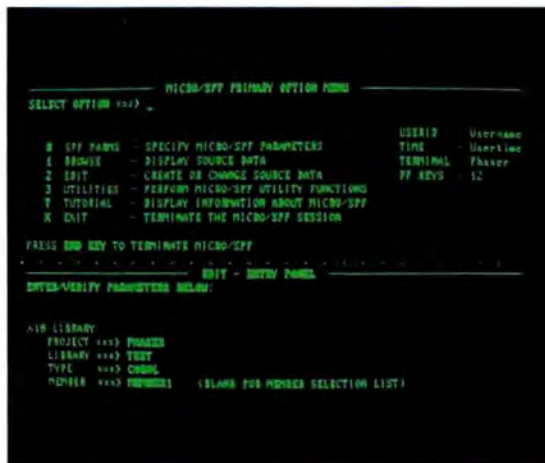
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Reader Service #244

We Interrupt This Program

Stuart Greenberg

If your application demands speed but you're not ready to code a full program in assembly language, merging assembly language routines into BASIC programs may be the answer. You can use the subroutines in this article with your BASIC programs to move blocks of data quickly and to create and store screens.

It was not so long ago that microcomputers were built from kits rather than bought as prepackaged systems. You had to be willing to get a little closer to the machine in those days. Today many people who use personal computers don't have that sort of intimate understanding of their machines. Perhaps you can imagine a little man inside the machine carrying a bucket of bits and waving a bit-bat to move data around with speed and precision. By listening closely you might also hear him say, "We interrupt this program for an important subroutine." You'd have to listen very fast, of course,

If the direction chosen is forward, the addresses are incremented by one each time a byte is moved.

since subroutines are invoked and exited many times in a fraction of a second. Even when your machine is seemingly dormant but awaiting input, an array of subroutines is being executed just to let the operating system know that there is nothing to do.

Now that you have an idea of the frequency with which subroutines occur in systems software, consider the important part that subroutines play in your own programs. In a well-structured program, subroutines

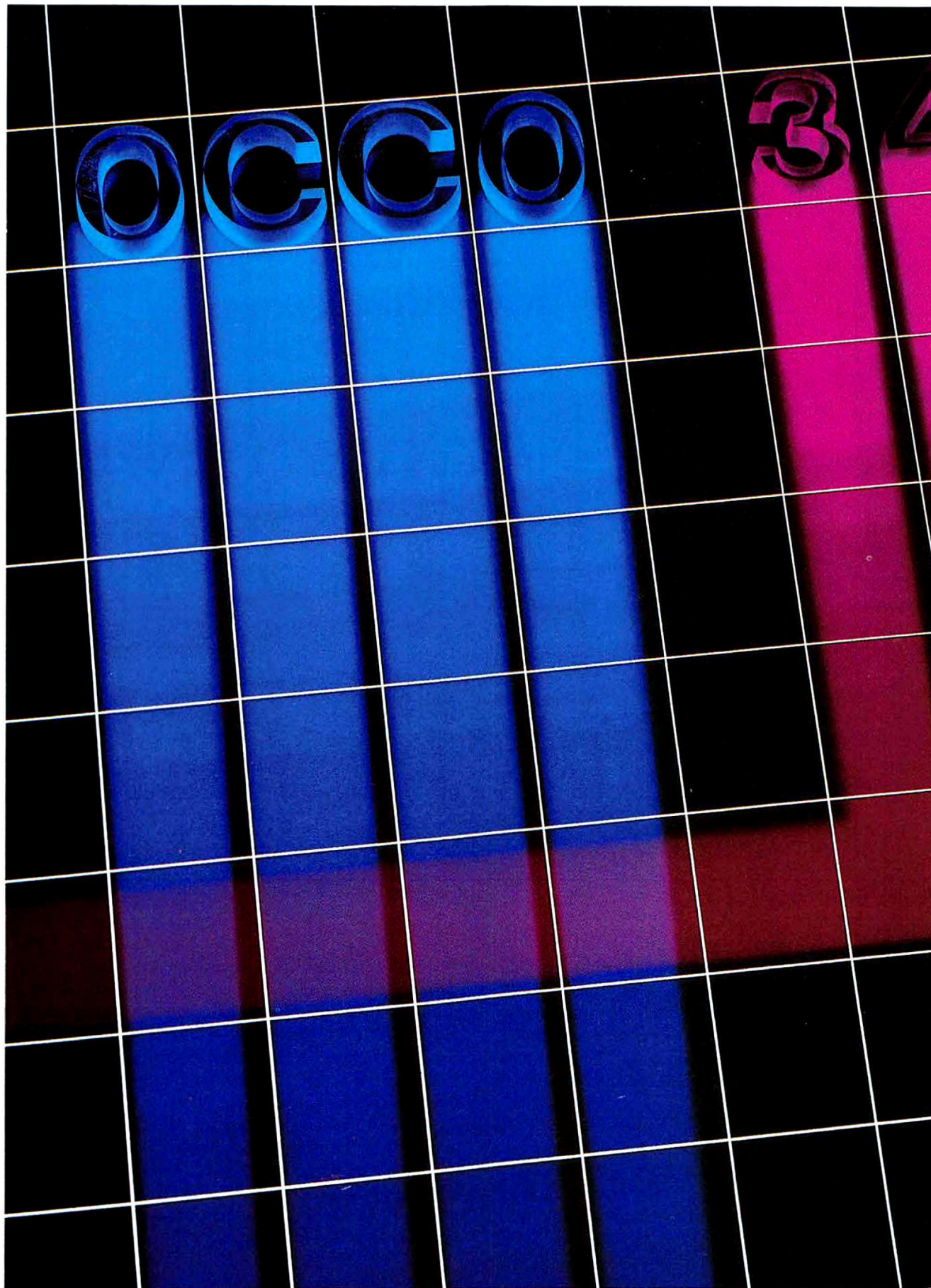
create the foundation upon which the main processing part of the program stands. If these subroutines are written to be sufficiently general, they can be used for many purposes by different programs. This technique can save a substantial amount of time, since you are documenting a general subroutine once instead of writing and maintaining documentation for several specific routines.

In my day-to-day programming I draw from a library of several general subroutines when I "build" a program. Most are in BASIC, but some are in assembly language. I add a routine to this library whenever I feel that it would be of general use. One of these subroutines is written in assembly language and is called BMOVE.

Moving Blocks

BMOVE is short for block move and, as the name suggests, it will move a block of data from one location in memory to another. The block move instruction was introduced to the microcomputer world by the Z-80 microprocessor chip. This chip included two instructions, LDIR and LDDR, that would move data from an area pointed to by one register to an area pointed to by another register and automatically loop until a third register counted down to zero. The increase in speed achieved by using these instructions was dramatic, and it was immediately exploited. For example, many TRS-80 games and other programs use block move routines to move data quickly from memory to screen and vice versa.

Naturally, when 16-bit microprocessors were designed, the block move command was designed into them. Pointers to the source and destination areas and a count of bytes are simply loaded into registers (storage locations in the 8088), and the block move instruction (REP MOVSB) takes care of the rest. This coding was designed to be easy to implement, but the subroutine presented here is complicated slightly by passing variables from BASIC.




```

1          NAME BMOVE
2          PAGE 60,132
3          TITLE      .      BMOVE - BASIC BLOCK MOVE ROUTINE
4
5          ; BMOVE - Basic Block Move Routine
6          ;          Written by Stuart Greenberg
7          ;          Copyright May,1983
8          ;          May not be copied for commercial use!
9
10         ; Called by Basic Program As Follows:
11
12         ; CALL BMOVE%(FROMSEG%,FROMOFF%,TOSEG%,TOOFF%,COUNT%,DIRECTION%)
13
14         ; Where:
15
16         ; FROMSEG%=source segment
17         ; FROMOFF%=source offset
18         ; TOSEG%=destination segment
19         ; TOOFF%=destination offset
20         ; COUNT%=number of bytes to move
21         ; DIRECTION%=direction of move (0=forward, all others=backward)
22
23 0000     STACK_AREA      SEGMENT STACK
24 0000     STACK_AREA      ENDS
25
26 0000     CODE_AREA       SEGMENT
27
28         ASSUME CS:CODE_AREA, SS:STACK_AREA
29 0000     BMOVE            PROC          FAR
30
31 = 0006   NUM_ARG          EQU          6
32         ;
33         ;          Offset of Pointer to:
34 = 0010   FROM_SEG        EQU          (NUM_ARG-1)*2+6 ;          FROMSEG%
35 = 000E   FROM_OFFSET     EQU          (NUM_ARG-2)*2+6 ;          FROMOFF%
36 = 000C   TO_SEG          EQU          (NUM_ARG-3)*2+6 ;          TOSEG%
37 = 000A   TO_OFFSET       EQU          (NUM_ARG-4)*2+6 ;          TOOFF%
38 = 0008   COUNT           EQU          (NUM_ARG-5)*2+6 ;          COUNT%
39 = 0006   DIRECTION       EQU          (NUM_ARG-6)*2+6 ;          DIRECTION%
40
40 0000 55          PUSH     BP          ; Save BP

```

Listing 1

The sample programs presented later in the article show you how to use the BMOVE subroutine to fill an integer array with a value, move part of an integer array up or down, save screen images in memory, and flash stored screen images back to the screen. The application section of the article describes how the subroutine might be used.

How It's Done

Don't let the fact that BMOVE is in assembly language bother you. Knowledge of assembly language is not required for use of BMOVE, but even novices should try to follow the detailed explanation that follows.

BMOVE (see Listing 1) was written using a framework common to all of my assembly language subroutines. This framework is based on one that appeared in issue 1.7 of *Revolution*, the newsletter of the Autumn Revolution Users' Group, and it produces very clear and well-formatted code. Consider the framework line by line as you examine the actual details of the code.

Lines 1 through 3 specify the name of the routine and printing options to the assembler. Unfortunately, space will not permit a thorough tutorial on assembly language. NAME, PAGE, TITLE, and other specific items not described in detail here are described in the *IBM Macro Assembler* manual.


```

41 0001 8B EC      MOV      BP,SP                ; Put SP in BP
42
43 0003 FC          CLD                          ; Set-up for Forward Direction
44 0004 8B 5E 06    MOV      BX,[BP]+DIRECTION    ; Get Pointer to DIRECTION%
45 0007 83 3F 00    CMP      WORD PTR [BX],0      ; Is Direction Forward?
46 000A 74 01      JE       SET_REGS              ; YES-Don't Change Direction Flag
47 000C FD          STD                          ; NO - Set-up for Backward
48                                     ; Direction
49 000D            SET_REGS:
50 000D 8B 5E 0E    MOV      BX,[BP]+FROM_OFFSET  ; Get Pointer to FROMOFF%
51 0010 8B 37      MOV      SI,[BX]              ; Store Value in SI
52 0012 8B 5E 0C    MOV      BX,[BP]+TO_SEG       ; Get Pointer to TOSEG%
53 0015 06         PUSH     ES                   ; Preserve ES Register
54 0016 8E 07      MOV      ES,[BX]              ; Store Value in ES
55 0018 8B 5E 0A    MOV      BX,[BP]+TO_OFFSET    ; Get Pointer to TOOFF%
56 001B 8B 3F      MOV      DI,[BX]              ; Store Value in DI
57 001D 8B 5E 08    MOV      BX,[BP]+COUNT      ; Get Pointer to COUNT%
58 0020 8B 0F      MOV      CX,[BX]              ; Store Value in CX
59 0022 8B 5E 10    MOV      BX,[BP]+FROM_SEG     ; Get Pointer to FROMSEG%
60 0025 1E         PUSH     DS                   ; Preserve DS Register
61 0026 8E 1F      MOV      DS,[BX]              ; Store Value in DS
62
63 0028 F3/ A4      REP      MOVSB                ; Do Move: [DS:SI] -> [ES:DI]
64                                     ; CX <- CX - 1
65                                     ; DS:SI <- DS:SI +/- 1
66                                     ; ES:DI <- ES:DI +/- 1
67                                     ; Repeat Until CX = 0
68
69 002A 1F         POP      DS                   ; Restore Segment
70 002B 07         POP      ES                   ; Registers
71 002C 5D         POP      BP                   ; Restore BP
72
73 002D CA 000C    RET      2*NUM_ARG            ; Return
74
75 0030            BMOVE     ENDP
76
77 0030            CODE_AREA      ENDS
78
79            END      BMOVE

```

The comments on lines 10 through 21 list the BASIC variables and show the call statement necessary to invoke BMOVE from a BASIC program. Notice that the type of BASIC variable is shown by suffixing the variable name with the appropriate character; in this case a percent sign indicates an integer variable. Different types of BASIC variables require different amounts of storage space. The suffix is a reminder to use the proper assembly language instructions when you are accessing each variable, and it also helps you avoid using the wrong variable type in a BASIC program that calls the routine. It may not seem important when you first code the routine, but this documentation proves very handy when you need to write a program to call the routine a month or a year later.

The *Macro Assembler* allows programs to be divided into manageable parts, called segments. Each segment can be up to 64K in length and is pointed to by each of four segment registers. One such segment that BMOVE must define is an area in memory for temporary storage, called the stack segment. Pointers to the BASIC variables and a return vector to BASIC are in known locations (offsets) in the stack segment when BMOVE gets control. BMOVE can also use the PUSH and POP commands (described later) to save and restore the contents of the 8088's registers via the stack.

Since BASIC defines and maintains a stack of sufficient size, all BMOVE has to do is name an area and tell

● Hands On

the assembler that the Stack Segment (SS) register already points to it. The statements in lines 23 and 24 of Listing 1 take care of the former, and the `SS:STACK__AREA` specification in the `ASSUME` statement (line 28) accomplishes the latter. The `ASSUME` statement also tells the assembler that the Code Segment (CS) register will be pointing to the `BMOVE` code segment, which begins at line 26, when the subroutine is invoked from BASIC. The other two segments, data and extra, do not need to be defined since `BMOVE` will not access them directly. The Data Segment (DS) and Extra Segment (ES) registers will be pointing to BASIC's data segment when `BMOVE` is invoked from BASIC. `BMOVE` will find the passed variable values via the DS register and will alter the DS and ES registers later on to point to the source and destination memory blocks.

The `PROC` statement (line 29) indicates the beginning of a block of related code called a procedure (`PROC` for short). The `FAR` operand of the `PROC` statement is required for procedures called from BASIC programs. It tells the assembler that both the segment and offset addresses were used to invoke `BMOVE`. BASIC uses the

The order of the `POP` instructions is opposite that of the `PUSH` instructions.

`DEF SEG =` and `CALL` statements, respectively, to define these values. The `Return (RET)` statement in line 73 uses this information to generate the code needed to return to BASIC. A version of `CALL` and `RET` uses only the offset address (`NEAR`), but BASIC is not able to use that type of addressing for calling subroutines.

Lines 31 through 38 assign values to variable names that will be used within the code that follows that section. There are several reasons for doing this. If a value is used in many places throughout the code but may be changed in the future, assigning it a name enables you to change only the line defining the name and have the assembler automatically assign the new value wherever the name is used. A name might also be assigned if repeatedly using an expression to represent a value would require an excessive amount of typing or if the name would be easier to understand than the expression would be when you are reading the code. The result of each expression in lines 33 through 38 is the offset from a known location in the stack segment, stored in the Stack Pointer (SP) register, where a pointer to the actual passed data is stored. The derivation of this expression is described in Appendix C of the BASIC manual.

At last we come to some executable code! In lines 40 and 41 the original value of the Base Pointer (BP) register is saved on the stack (`PUSHed`) and given the value of the SP register. The SP register points to the position in the stack where our variable pointers were stored by BASIC; now BP points there too.

`BMOVE` can move a block of data either forward or backward through memory. The application section of this article discusses the importance of the direction of a block move. Lines 43 through 47 in Listing 1 set or reset an indicator in the 8088 called the direction flag. If the value for the BASIC variable `DIRECTION%` were zero, the direction flag would be cleared (indicating forward movement); otherwise it is set (indicating backward movement). The program first assumes a forward direction with the `Clear Direction Flag (CLD)` instruction in line 43. Line 44 loads the pointer to `DIRECTION%` into the BX register. The sample program uses the BX register for intermediate storage, but any unused register would have done just as well. Line 45 refers to the actual value of `DIRECTION%` as the two bytes (`WORD`) pointed to (`PTR`) by the Base register (BX). If `DIRECTION%` is equal to zero, the `Jump If Equal (JE)` instruction in line 46 will bypass the `Set Direction Flag (STD)` instruction in line 47; otherwise the `STD` instruction will be executed and a backward move will be indicated to the 8088.

The BASIC variables are loaded into the proper 8088 registers in lines 50 through 61. Line 50 loads the pointer to `FROMOFF%` into the BX register, as was done for `DIRECTION%` in line 44. Remember that the BX register is being used for temporary storage and, since it is no longer needed to point to `DIRECTION%`, it can now be reused. Using the BX register as a pointer to the actual data, line 51 loads the value of `FROMOFF%` into the Source Index (SI) register. The method used in these lines (loading the pointer to the data into BX, then using BX as a pointer to load the data into the desired register) is repeated for each register that needs loading (ES, DI, CX, and DS). The two `PUSH` instructions, one in line 53 and the other in line 60, preserve the ES and DS registers so that the values can be restored to the original values that were passed from BASIC. You may have noticed that with the exception of the DS register the registers were loaded in the same order as the associated variables in the BASIC `CALL` statement. The order is actually arbitrary except for the loading of the DS register. This register is used by the other `MOV` instructions to point to the data segment containing the BASIC variables. Changing the DS register too soon causes the 8088 to lose track of BASIC's data segment and load invalid data.

And now the moment you've been waiting for: the actual block move instruction. When line 63 is executed, `COUNT%` (CX register) number of bytes starting at the address pointed to by `FROMSEG%` and `FROMOFF%`

(DS and SI registers) is moved to an area pointed to by TOSEG% and TOOFF% (ES and DI registers). If the direction chosen is forward, the addresses are incremented by one each time a byte is moved; otherwise the addresses are decremented by one. You can get a feel for the power of the REP MOVSB instruction by looking at all the instructions required to move the few bytes necessary to set up for the block move and knowing that as many as 64K bytes (the capacity of the CX register) can be moved with this one line of code.

Clean It Up

We're in the home stretch now. Before exiting back to BASIC, BMOVE has to comply with what I call Roddenberry's Rule of Order (also known as the Noninterference Directive), which states that a program will not interfere with the normal execution of another program. The BASIC manual dictates that if the contents of any of the segment or SP registers are altered during the execution of the subroutine, the original value or values must be restored before the subroutine is completed. The sample program also restores the BP register. This process isn't specifically required but doesn't hurt. The values in the affected registers were saved by the earlier PUSH instructions (lines 40, 53, and 60), which preserved the original values of the BP, ES, and DS registers. The original values are restored by the POP instructions in lines 69 through 71. Notice that the order of the POP instructions is opposite that of the PUSH instructions. The 8088 uses a last-in, first-out (LIFO) stack—the last register PUSHed must be the first register POPped.

At this point the only item remaining to be restored is the condition of the stack. Remember that the pointers to the variables were passed to BMOVE by PUSHing them onto the stack. BMOVE must remove the pointers to free up the space on the stack; otherwise the stack would grow unnecessarily each time BMOVE is invoked. The 8088 makes the clean-up task easy by allowing a certain number of bytes on the stack to be discarded after accessing the return vector. Since the pointers take up 2 bytes each, the number of bytes to skip is equal to twice the number of arguments passed to the subroutine. The Return (RET) instruction in line 73 notifies the 8088 to discard the proper number of bytes (2*NUM_ARG) and returns control to BASIC.

The remaining lines are housekeeping. Line 75 indicates the end of the procedure, line 77 marks the end of the code segment, and finally, line 79 ends the assembly language code.

BMOVE Applications

As you will see, it isn't necessary to know what each and every byte of BMOVE does in order to make use of it. You may wish to treat BMOVE as a black box and simply learn how to set up the necessary variables and issue the CALL instruction in BASIC.

Listing 2 has two subroutines. The first one (starting at line 50000) uses a technique known as string packing to load BMOVE into memory as a BASIC string (BM.PGM\$). String packing eliminates the need to reserve extra memory outside BASIC, which can be difficult if you have a limited amount of memory available.

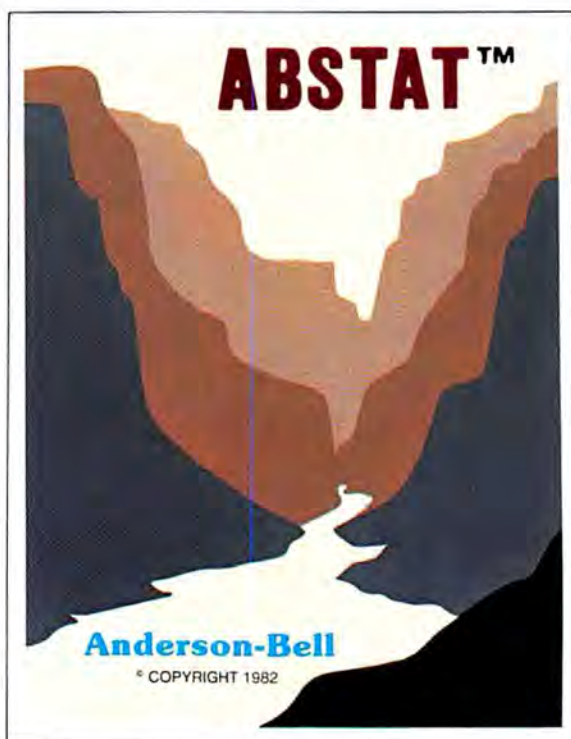
```

50000 ' Subroutine Name = BMOVE      Length = 48
50001 '
50002 ' Data Statements and Load Routine
50003 DATA &H55,&H8B,&HEC,&HFC,&H8B,&H5E,&H06,&H83,&H3F,&H00,&H74,&H01,&HFD
50004 DATA &H8B,&H5E,&H0E,&H8B,&H37,&H8B,&H5E,&H0C,&H06,&H8E,&H07,&H8B,&H5E
50005 DATA &H0A,&H8B,&H3F,&H8B,&H5E,&H08,&H8B,&H0F,&H8B,&H5E,&H10,&H1E,&H8E
50007 DATA &H1F,&HF3,&HA4,&H1F,&H07,&H5D,&HCA,&H0C,&H00
50008 RESTORE 50003
50009 BM.PGM$=STRING$(48,32)
50010 FOR X.X=1 TO 48
50011   READ X.A:MID$(BM.PGM$,X.X,1)=CHR$(X.A)
50012 NEXT X.X
50013 DEF SEG:BM.STRING=VARPTR(BM.PGM$)
50014 BM.ENTRY=PEEK(BM.STRING+1)+PEEK(BM.STRING+2)*256
50015 ' Initialize Parameters. . .
50016 BM.FROMSEG%=0:BM.FROMOFF%=0:BM.TOSEG%=0:BM.TOOFF%=0:BM.COUNT%=0:
   BM.DIRECTION%=0
50017 RETURN
50020 ' GOSUB 50020 to Execute CALL. . .
50021 DEF SEG:CALL BM.ENTRY(BM.FROMSEG%,BM.FROMOFF%,BM.TOSEG%,BM.TOOFF%,
   BM.COUNT%,BM.DIRECTION%)
50022 RETURN

```

Listing 2

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● Hands On

As you can see, several variables are set in this routine. Notice that the variables directly related to BMOVE all use the prefix BM. The prefix is used to avoid conflict with other variables in the main BASIC program, allowing BMOVE to be used in an existing program by simply inserting the code in Listing 2 without the fear of inserting problems along with it.

BASIC's VARPTR function is used to find the location of the string descriptor for BM.PGMS, and PEEKs are used to obtain the offset address of BM.PGMS within BASIC's data segment. This value is assigned to BM.ENTRY% and is the entry address of BMOVE. The second subroutine (starting on line 50020) performs an actual CALL to BMOVE using a standard set of variables as parameters. To use BMOVE you must execute a GOSUB to line 50000 early in your main program, set up the parameter variables, and execute a GOSUB to 50020.

Type in the routines in Listing 2 and save them with the ASCII option (SAVE"BMOVE.SUB",A) so you can merge them back in later.

Listing 3 has three sample routines. They all operate on integer arrays and perform functions that you may have already written into BASIC programs. The first sample program involves initializing a 1001 element array (elements 0 through 1000) to a constant value. Both the traditional BASIC code and the BMOVE equivalent are demonstrated here to show the difference in execution speed. Figure 1 shows how an element may be propagated throughout an entire array by using BMOVE in a forward direction with overlapping data.

The second sample program allows an element to be inserted into an array at a specified point. The elements from this point to the bottom are moved down to make way for the newcomer, and the last element's value is discarded. Among the uses of this technique is the insertion sort in which each value is added to the array by moving down all elements containing a higher value and inserting the new value in its proper place.

The third sample program eliminates an element by moving all the following elements up and overlaying the departing element. After the elements are moved up, the last element will be duplicated into the next-to-last element. If this side-effect is a problem, a new value for the last element will have to be assigned manually. Figures 2 and 3 show how data-block overlap and movement direction are used to shift memory forward or backward as was done in these two sample programs.

One way to combine all these techniques is to use the technique in Demo #1 (see Listing 3) to initialize an array to a special value and add values in ascending order using the technique in Demo #2. If you want to delete a value in the middle, you can use the technique in

We Interrupt This Interrupt

Hartley G. Lesser

The speed and power of assembly language need not be beyond the grasp of BASIC aficionados, as Stuart Greenberg proves in this article. For people whose acquaintance with assembly language is somewhat limited, an explanation of a few primary elements will be helpful.

Any discussion of assembly language programming will make constant reference to a *register*, an internal memory location that stores a given value. Think of a register as unaddressed specialized memory that assists your computer in handling arithmetic efficiently.

Another word common to assembly language programming is *offset*. The PC's 8088 microprocessor can address any of 1,048,576 bytes (1 megabyte). This enormous address range is approximately 16 times greater than the address range available in an 8-bit microprocessor, such as the 8080, which uses two 8-bit bytes to address 65,536 (2^{16}) bytes. How does the 8088 address its much larger range? Its data and address registers, as well as the Instruction Pointer register, are only 16 bits wide, but to address 1,048,576 bytes, 20 bits are needed ($2^{20} = 1,048,576$).

The 8088 uses an offset to achieve the enlarged range. It creates a 20-bit address in the segment register that allows the greater range.

To understand this concept, we have to think in binary terms. When a binary number is displaced, or moved, one position to the left, the binary number has actually been multiplied by a factor of 2 ($0000\ 0001 = 1$, offset 1 changes value to $0000\ 0010 = 2$). Two moves, or offsets, to the left produce a multiplication of 4 ($0000\ 0010$ becomes $0000\ 0100 = 4$), three offsets mean a multiplication of 8 ($0000\ 0100$ becomes $0000\ 1000 = 8$), and four mean a multiplication of 16 ($0001\ 0000$). This 4-bit offset, or binary multiplication, produces a 20-bit address in the segment register.

Let's try to visualize this technique employed by the 8088. First, we have a 16-bit value as the offset address:

```
15 _____ 0
| _____ | OFFSET ADDRESS
```

The segment register's 16-bit value is offset four positions to the left by adding four zeros. This creates a 20-bit value in the segment address:

```
15 _____ 0
| _____ | SEGMENT REGISTER | 0000 | SEGMENT ADDRESS
```

The values in the offset address and the segment address are then added together, producing the 20-bit effective address where the 8088 goes to work:

```
19 _____ 0
| _____ | PHYSICAL ADDRESS
```

As you can see, the actual address for the operation is the value in the offset address plus the value in the segment register times 16, which is obtained by a four-position offset to the left. The "Sample Physical Address Calculation" provides a further illustration, giving some values for these addresses so you can see the final result. A number followed immediately by an *H* indicates that the number is in hexadecimal notation.

Assembly language uses four 16-bit registers (AX, BX, CX, and DX); each may be divided into two 8-bit registers that use either the H(igh) or L(ow) part of the 16-bit register X (AH, AL, BH, BL, CH, CL, DH, and DL). These register relationships are demonstrated better in the following example. An entry of the hex value DEFG into the AX register is the same as inputting DE into the AH and FG into the AL registers. These registers all play vital roles in general programming but serve some specific purposes as well.

AX, for example, is known as the Accumulator. Input/output operations, some string operations, and word-sized (16-bit) multiplication and division are handled here. The Base register (BX) addresses data in memory, while the Count register (CX) counts loop iterations and repetitive string operations. Only data registers can be referenced as either 8- or 16-bit.

The responsibility of the four segment registers is to keep programs and data in separate memory areas. Without the segments, you'd be limited

(continues)

We Interrupt This Interrupt

to 64K of data and 64K of program code. By manipulating these segments through program control, you can access up to 1024K of data. Each segment holds up to 64K and segments can overlap, especially in systems with no more than 64K of memory. When these segment registers are changed, any location can be addressed by the 8088.

The Code Segment register (CS) points to the memory area for the program currently being executed. The Stack Segment register (SS) points to a memory location that is being used temporarily for data and address storage. Your computer can stack different sets of information and still maintain the data's integrity. The Stack Pointer register (SP) points to the top of this stack. The IBM PC uses a last-in, first-out (LIFO) protocol. When a record of what is being worked on must be stored due to an interrupt, the current program address is PUSHed onto the stack. When the interrupt routine is finished, the working storage (your current program) is POPped off the stack. Proper sequencing is maintained by the stack, keeping your old work safe so that new work can be initiated. Program variables are usually held in the Data Segment register (DS), the segment upon which operations are currently being performed. The Extra Segment register (ES) is used in string operations and offers extra addressing capacity.

Pointer and index registers form the final group of the 8088's internal registers. They combine the segment register's base address with an offset in another register. The Base Pointer register (BP) or SP register give the offset, while the 8088 gets the base address from the SS register. If it's a data segment, then the offset is retrieved from the BX register or one of the index registers, Source Index (SI) or Destination Index (DI).

In most systems an instruction is retrieved from a memory location and then operated upon; following this, the instruction in the next memory location is retrieved and operated upon, and so forth. As each instruction has to be fetched before the instructions are obeyed, there is a delay. Not so with the 8088. Instruction fetching and execution are separate functional units. While the execution unit (EU) is executing an instruction, the bus interface unit (BIU) is already retrieving the next instruction. The Instruction Pointer register (IP) is

the next-fetch-address register, because it contains the offset of the next instruction to be acted upon by the EU.

Once you understand segment registers, the pseudo-op (pseudo-operation) ASSUME is fairly simple to understand. A pseudo-op is an instruction to an assembler, not the microprocessor, to perform a specific task. ASSUME tells the assembler exactly what segment a segment register belongs to. NEAR and FAR are pseudo-op distance attributes. A FAR procedure has the ability to be called from any segment. A NEAR procedure can only be called into play from the program within the segment that defined it. And what is a procedure? It is a group of instructions that are executed from various program locations. Each procedure is written only once so that programs can be shorter.

Flags report status conditions after an instruction has been completed. The flag register has nine flags, each of which operates differently. For example, the Carry Flag (CF) acts as a result indicator for multiplication. If the CF equals 1, then a carry has been produced by an add operation (or a borrow has been produced by a subtraction). The Parity Flag (PF) is used mainly in data communications applications, while the Auxiliary Carry Flag (AF) operates on "packed" decimal numbers. A packed decimal byte can hold the numbers 00 to 99. The Zero Flag (ZF) is equal to 1 if a zero results from an operation, and the Sign Flag (SF) is used only when operations are performed on signed numbers, as it mirrors the most significant bit of the operation's result. The Trap Flag (TF) is used for debugging, and the Interrupt Enable Flag (IF) allows external devices to request system recognition. Index registers are increased (in the forward direction) or decreased (in the backward direction) according to the status of the Direction Flag (DF). The Overflow Flag (OF) indicates errors during signed number operations.

This brief explanation will hopefully increase your understanding of the programming possibilities presented in this article. BASIC need not be basic any longer.

Sample Physical Address Calculation

Offset address = 12H	0000 0000 0001 0010 (16-bit)
Segment address = 4000H + 0100 0000 0000 0000 (20-bit)	
Physical address = 4012H	0100 0000 0000 0001 0010 (20-bit)


```

1 ' MOVARRAY.DEM - Demonstration program for the BMOVE Subroutine
2 '
3 '           Written by: Stuart Greenberg
4 '           Copyright May, 1983 - May not be copied for commercial
5 '           use
10 DEF SEG=0:BASIC.SEG%=PEEK(&H510)+PEEK(&H511)*256:BASIC.TOP%=BASIC.
    SEG%+&H1000
20 ' Set-up BMOVE Routine
30 GOSUB 50000
40 CLS:KEY OFF
100 ' The following three routines (1000, 2000, 3000) perform
110 ' demonstrations of the BMOVE subroutine. In each case
120 ' parameter variables are assigned appropriate values
130 ' and a GOSUB to 50020 is executed. The parameter
140 ' variables are:
150 '     FROMSEG% - The segment address of the source block
160 '     FROMOFF% - The offset address of the source block
170 '     TOSEG%   - The segment address of the destination block
180 '     TOOFF%   - The offset address of the destination block
185 '     COUNT%   - The number of bytes to move (1 integer=2 bytes)
190 '     DIRECTION% - 0=Forward, Any other value=Backward
200 '
210 ' =====
220 '
1000 ' DEMO #1 - This demo will load an integer array containing 1001
    elements using the FOR/NEXT method and then the BMOVE
1010 ' subroutine. The FOR/NEXT loop will load the array with
1020 ' zeroes and BMOVE will reassign each element the value
1030 ' 1983. After hitting the space bar the array is
1040 ' displayed to show that all elements really and truly
1050 ' contain 1983.
1060 '
1065 PRINT "D E M O   # 1"
1070 DIM A%(1000)                                'Define array
1075 PRINT TAB(25);"--START-";TAB(40);"---END--"
1080 PRINT "FOR/NEXT loop: ";TAB(25);TIME$;
1090 FOR X%=0 TO 1000                            'FOR/NEXT loop
1100   A%(X%)=0                                  ' assigns 0 to
1110 NEXT                                         ' each element
1120 '
1130 PRINT TAB(40);TIME$;PRINT "BMOVE: ";TAB(25);TIME$;
1140 A%(0)=1983                                  'First element=1983
1150 BM.FROMSEG%=BASIC.SEG%;BM.TOSEG%=BASIC.SEG% 'From & to segments
1155 '                                           are Basic's work area
1160 DEF SEG                                     'Set segment for VARPTR
1170 BM.FROMOFF%=VARPTR(A%(0))                  'Address of 1st element
1180 BM.TOOFF%=BM.FROMOFF%+2                    'Address of 2nd element
1190 BM.COUNT%=2000                             '2000 bytes to move
1200 BM.DIRECTION%=0                           'Forward direction
1210 GOSUB 50020                                'Invoke BMOVE
1220 PRINT TAB(40);TIME$
1230 '
1240 GOSUB 45000
1255 LOCATE 25,1:PRINT SPACE$(79);:LOCATE 4,1
1257 PRINT:PRINT:PRINT "--ARRAY VERIFICATION--"    'Verify entire array
1260 FOR X%=0 TO 5
1270   PRINT USING "Element ####      = ####";X%,A%(X%) 'First 5 visually
1280 NEXT

```

(continues)


```

1290 PRINT STRING$(22,249)
1300 FOR X%=6 TO 995
1310     LOCATE CSRLIN,1
1320     IF A%(X%)<>1983 THEN STOP
1330     PRINT USING "Element 6 - ### = ####";X%,A%(X%);
1340 NEXT
1350 PRINT:PRINT STRING$(22,249)
1360 FOR X%=996 TO 1000
1370     PRINT USING "Element      #### = ####";X%,A%(X%)
1380 NEXT
1390 ' E N D   O F   D E M O   # 1
1400 '
1410 '=====
1420 '
2000 ' DEMO #2 - This demo will move the lower part of an array down to
2010 '     make room for a value to be inserted in the middle. Elements 31
2020 '     thru 99 will move to 32 thru 100 and a new value will be assigned
2030 '     to element 31. This method can be the basis of an insertion
2040 '     sort where each element is checked against a new value and
2050 '     inserted in its proper place.
2060 '
2062 GOSUB 45000
2065 CLS:PRINT "D E M O   # 2"
2067 PRINT "Before:"
2070 DIM B%(100)
2080 FOR X%=0 TO 100
2090     B%(X%)=X%
2095     PRINT B%(X%),
2100 NEXT
2110 '
2120 BM.FROMSEG%=BASIC.SEG%:BM.TOSEG%=BASIC.SEG%
2130 '
2140 DEF SEG
2150 BM.FROMOFF%=VARPTR(B%(99))+1
2160 BM.TOOFF%=BM.FROMOFF%+2
2170 BM.COUNT%=138
2180 BM.DIRECTION%=1
2190 GOSUB 50020
2200 B%(31)=1983
2202 GOSUB 45000
2205 LOCATE 2,1:COLOR 15,0:PRINT "After: "
2210 FOR X%=0 TO 100
2220     PRINT B%(X%),
2230 NEXT
2240 ' E N D   O F   D E M O   # 2
2250 '
2260 '=====
2270 '
3000 ' DEMO #3 - This demo will move the lower part of an array up to
3010 '     delete an element from the middle. Elements 32 thru 100 will
3020 '     move up to 31 thru 99 thus deleting element 31.
3060 '
3070 GOSUB 45000
3080 LOCATE 1,1:COLOR 7,0:PRINT "D E M O   # 3"
3090 PRINT "Before:"

```

Listing 3 (continued)


```

3100 FOR X%=0 TO 100                                'Reprint array showing
3110   PRINT B%(X%),                                '  starting values
3115 NEXT
3120 BM.FROMSEG%=BASIC.SEG%:BM.TOSEG%=BASIC.SEG%    'From & to segments
3130 '                                                are Basic's work area
3140 DEF SEG                                          'Set segment for VARPTR
3150 BM.FROMOFF%=VARPTR(B%(32))                     'Address of element 32
3160 BM.TOOFF%=BM.FROMOFF%-2                         'Address of element 31
3170 BM.COUNT%=138                                   'Byte count=2*elements
3180 BM.DIRECTION%=0                                'Forward direction
3190 GOSUB 50020                                     'Invoke BMOVE
3192 GOSUB 45000
3195 LOCATE 2,1:COLOR 15,0:PRINT "After:  "
3210 FOR X%=0 TO 100                                'Reprint array showing
3220   PRINT B%(X%),                                '  new values
3230 NEXT
3240 COLOR 7,0
3250 '
3260 ' E N D   O F   D E M O   # 3
3270 '
3280 '=====
4000 GOSUB 45000                                     'Wait to continue
4010 CLS:PRINT "E N D   O F   D E M O S"            'End of Demo routines
4020 END
45000 LOCATE 25,1:COLOR 23,0:PRINT TAB(28);"Hit Space Bar to Continue"
      ;:COLOR 7,0
45001 A$=INKEY$:IF A$<>" " THEN 45001
45002 LOCATE 25,1:PRINT SPACE$(79);:LOCATE 4,1:RETURN
50000 ' Subroutine Name = BMOVE      Length = 48
50001 '
50002 ' Data Statements and Load Routine
50003 DATA &H55,&H8B,&HEC,&HFC,&H8B,&H5E,&H06,&H83,&H3F,&H00,
      &H74,&H01,&HFD
50004 DATA &H8B,&H5E,&H0E,&H8B,&H37,&H8B,&H5E,&H0C,&H06,&H8E,
      &H07,&H8B,&H5E
50005 DATA &H0A,&H8B,&H3F,&H8B,&H5E,&H08,&H8B,&H0F,&H8B,&H5E,
      &H10,&H1E,&H8E
50007 DATA &H1F,&HFD,&H3,&HA4,&H1F,&H07,&H5D,&HCA,&H0C,&H00
50008 RESTORE 50003:DEF SEG
50009 BM.PGM$=STRING$(48,32)
50010 FOR X.X=1 TO 48
50011   READ X.A:MID$(BM.PGM$,X.X,1)=CHR$(X.A)
50012 NEXT X.X
50013 BM.STRING=VARPTR(BM.PGM$)
50014 BM.ENTRY=PEEK(BM.STRING+1)+PEEK(BM.STRING+2)*256
50015 ' Initialize Parameters. . .
50016 BM.FROMSEG%=0:BM.FROMOFF%=0:BM.TOSEG%=0:BM.TOOFF%=0:BM.COUNT%=0:BM.
      DIRECTION%=0
50017 RETURN
50020 ' GOSUB 50020 to Execute CALL. . .
50021 DEF SEG:CALL BM.ENTRY(BM.FROMSEG%,BM.FROMOFF%,BM.TOSEG%,BM.TOOFF%,BM.
      COUNT%,BM.DIRECTION%)
50022 RETURN
64000 SAVE"movarray.dem"

```


● Hands On

Demo #3 and set the last element equal to the special value to indicate that the array is not full. The existence of the special value in the last element assures you that the array has not filled up and that insertion of another value will not cause a loss of data. The array always contains the values in sorted order followed by elements set to the special value.

Before executing the sample routines in the program MOVARRAY.DEM, examine some of the code in Listing 3. Line 10 PEEKs locations 0510H and 0511H to obtain the segment address of the start of BASIC's work space (see the *IBM Personal Computer Technical Reference* manual, page 3-22), assigns the value to the variable BASIC.SEG%, adds 1000H to BASIC.SEG% to determine the top of BASIC's work space, and assigns this value to BASIC.TOP%. BASIC.SEG% is needed when an assembly language subroutine needs to access data within BASIC's work space. In Demo #1, for example, the array A%. BASIC.TOP% contains the next available segment above BASIC's 64K work space and can be used to indicate the start of a safe haven for code or data to be stored outside BASIC's influence. This assumes a full

64K BASIC work space. If you have less than 96K of memory or you have high memory reserved for a RAM disk or spooler, you will have to change this value manually. The steps required to make this manual setting are beyond the scope of this article but are described in the BASIC manual.

In the course of writing these sample routines, the desirability of a subroutine to halt execution and wait for an operator request to continue became obvious. The subroutine was added starting at line 45000. When invoked via a GOSUB 45000, it will display a flashing message, wait for the operator to hit the space bar, and continue processing. This subroutine saved a considerable amount of coding that would have been required had the routine been typed in each time it was needed.

Type in the code for the sample program MOVARRAY.DEM, and if it isn't already present, merge in the BMOVE subroutine you saved earlier. Save the entire program to disk with the command SAVE"MOVARRAY.DEM", and when you type RUN the first demo will start. You will notice that the BMOVE routine runs significantly faster than the FOR...NEXT loop.

By the way, if you don't believe that all the elements have been set to 1983, just press the space bar. The entire

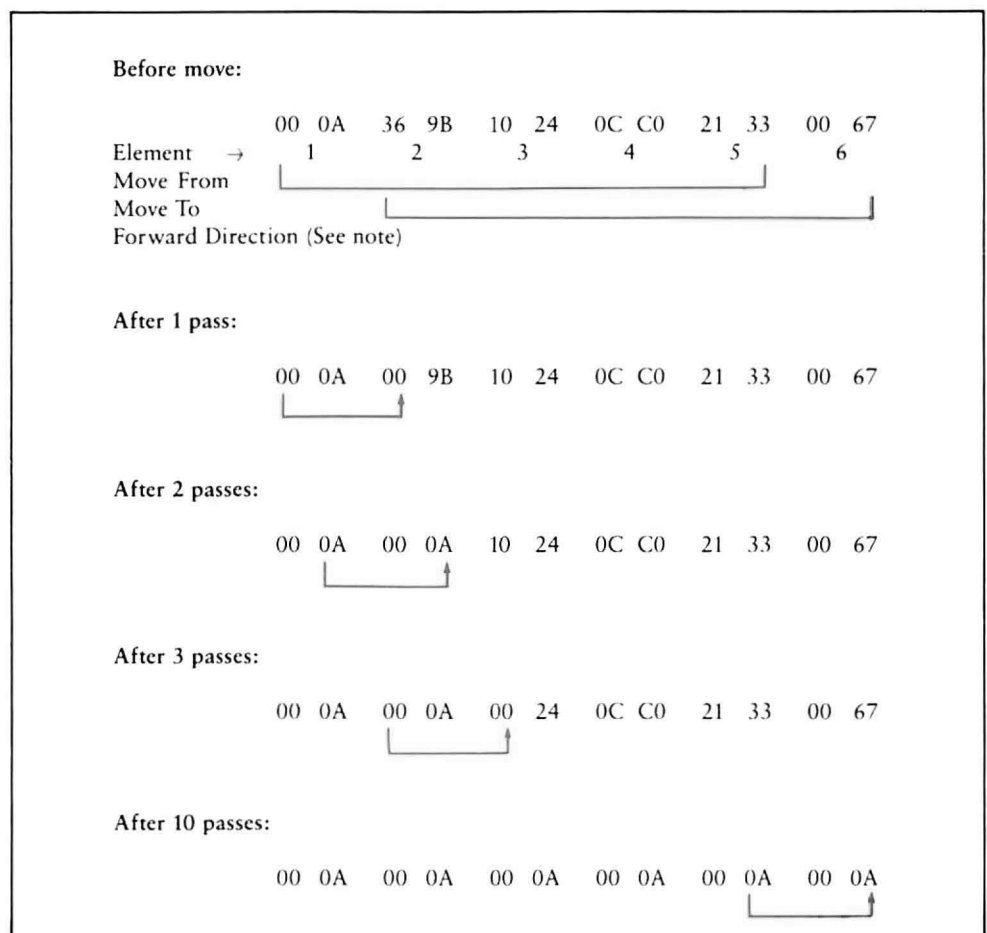


Figure 1: From address < to address, forward direction. Element 1 is copied into 2 through 6.

array will be displayed on the screen and each element will be equal to 1983. Continue through the demonstration routines by pressing the space bar when requested, and note the effect on the array after Demos #2 and #3. They used a small array (101 elements) for easy viewing since the speed of BMOVE was already demonstrated in Demo #1. If you need to be convinced of the true speed advantage of the BMOVE routine, change the DIMensions and BMOVE parameters to use a larger array for each demo. A 5001 element array will take approximately 30 seconds to initialize using FOR...NEXT, but it will be instantaneous using BMOVE. You'll find BMOVE a valuable tool as you experiment with BMOVEing pieces of arrays.

Hold That Screen

Listing 4 is another subroutine called Screen Slinger. It allows you to create screens and store them in memory. When you want to display one of the screens, just give Screen Slinger the G command and the screen is BMOVED from memory to the display in the blink of an eye. Screen Slinger can be used to display menus and the

legends for fill-in-the-blank-type data screens. It can also be used for creating animated effects by saving the individual "snap shot" of screens and "slinging" them rapidly in succession.

When you are using Screen Slinger, the main consideration is the amount of memory available above BASIC (beyond BASIC.TOP%). Each monochrome display screen requires 4K, and each color graphics display screen requires 16K. The number of screens is limited only by the amount of available memory; of course, if you have no memory available, you can't use Screen Slinger at all. Each screen is stored contiguously in memory and is accessed by its assigned screen number. Screen Slinger can also save or load a block of screens to and from the disk so that you need only create the screen once and call it into memory from disk when the target program is run. Alternatively, you could load all the screens needed for an application when you start it. That way they will remain resident even when you chain to another program.

Screen Slinger is split into two sections, each having four functions. The split is necessary because the method used to save text screens is different from that used to save graphics screens. The text screen is simply a con-

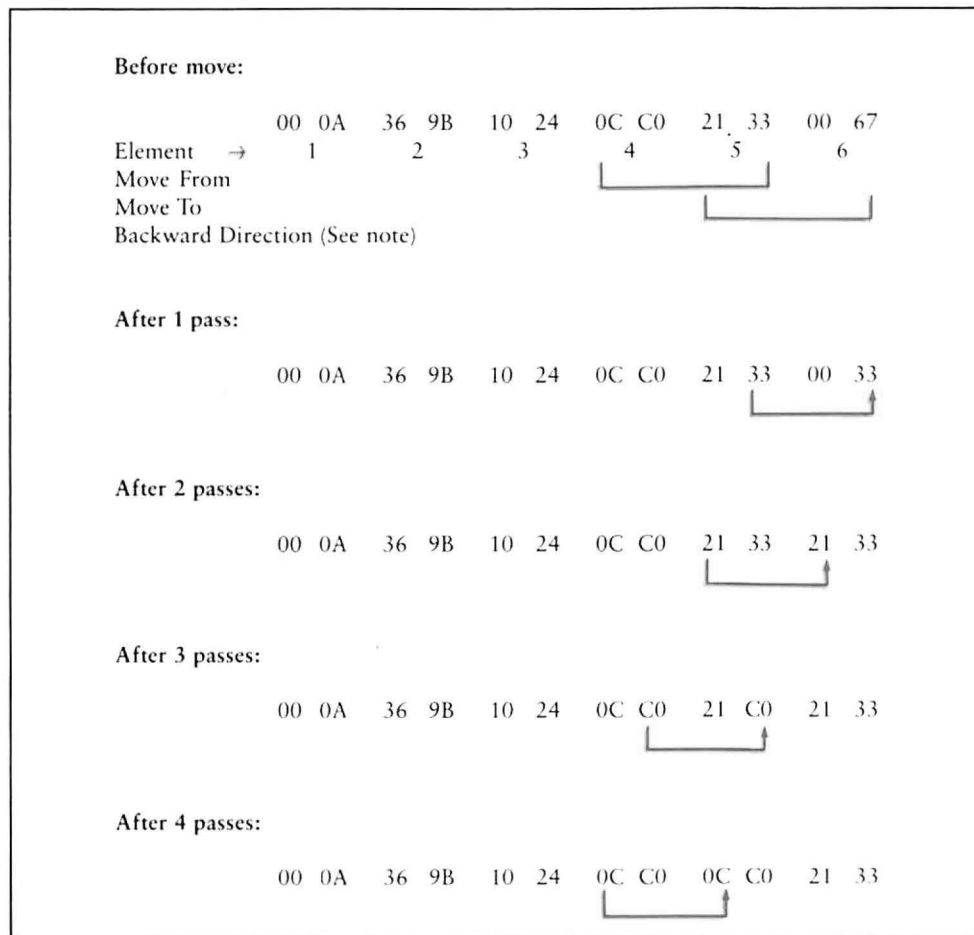


Figure 2: From address < to address, backward direction. Elements 4 and 5 move down to 5 and 6.

Hands On

tiguous block of 4K bytes of memory, while the graphics screen consists of two 8K blocks. The variable `SS.MODE$` contains T for text or G for graphics to allow Screen Slinger to choose the correct routine to perform the required function. The function itself is chosen by setting the variable `SS.CMD$` to one of the following values:

G Gets a block of screens from disk
P Puts a block of screens to disk
S Stores a screen in memory
R Restores a screen to the display

The variable `SS.SRNUM%` must contain the desired screen number for commands S and R. Since

Screen Slinger uses BLOAD to get the screens from disk, it must load all the screens saved in a file at one time, but it can store any or all screens currently stored in memory. In either case, `SS.SRNUM%` indicates the first screen number, and for the P command `SS.COUNT%` must contain the number of screens to put to disk. For commands G and P the variable `SS.NAME$` must contain the name of a disk file. Finally, the variable `SS.BASE%` must be set to the beginning of the memory area used to store the screens.

Type in Listing 4 and save it in ASCII format using the command `SAVE"SCRNSLGR".A`. Now type in Listing 5. If necessary, merge the Screen Slinger subroutine back in with the command `MERGE"SCRNSLGR"` and save the complete program by typing `SAVE"SCRNSLGR.DEM"`. If you are using a color monitor, you will have to make a few changes to the demo program. The starting segment ad-

Before move:

	00	0A	36	9B	10	24	0C	C0	21	33	00	67
Element →	1		2		3		4		5		6	
Move From												
Move To												
Forward Direction (See note)												

After 1 pass:

00	0A	36	9B	10	24	21	C0	21	33	00	67
----	----	----	----	----	----	----	----	----	----	----	----

After 2 passes:

00	0A	36	9B	10	24	21	33	21	33	00	67
----	----	----	----	----	----	----	----	----	----	----	----

After 3 passes:

00	0A	36	9B	10	24	21	33	00	33	00	67
----	----	----	----	----	----	----	----	----	----	----	----

After 4 passes:

00	0A	36	9B	10	24	21	33	00	67	00	67
----	----	----	----	----	----	----	----	----	----	----	----

Note: Direction refers to incrementing (forward) or decrementing (backward) the addresses after each move and is not related to the before and after positions of the bytes being moved.

Figure 3: From address > to address, forward direction. Elements 5 and 6 move up to 4 and 5.


```

1 ' SCRNSLGR.DEM - Demonstration program for the SCRNSLGR subroutine
2 '
3 '           Written by: Stuart Greenberg
4 '           Copyright May, 1983 - May not be copied for
5 '           commercial use!
10 DEF SEG=0:BASIC.SEG%=PEEK(&H510)+PEEK(&H511)*256:BASIC.TOP%=BASIC.
    SEG%+&H1000
20 DEF SEG=&H40:SCREENSEG%=&HB000-((PEEK(&H10) AND &H30)<>&H30)*&H800
30 KEY OFF:CLS
40 GOSUB 50000           'Initialize BMOVE
50 '                   Basic + 16 bytes
60 '                   Mode of screen=text
70 SS.BASE%=BASIC.TOP%+1 'Start of screen storage=Top of
80 '                   Basic + 16 bytes
90 SS.MODE$="G"         'Mode of screen=text
91 '
92 PRINT "Demonstration of Screen Slinger":PRINT
94 INPUT "Enter 1 to create screens or 2 to use saved screens: ",A
96 IF A=2 THEN INPUT "Enter filename: ",SS.NAME$:CLS:GOTO 540 ELSE CLS
98 '
100 A$=CHR$(249)+CHR$(250)+CHR$(250)
110 B$="BMOVE - The Block Move Subroutine by Stuart Greenberg"
    'Message to print
120 '
130 ' Create first screen:
140 '
150 Y=0           'Set border offset
160 GOSUB 1000    'Display border
170 SS.CMD$="S":SS.SRNNUM%=1:GOSUB 49100 'Save screen 1
180 '
190 ' Create second screen:
200 '
210 Y=2           'Set border offset
220 LOCATE 13,15:COLOR 15,0:PRINT B$;:COLOR 7,0 'Display msg highlighted
230 GOSUB 1000    'Display border
240 SS.CMD$="S":SS.SRNNUM%=2:GOSUB 49100 'Save screen 2
250 '
260 ' Create third screen:
270 '
280 Y=1           'Set border offset
290 LOCATE 13,15:PRINT B$; 'Display msg normal
300 GOSUB 1000    'Display border
310 SS.CMD$="S":SS.SRNNUM%=3:GOSUB 49100 'Save screen 3
320 '
330 ' Display each screen in turn - repeate indefinately
340 '
350 X=1
360 SS.CMD$="R"    'RESTORE command
370 SS.SRNNUM%=X:GOSUB 49100 'Each screen (X=1 to 3)
380 X=X+1:IF X>3 THEN X=1 'Increment X
390 FOR Y=1 TO 50:NEXT Y 'Display delay
400 IF INKEY$="" THEN 370 ELSE IF LOOP=1 THEN 630 'Check for keypress
410 '
420 ' When any key is pressed - continue:
430 '
440 COLOR 7,0     'Reset color
450 LOCATE 13,15:PRINT SPACE$(LEN(B$)) 'Blank msg
460 LOCATE 13,15:INPUT "Enter filename for screen save: ",SS.NAME$
470 SS.SRNNUM%=1  'First screen number=1
480 SS.SRNCNT%=3  'Number of screens to save=3

```

(continues)


```

490 SS.CMD$="P"                                'PUT command
500 GOSUB 49100                                'Save screens
510 '
520 ' Now to reload screens:
530 '
540 LOCATE 13,15:PRINT SPACE$(LEN(B$))         'Blank msg
550 LOCATE 13,15:PRINT "Reloading screens from: ";SS.NAME$;
560 SS.SRNUM%=1                                'First screen number
570 SS.CMD$="G"                                'GET command
580 GOSUB 49100                                'Reload screens
590 LOOP=1
600 GOTO 350                                  'Redisplay screens
610 '
620 ' End of demo message
630 CLS:PRINT "End of demonstration":END        'End of Demo routine
640 '
650 ' End of mainline code
1000 '
1010 ' Display boarder subroutine:
1020 '
1030 ' Top:
1040 '
1050 FOR X=1 TO 79
1060   Y=Y+1:IF Y>3 THEN Y=1
1070   IF Y=1 THEN COLOR 15,0 ELSE COLOR 7,0
1080   LOCATE 1,X:PRINT MID$(A$,Y,1);
1090 NEXT X
1100 '
1110 ' Right side:
1120 '
1130 FOR X=2 TO 24
1140   Y=Y+1:IF Y>3 THEN Y=1
1150   IF Y=1 THEN COLOR 15,0 ELSE COLOR 7,0
1160   LOCATE X,79:PRINT MID$(A$,Y,1);
1170 NEXT X
1180 '
1190 ' Bottom:
1200 '
1210 FOR X=79 TO 1 STEP -1
1220   Y=Y+1:IF Y>3 THEN Y=1
1230   IF Y=1 THEN COLOR 15,0 ELSE COLOR 7,0
1240   LOCATE 25,X:PRINT MID$(A$,Y,1);

```

Listing 4 (continued)

```

49101 IF SS.MODE$="G" THEN 49110
49102 'Text Display:
49103 ON INSTR("SRPG",SS.CMD$) GOTO 49104,49105,49106,49107:RETURN
49104 BM.FROMSEG%=SCREENSEG%:BM.FROMOFF%=0:BM.TOSEG%=SS.BASE%:BM.
    TOOFF%=4096*(SS.SRNUM-1):BM.COUNT%=4096:GOSUB 50020:RETURN
49105 BM.FROMSEG%=SS.BASE%:BM.FROMOFF%=4096*(SS.SRNUM-1):BM.
    TOSEG%=SCREENSEG%:BM.TOOFF%=0:BM.COUNT%=4096:GOSUB 50020:RETURN
49106 DEF SEG=SS.BASE:BSAVE SS.NAME$,4096*(SS.SRNUM-1),4096*SS.
    SRNCNT:RETURN
49107 DEF SEG=SS.BASE:BLOAD SS.NAME$,4096*(SS.SRNUM-1):RETURN
49108 '
49109 'Graphics Display:
49110 ON INSTR("SRPG",SS.CMD$) GOTO 49111,49113,49115,49116:RETURN

```

Listing 5


```

1250 NEXT X
1260 '
1270 ' Left side:
1280 '
1290 FOR X=24 TO 2 STEP -1
1300   Y=Y+1:IF Y>3 THEN Y=1
1310   IF Y=1 THEN COLOR 15,0 ELSE COLOR 7,0
1320   LOCATE X,1:PRINT MID$(A$,Y,1);
1330 NEXT X
1340 '
1350 RETURN
50000 ' Subroutine Name = BMOVE      Length = 48
50001 '
50002 ' Data Statements and Load Routine
50003 DATA &H55,&H8B,&HEC,&HFC,&H8B,&H5E,&H06,&H83,&H3F,&H00,
&H74,&H01,&HFD
50004 DATA &H8B,&H5E,&H0E,&H8B,&H37,&H8B,&H5E,&H0C,&H06,&H8E,
&H07,&H8B,&H5E
50005 DATA &H0A,&H8B,&H3F,&H8B,&H5E,&H08,&H8B,&H0F,&H8B,&H5E,
&H10,&H1E,&H8E
50006 DATA &H1F,&HF3,&HA4,&H1F,&H07,&H5D,&HCA,&H0C,&H00
50007 DATA &H1F,&HF3,&HA4,&H1F,&H07,&H5D,&HCA,&H0C,&H00
50008 RESTORE 50003
50009 BM.PGM$=STRING$(48,32)
50010 FOR X.X=1 TO 48
50011   READ X.A:MID$(BM.PGM$,X.X,1)=CHR$(X.A)
50012 NEXT X.X
50013 DEF SEG:BM.STRING=VARPTR(BM.PGM$)
50014 BM.ENTRY=PEEK(BM.STRING+1)+PEEK(BM.STRING+2)*256
50015 ' Initialize Parameters. . .
50016 BM.FROMSEG%=0:BM.FROMOFF%=0:BM.TOSEG%=0:BM.TOOFF%=0:BM.
COUNT%=0:BM.DIRECTION%=0
50017 RETURN
50018 DEF SEG:CALL BM.ENTRY(BM.FROMSEG%,BM.FROMOFF%,BM.TOSEG%,
BM.TOOFF%,BM.COUNT%,BM.DIRECTION%)
50019 RETURN
50020 ' GOSUB 50020 to Execute CALL. . .
50021 DEF SEG:CALL BM.ENTRY(BM.FROMSEG%,BM.FROMOFF%,BM.TOSEG%,
BM.TOOFF%,BM.COUNT%,BM.DIRECTION%)
50022 RETURN
64000 SAVE"scrns1gr.dem"

```

```

49111 BM.FROMSEG%=SCREENSEG%:BM.FROMOFF%=0:BM.
TOSEG%=SS.BASE%+(SS.SRNUM%-1)*1000:BM.
TOOFF%=0:BM.COUNT%=8000:GOSUB 50020
49112 BM.FROMSEG%=SCREENSEG%+&H200:BM.FROMOFF%=0:BM.
TOSEG%=SS.BASE%+(SS.SRNUM%-1)*1000:BM.TOOFF%=8000:BM.
COUNT%=8000:GOSUB 50020:RETURN
49113 BM.FROMSEG%=SS.BASE%+(SS.SRNUM%-1)*1000:BM.FROMOFF%=0:BM.
TOSEG%=SCREENSEG%:BM.TOOFF%=0:BM.COUNT%=8000:GOSUB 50020
49114 BM.FROMSEG%=SS.BASE%+(SS.SRNUM%-1)*1000:BM.FROMOFF%=8000:BM.
TOSEG%=SCREENSEG%+&H200:BM.TOOFF%=0:BM.
COUNT%=8000:GOSUB 50020:RETURN
49115 DEF SEG=SS.BASE:BSAVE SS.NAME$,16000*(SS.SRNUM-1),16000*SS.
SRNCNT:RETURN
49116 DEF SEG=SS.BASE:BLOAD SS.NAME$,16000*(SS.SRNUM-1):RETURN

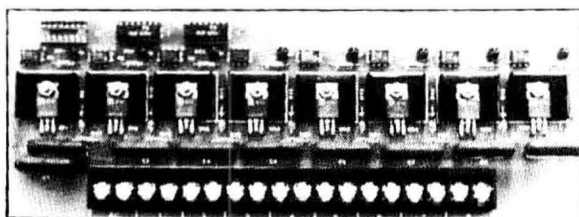
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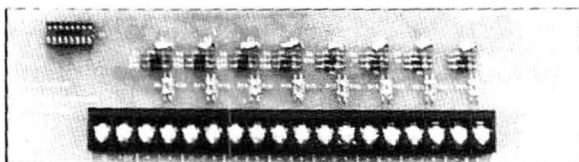
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● Hands On

dress for the screen memory will automatically be set by line 20 unless you have both color and monochrome display interfaces in your machine. If you have both, you can replace the code in line 20 to set the variable SCREENSEG% to either &HB000 for monochrome or &HB800 for color. Although the demo program is set up for text mode, you can save color graphics screens just as easily. Simply change the T in line 90 to a G and replace the screen creation code with appropriate code to create screens in either SCREEN 1 or SCREEN 2 mode. Screen Slinger will automatically manipulate the 16K graphics screen instead of the 4K text screen. Remember that the number of screens you can hold is limited to the amount of free memory above BASIC and that graphics screens take up four times as much space as text screens. You might also like to enter COLOR statements here and there to be fancy.

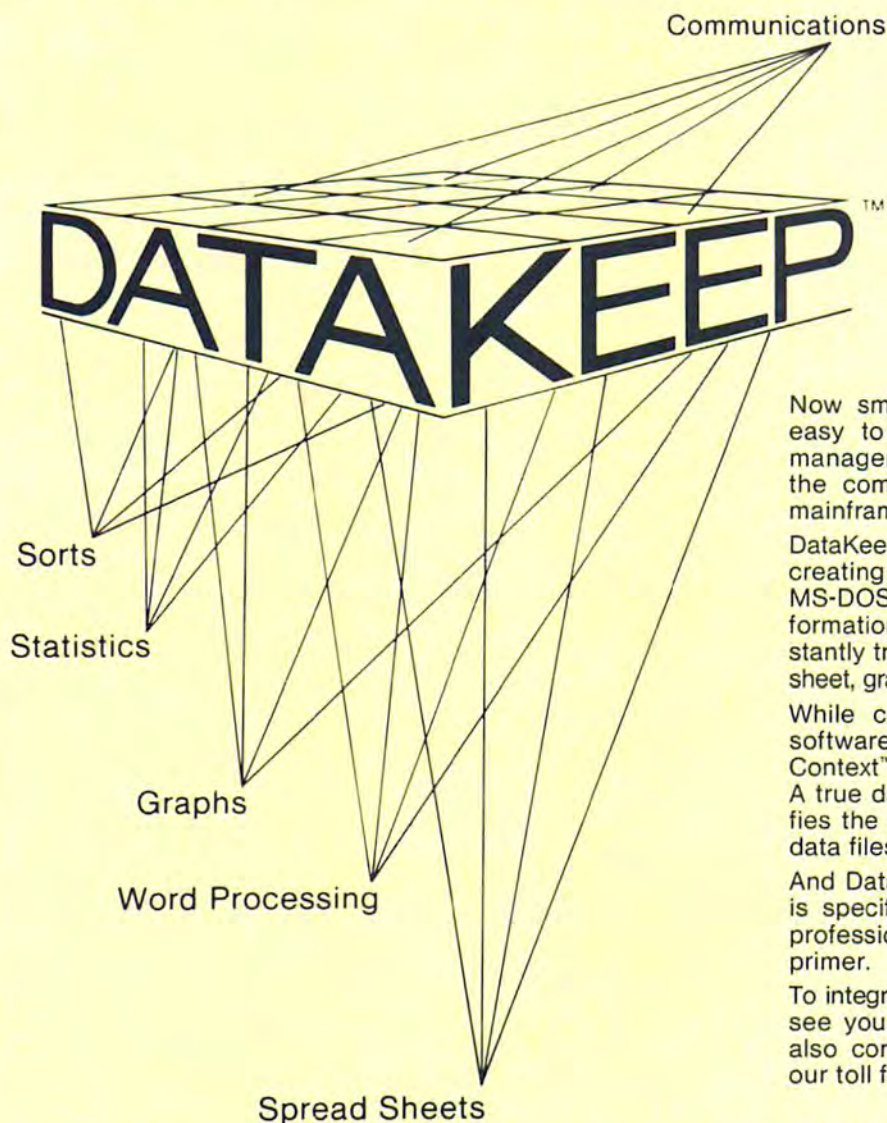
You can now run the Screen Slinger demo to create and flash a few screens around. When the program starts it will ask whether you want to create screens or restore them from a file. The first time you run the demo, choose option 1; three screens will appear. After each screen is created, it is saved in memory starting 16 bytes above the top of BASIC (BASIC.TOP% + 1). I add 16 bytes as a buffer (sometimes I'm overly cautious). Notice that the saves are virtually instantaneous. When all three screens are saved, they will be flashed on the screen in rapid succession, creating an animated effect. To stop the show, press the space bar and enter a file name. The three screens will now be saved to disk, reloaded, and re-displayed. Press the space bar again to exit the program. If you wish, you may rerun the program at any time, select option 2, and enter the file name entered in the previous run. The screens will be reloaded, and the animated display will reappear. After a short examination of the demo program, you will be able to create "slingable" screens for your own applications programs.

We now return control of your programs to you until the next time the little man in the machine says, "We interrupt this program...." ●

Stuart Greenberg is a programmer and coordinator of microcomputer services for a large corporation. He lives in Holtsville, New York, and is vice-president of the PC User Group of the Long Island Computer Association.

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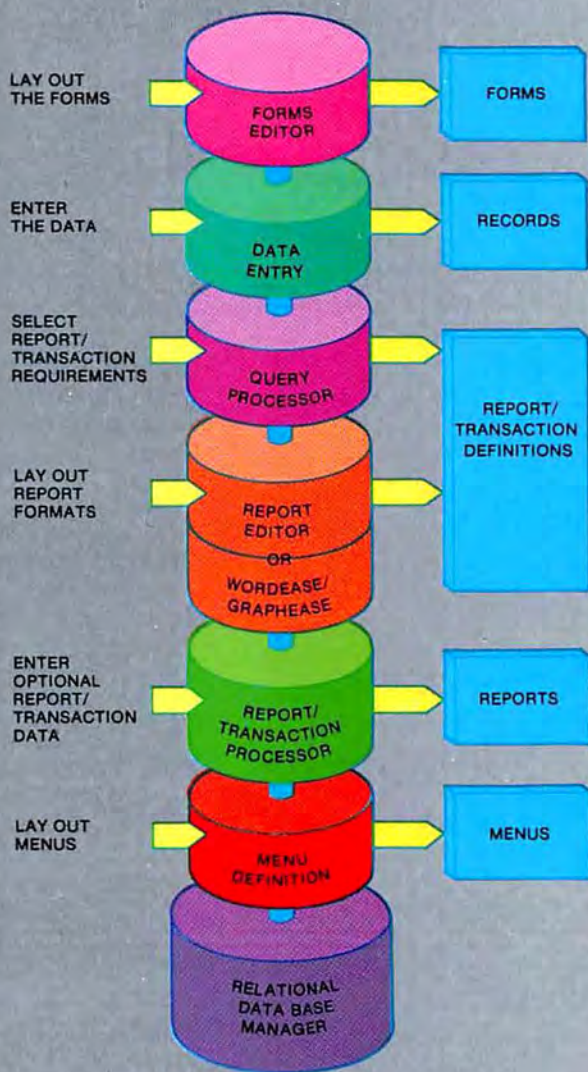
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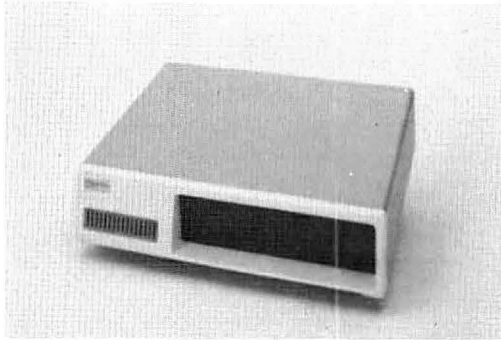
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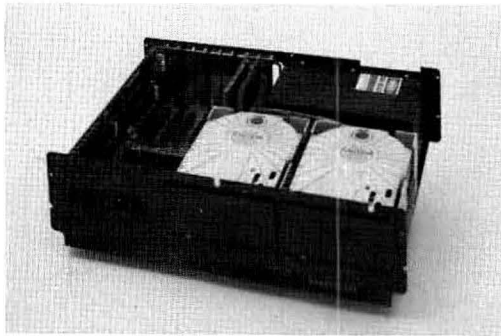
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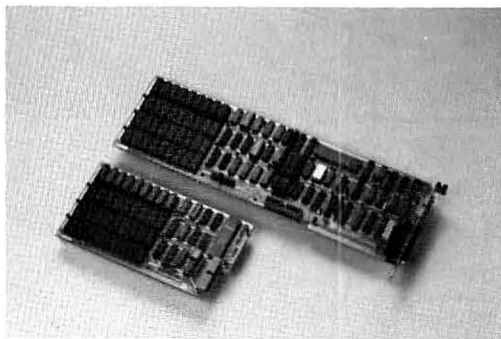
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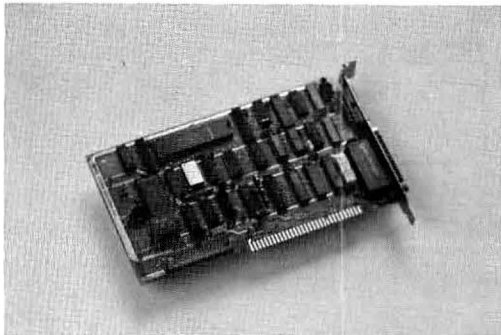
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A Tandy New Peripheral

The new Radio Shack Model 100, a "cable-compatible" add-on to your IBM PC or compatible system

Richard A. Brown

Aren't there times when you would like to be using your IBM PC but have no convenient way to haul your system around? Tandy Corporation's Radio Shack TRS-80 Model 100 may be the answer to your portable computer dreams, making your commute travel time far more productive. Traveling to work via public transportation each day should not prevent you from taking notes, composing letters, and updating or checking your appointment calendar as the miles roll past. Arriving at your destination, you can upload everything you've done on your Model 100 to your IBM Personal Computer or to another computer for further processing. This capability is a two-way street: you can also download from another system to the Model 100. Direct access in either direction is accomplished through a RS-232C serial port.

This communications hookup is quite simple, requiring only a serial board in the PC, a serial cable with the proper DB-25 connectors on each end, PC-DOS, and a null modem. A null modem is an inexpensive serial connector with the wires for pins numbered 2 and 3 cross connected. This strange construction is necessary because the PC and the Model 100 are both designed to use pin 2 to transmit data and pin 3 to receive data. Leaving pins 2 and 3 connected

straight across to each other would leave no way for the computers to talk to one another. By crossing these two wires, the Model 100 sends its information to pin 3 on the PC, which is where the PC is expecting to receive data. Tandy also thoughtfully built a serial port into the Model 100.

To make the hookup, you plug the null modem onto either end of the serial cable and then plug the cable into each computer. The PC requires the female end of the cable; the Model 100, the male. That's all there is to the actual hardware connection.

The Model 100 handles portable word processing quite admirably.

To utilize this setup, bring up the Telcom program on the Model 100, then use the Status function key, <F4>, to initialize the correct communications parameters. To enter the Terminal mode press <F4> again, and you're almost ready to start trading data between the two machines.

The next step is to use the Mode program that comes with PC-DOS to configure the serial port on your PC

to match the parameters set on the Model 100. Put a formatted disk in drive B and give the command to copy the data arriving at the serial port to a disk file. Use a file name such as DATASWAP.TXT, and then issue the command
COPY AUX B:DATASWAP.TXT
This causes the information being received at the serial port to be written to a file on drive B named DATASWAP.TXT

Next, use the Upload function key, <F2>, on the Model 100 and indicate which file you want to send to the PC. This procedure may be slightly different if you have a compatible system, so consult your user manual.

Data to Go

Now that you can upload information from the Model 100 to the PC, how about downloading information from the PC to the Model 100? First, use the Model 100's Download function, <F2>, to prepare the computer to accept the file. The command syntax for the PC to send the requested file out the serial port is
COPY B:DATASWAP.TXT AUX
Naturally, if you have a modem communications program for your PC, it could be used to eliminate the requirement of manually setting the serial port using the Mode command. Communication speeds of these programs are probably limited to the



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300 to 1200 baud range, the speeds at which most modems run. Transfer of information may take a little longer at these speeds, but if you're not comfortable using the Mode command, a communications program is the most painless method of transferring your data. This uploading capability of the Model 100 makes it a genuinely first-rate portable peripheral for the PC.

Touching is Believing

The keyboard and display are the computer's most important user interface components. The Model 100 sports a full-sized, typewriter-style keyboard. This "qwerty" keyboard is equivalent to the type found on most full-sized desktop computer systems. The full ASCII character set, as well as another 128 graphics and foreign language characters, are available. The "upper" 128 graphics characters are proprietary (see Figure 1) and are not the same as the PC's graphics characters. To print these

The large display (by portable standards) is a 320-character liquid crystal display (LCD) of 8 lines by 40 characters.

characters, a printer must be equipped with the same graphics character set. Use of the <Num> key activates a numeric keypad built into the keyboard, which makes entry of large quantities of numerical data far easier. The keys bottom easily and produce the characteristic clicking sound so familiar to users of the PC. Take the Model 100 on your

commute to work, and you'll notice more than a few people turning their heads to look for the source of the rhythmic clicking.

There are 16 function keys, of which 8 are programmable. Four programmable keys are dedicated to commands and four are used for cursor control (see Figure 2). I would have preferred these keys to be the same size and shape as the keyboard keys. Instead, they are small rectangular buttons, placed much too close together in four clusters of four keys each. Especially troublesome are the cursor control keys. These keys would have been better laid out in a diamond-shaped pattern instead of a straight-line arrangement. These special keys are the only weak point in an otherwise excellent keyboard. Many other operations are performed through use of the <Ctrl> key in conjunction with a keyboard key (see Figure 3). I spent extended periods hammering away on the Model 100 keyboard with little or no fatigue.

The large display (by portable standards) is a 320-character liquid crystal display (LCD) of 8 lines by 40 characters. Compare this to the 12- to 32-character displays offered by most of the Model 100's competitors. A small rotary switch adjusts the display's intensity to provide comfortable viewing.

If you're used to the more conventional 80-character by 24-line display, however, you'll need time to adjust to the screen of the Model 100. I soon adapted, and considering the convenience that portability offers, the display is adequate for most applications. The character set is easily readable, but the overhead lighting glare reflected from the LCD's glass covering is annoying. Repositioning the computer should correct that inconvenience.

Peripheral Vision

The Model 100's efficient keyboard and display are just the beginning. I've already discussed one manner of communication, machine to machine, but the Model 100 has other ways of communicating with the out-

side world. Along with the serial port and built-in modem plug, a parallel printer connector is tucked away inconspicuously on the Model 100's back panel. This feature negates one of the hidden costs of owning a personal computer: the necessity of purchasing additional input/output (I/O) boards before you can communicate with other devices.

A plug is also provided for a bar-code reader device attachment. This would be especially handy for a business that uses the bar-code marking method on its sales items. Bar-code technology also has potential as an inexpensive method of publishing and distributing software. Imagine carrying around your applications software in a loose-leaf notebook instead of in boxes of cassette tapes or floppy disks. When you want to run a particular program, simply wave your magic wand over the appropriate page, and you're up and computing.

How large a notebook would you need for an applications program? Consider the memory capacity of the Model 100 and the fact that in reality 1K to 2K of data can be sorted on a current page of bar code; anything more than 20K becomes impractical. Bar-coded software, however, is non-volatile and certainly less susceptible to damage than a cassette tape or floppy disk.

Future plans for the Model 100, though speculative, could prove exciting. Tandy has included a plug-in socket on the bottom of the Model 100 for alternate ROM modules. (The possibility of a plug-in spreadsheet program was the topic of discussion at a local Radio Shack Computer Center.) Although the Model 100 screen strikes me as a bit small for extensive spreadsheet work, some specially developed applications for real estate agents, field engineers, or anyone on an expense account seem likely future applications.

Located next to the plug-in ROM socket is a connector to bring internal bus signals out to an external device. This might extend the amount

123	124	125	126	128	129	130	131	132	133	134	135	136	137	138
{		}	~	☎	📶	ⓧ	📶	#	+	🏠	📺	i	✓	≠
139	140	141	142	143	144	145	146	147	148	149	150	151	152	153
Σ	≈	±	∫	◀	⌒	⌒	↕	⚖	⚖	♂	♀	%	↑	↓
154	155	156	157	158	159	160	161	162	163	164	165	167	168	169
→	←	♣	◇	♥	♠	`	à	ç	£	`	μ	▼	†	\$
170	171	172	173	174	175	176	177	178	179	180	181	182	183	184
☐	☐	¼	¾	½	∞	¥	Ä	Ö	Ü	¢	~	ä	ö	ü
185	186	187	188	189	190	191	192	193	194	195	196	197	198	199
B	T _M	é	ù	è	..	£	â	ê	î	ô	û	^	ë	ï
200	201	202	203	204	205	206	207	208	209	210	211	212	213	214
á	î	ó	ú	ý	ñ	ã	õ	Â	Ê	Î	Ô	Ù	Ï	Ë
215	216	217	218	219	220	221	222	223	225	226	227	228	229	230
É	Á	Í	Ó	Ú	Ý	Ù	È	À	■	■	■	■	■	■
231	232	233	234	235	236	237	238	239	240	241	242	243	244	245
—	—	┃	┃	▣	▣	▣	▣	▣	▣	┐	┐	┐	┐	┐
246	247	248	249	250	251	252	253	254	255					
└	└	└	└	└	▤	▤	▤	▤	▤					

Figure 1: The Model 100's graphics character set

of RAM that could be used and could mean an interface with micro-floppy drives. Tandy claims, however, to have no plans for such a disk storage device. One of the most likely applications for this bus extender is as an external monitor connector. While peeking around in the operating system and experimenting with the machine's capabilities, I was surprised to find a designation for a device named CRT. If this stands for the traditional cathode-ray tube, it seems a safe bet that Tandy plans to expand the viewing area. This would make the Model 100 an even more attractive machine.

A Carry-On Word Processor

The Model 100 handles portable word processing quite admirably. To see how effectively the computer co-operates with the user, imagine that you're on an airplane in transit to an important business meeting. Due to your rushed workday, the critical speech you're to give to the executive board only a few hours from now still hasn't been polished. However, you don't look quite as concerned as the other businesspeople on board, who are fidgeting with their seatbelts as the plane taxis for takeoff.

Once you're airborne and the seatbelt sign goes off, the sound of briefcase locks snapping open echoes throughout the cabin. Reams of pa-

per are shuffled on various laps, and Osbornes and COMPAQs remain tucked uselessly beneath the seats. You smugly remove your Model 100 from its soft carrying case and are immediately ready to review your speech and put the final touches on it.

You turn on the power switch and the main menu greets you, showing the current day and date, time, amount of free RAM, the names of the four ROM-based programs, and up to 19 of your own file names. You place the cursor on a file named SPEECH.DO. The .DO indicates that this file is a document. You press <ENTER> and the text editing program, Text, is automatically invoked. The cursor is placed at the beginning

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of the file. As the closing remarks need the most work, you press the key combination of <Ctrl>-<CursorDown> to move directly to the end of the file.

Your closing comments are superb—crisp and concise, reemphasizing the main points covered in the speech. The information about the company's marketing plans for the next year doesn't belong in the fifth paragraph, however. It should be moved from its present location to a position directly after the sales figures for the first and second quarters of the year.

Pressing <Ctrl>-<CursorUp> returns the cursor to the beginning of the speech. The marketing details must be located for moving to the appropriate location. The assignments that the Text program gives to the function keys are accessed by pressing the Label command key (Figure 4 shows the function key assignments for the ROM-based Model 100 programs). This display is shown on the eighth line.

After pressing the Find function key, <F1>, you enter *marketing* and press <ENTER>. The program searches through the file, beginning at the present cursor position, for the word *marketing*. When the search word is found, the cursor is positioned in the file at the first occurrence of the designated word. This is not, however, the entry you want. Simply press <ENTER> again, and the cursor is moved to the next occurrence of the search word.

Once the exact entry is found, a quick glance at the status line shows you that the Select function, <F7>, marks the text to be cut. As you press <F7> the character under the cursor changes to inverse video (white character on a black background). You use <CursorRight> to move to the right in the text. Each character the cursor passes over changes to inverse video, indicating

Key	Operation
Label	Prints the definitions of the function keys
Print	Equivalent of entering LCOPY
Shift-Print	Equivalent of entering LLIST
F1	Equivalent of entering FILES
F2	Equivalent of entering LOAD
F3	Equivalent of entering SAVE
F4	Equivalent of entering RUN
F5	Equivalent of entering LIST
F8	Equivalent of entering MENU

Figure 2: BASIC key word operation

that the text has been designated for the maneuver. As this is a large block of text, you use the <Shift>-<F7> key combination to select a screenful of characters to be changed.

<Shift>-<CursorDown> moves the cursor to the following screen, and <Shift>-<F7> continues to mark each screen for the move.

The last part of the speech is finally marked to be moved. The Cut function key, <F5>, lifts all of the characters displayed in inverse video out of the file. These characters are placed in a holding buffer (a separate area of the Model 100's memory). Again, press <F1> (Find) and enter *Sales 1983* as the search characters. The cursor is placed at the beginning of the sales information section of the speech. You move the cursor down to the location at which the marketing plans should be inserted and press the Paste command key. All of the text that was marked and cut is repositioned at the current cursor location. If you had wanted to duplicate a portion of the text, you would have used the same procedures, but instead of the Cut function key, you would have pressed the Copy function key, <F6>.

Once your speech is edited satisfactorily, you can save the corrected copy by pressing the Save function key, <F8>. The text file is updated and you automatically exit the Text program and return to the main menu. The editing, cutting, and pasting have been accomplished with elegant ease, and without memorizing complicated control sequences or

calling in program overlays. All of the Text program's capabilities are immediately available through one or two simple keystroke sequences.

Calendar Control

Things have gone well for you today. Perhaps too well? Something must have been forgotten. Since you're still looking at the Model 100's main menu, you can position the cursor over the Schedl file and press <ENTER> to access the Calendar file. The mini-data manager program is invoked, and the function keys status line tells you that <F1> performs the Find feature. Pressing <F1> and entering your city of destination causes Schedl to show all entries having city names as part of the data. When nothing shows up on the LCD display, you press <F1> again and enter the current date. All of the entries containing today's date will then be displayed. The eighth line of the display changes to tell you that pressing <F3> will display more entries because there are more matches with today's date than can be shown at one time on your display. Press <F4> to quit the search.

Since the notes currently on screen have already been taken care of, you press <F3> to see more entries. The second screen reveals a reminder that tomorrow is your supervisor's birthday. That means a call to your assistant once you get off the plane, so that a card can be sent to your boss. Using <F3> to skim through the remaining notes, you find nothing else

Control code	Operation performed
Ctrl-A	Moves the cursor to the beginning of the first word to the left
Ctrl-B	Moves the cursor to the end of the file
Ctrl-C	Cancels a SELECT, SAVE, LOAD, FIND, or PRINT function
Ctrl-D	Moves the cursor one character to the right
Ctrl-E	Moves the cursor up one line from the current line
Ctrl-F	Moves the cursor to the beginning of next word to the right
Ctrl-G	Saves a file or program
Ctrl-H	Deletes the previous character
Ctrl-I	Tab function
Ctrl-L	Identical to the Select function key
Ctrl-M	Carriage return and line feed
Ctrl-N	Identical to the Find function key
Ctrl-O	Identical to the Copy function key
Ctrl-P	Printer codes embedded in a text file—these codes appear on the display but are not printed by the printer
Ctrl-Q	Moves the cursor to the left-most position of current line
Ctrl-R	Moves the cursor to the right-most position of current line
Ctrl-S	Moves the cursor one character to the left
Ctrl-T	Moves the cursor to the top of the display in the current column
Ctrl-U	Identical to the Cut function key
Ctrl-V	Identical to the Load function key
Ctrl-W	Moves the cursor to the beginning of the current file
Ctrl-X	Moves the cursor down one line from its current position
Ctrl-Y	Prints the entire file
Ctrl-Z	Moves the cursor to the end of the current file

Figure 3: Control key operations

amiss. The Text program could be used to edit your Schedl data file to add new appointments and notes, or to delete old material. Now, it's time for a rest if the shuffling of papers elsewhere on the plane doesn't disturb your peace.

Modem Maneuvers

Once you've settled in your hotel room, you compose an important memo to be sent to your home office and you remember that you should check The Source for some messages you've been expecting. Once again,

you remove the Model 100 from its case along with the modem connection cable. If the hotel room is equipped with modular-style jacks, the connection is exquisitely simple. Attach one end of the cable to the

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jack in the rear of the unit and plug the other end into the wall telephone outlet. Hook up the cassette recorder and its connecting cable to your computer, press Play on the recorder and enter the Text program. At the file name prompt, you type in the name under which you saved your memo and press <ENTER>. Since this file is not currently in the Model 100's memory, the LCD display is blank, as if you were going to create a new file.

entry containing this word. This is the entry you have used to designate the phone number of your office computer, so the number appears on the screen.

The Call function key, <F2>, activates the auto-dial feature of the modem, and each digit of your office phone number appears on the screen, one at a time. This number is a dial-in port to the mainframe your company has hidden in the basement. Since you have included your log-on sequence and password in the Addrss

around to see if any new items have been added to the IBM bulletin board, it's time to log off. All of the downloaded information is safely stored for later retrieval.

BASIC Elements

If you program in BASIC on your PC, the transition to the Model 100 is easy. The BASIC languages for the PC and the Model 100 were both developed by Microsoft and, therefore, share many of the same statements. Since the Model 100 does not cur-

Applications of function keys

Programs	F1	F2	F3	F4	F5	F6	F7	F8
BASIC	Files	Load	Save	Run	List	_____	_____	Menu
Text	Find	Load	Save	_____	Copy	Cut	Select	Menu
Telcom	Find	Call	Status	Terminal	Echo	Wait	_____	Menu
Addrss	Find	_____	_____	_____	Lfnd	_____	_____	Menu
Schedl	Find	_____	_____	_____	Lfnd	_____	_____	Menu

Lfnd performs the same procedure as Find, except that the information is printed to the printer instead of the computer's display.

The four command keys—Paste, Label, Print, and Pause—and the four cursor movement keys perform the same operations in all of the Model 100's applications programs.

Figure 4: Program key definitions

Pressing the Load function key, <F2>, causes the prompt "Load from:" to be displayed. Enter the name you gave to your memo when you last saved it by pressing <F3>. The cassette tape begins to roll, and soon the memo appears on the screen. Now you know that the file has been loaded into memory and is ready to be transmitted via the modem.

To accomplish this, exit the Text program by pressing <F8>. Then position the main menu cursor over the Telcom program, and press <ENTER>. When Telcom comes up, pressing <F1> activates the Find feature. At the prompt for a search string, you enter office and Telcom searches your Addrss data file for any

data file, the Model 100 automatically signs you onto the system and begins the Terminal mode. Once contact is established, the Up function key, <F3>, results in a prompt for a file name and then uploads your memo to the office mainframe.

After logging off the office computer, you press <F1> while still in Telcom to search for The Source entry. <F2> does the dialing and login for you. When you check The Source mailbox, you find the messages you were waiting for, so you press <F2> to activate the Download function. The Download feature saves everything being sent by The Source as you skim through the mail. You can come back later and read all of it in depth at your leisure. Once you've captured your mail and browsed

currently support disk drives, you'll find that the BASIC used in the Model 100 resembles the ROM-based, cassette version of BASIC on the PC. There are a few minor differences, such as the SCREEN statement. On the PC this command sets up attributes for screen memory, color, etc. Due to the limited screen capabilities of the Model 100, its SCREEN statement serves to determine if the eighth line of the display will be used to indicate labels for the assignments of the eight function keys.

Model 100 BASIC supports double- and single-precision numbers, as well as integers. The character-string handling facility is sufficient for most needs but it is not as powerful as that for the PC. Complete file operations are supported, and match capabilities

Under the Cover

The Radio Shack TRS-80 Model 100 unit weighs 3.9 pounds and is 2 by 11 $\frac{7}{8}$ by 8 $\frac{1}{2}$ inches. The unit is powered by four AA-size batteries. It includes a built-in 300 baud, answer/originate modem, peripheral and computer I/O, a real-time clock and calendar, and four applications programs. It is expandable to 32K of RAM.

The Model 100 is densely packed with low-power complementary metal-oxide semiconductor (CMOS) memory chips. The microprocessor is the 80C85, a low-power version of the old 8085, running at 2.4MHz. This microprocessor is a member of the 8080/Z80 family, which has a substantial base of applications programs. Converting a significant portion of that software for the 80C85 should be relatively easy.

The extensive interrupt capabilities of the 80C85 are well exploited through BASIC and can cause your program to jump to an interrupt handling subroutine if an interrupt signal is generated from the serial port, modem, a function key, or a preset value from the real-time clock. These interrupt features may be enabled

or disabled with a simple BASIC statement. Additionally, even if they are disabled, the computer may be instructed to remember whether an interrupt request was generated.

The modem circuitry provided is limited to generating pulse dial signals (the type of signal produced by a rotary dial phone) because the newer tone dialing signals are not currently available in CMOS technology. This means that if you use some of the alternative long-distance phone systems or your business phone system requires tone dialing, you have to manually dial the phone numbers before initiating the Telcom program.

Auto-dial and answer/originate modes are supported for the 300 baud, Bell 103 compatible modem. Communications parameters can be set to match almost any system you want to access. The modem can be configured for either full- or half-duplex operation, Xon/Xoff protocol may be enabled or disabled, and word lengths of 6, 7, or 8 bits are supported. Parity choices are odd, even, none, or ignore. You may

specify 1 or 2 stop bits, and the dialing pulse rate can be set for either 10 or 20 pulses per second.

The bidirectional serial port allows the same choice of parameters as the modem and may be set up to operate at speeds from 75 bps to 19,200 bps. Because the modem and serial port share much of the same circuitry, they can't be operated simultaneously.

The parallel printer connector uses a 26-pin dual-row connector to attach the parallel printer cable, which is available from Radio Shack. Installing this printer cable provides a standard Centronics parallel connection, allowing communication with any printer that uses this common interface.

The cassette tape option operates at 1500 bps, significantly faster than the usual 300 bps, and loads and saves data at a rate of approximately 70 words per second. During program loading, the bit stream is passed through the piezoelectric speaker. This is a throwback to the early days of personal computers when it was possible to determine the probable success of a load by listening to the bit stream. This feature can be disabled through BASIC.

include the expected operators and transcendental functions. However, the language does not include the capability to define a function at the beginning of a program and later call it by its defined name. Nor is the program able to clear (ERASE) an array to redimension it, thereby clearing RAM space. With such limited memory available, it would be nice to reclaim some RAM once an array had served its purpose.

The Model 100 has a unique command that controls the automatic

power-down feature. As with many new pocket calculators, the Model 100 monitors time between keyboard inputs. If you ignore the computer for an allotted amount of time, it automatically powers-down the operating system to conserve battery life. The factory default is 10 minutes, but this is adjustable to between 1 and 25 $\frac{1}{2}$ minutes, or it may be completely disabled.

The computer may also be programmed to power-down at a certain

time, or at a particular point in program operation, and then to resume operation where it left off when the power is once again applied. Some interesting applications ideas come to mind when the Model 100 is combined with the included modem.

You could set the computer up to receive a file from another computer late at night, when telephone rates are lowest. At your convenience the

● Hands On

next day, turning the computer back on could cause it to display the received file or, if hooked into the PC, to automatically upload the information for you.

If you do much programming, the ability to use the Text program to edit your BASIC programs will be appreciated. While in BASIC, typing EDIT and the line number or range of line numbers to be edited causes Text to be invoked automatically. Full-screen movement is supported and program line changes are not implemented until <F8> is pressed to return to BASIC. However, caution is advised—as with editing text files, your original file is the one being edited. Since any changes made become permanent, use the Copy function to prepare a duplicate version of your program for debugging purposes. The BASIC supplied with the Model 100 is powerful enough to accomplish most tasks you will want to run on this portable computer.

Pixels and Poking

The Model 100's individual display pixels can be turned on or off. Since this is accomplished through program control, graphic displays can be produced. Although the limited display doesn't provide much room, people will soon find amusing ways to use the computer's graphic capabilities. (Don't expect to find Pac-Man up and running on the Model 100 anytime soon.) The Model 100 also has statements for loading, saving, and calling machine language programs, though no system monitor is provided to allow direct memory access. The documentation provides you with some information on calling a few machine language routines included in the 32K ROM, such as how to reset the function keys to their default assignments. A more complete listing of locations to call some of the

routines used by the programs included in the 32K of ROM would have been a useful feature. If this information were available, it could be incorporated easily into a BASIC program to conserve memory and speed up program operation.

Error Help

I found the error messages used by the Model 100 to be rather cryptic. If you worked with the computer long enough, you would probably get used to them. The syntax for error messages consists of a two-letter error type identification code followed by the word *error*. You could run across the message "DD Error" and never realize that it was presented because you tried to redimension an array. I see no good reason for such abbreviated error prompts, especially with a 40-character display. A more descriptive message would go a long way toward making program debugging a less tedious task. While trying to decipher one of these cryptic messages, I discovered no less than four undefined error types in a table in the documentation.

Source of Life

Radio Shack has combined the best of two worlds to supply power to the Model 100. You have the choice of using either internal batteries or the optional AC power adapter. The Model 100 actually uses two sets of batteries: one set maintains the contents of RAM and the other provides the power for the operating system whenever the machine is turned on. The operating system runs from either the AC power pack or four AA-sized dry cells. The contents of RAM are maintained by rechargeable Ni-Cad (nickel-cadmium) batteries, which provide the power to hold data for up to 30 days before they need to be recharged. The recharging process is automatically accomplished from either the operating system batteries or the AC power adapter.

The four AA batteries that power the operating system run the Model 100 for about 20 hours. A low-bat-

tery indicator light warns you when the batteries are down to about 15 minutes of operating life. I was, however, able to use the computer for almost 2 hours after this indicator came on with no ill effects. Even if you totally drain the operating batteries, there is no need for concern about the Model 100's memory contents—the Ni-Cads hold the contents even though there may not be enough power to operate the computer.

Storing Questions

I do not like to use cassette tape for mass storage. Tape requires considerably more attention on the part of the operator; you must always be aware of which buttons are pressed on the recorder before initiating any tape-access operations. Until you adjust to using this medium, be prepared for a few nasty surprises.

Tandy plans to support the Model 100 with a comprehensive line of options and accessories.

Beyond the inconvenience of having your data stored in sequential access format, which means rewinding the tape if the current location is beyond the area you want to access, loading and saving data can be tricky.

You may find that a program or data you thought was saved has actually disappeared because you forgot to press the record button. Even worse, an attempt to load a program or read in data with the record button still pressed causes the tape to be erased. Backup of information requires that all operations be performed twice (once for the original and once for the backup), or you need another way to duplicate your tapes.

The problems don't end there. Because of the design of the recorder-control interface, you cannot use just any cassette recorder as your data storage device. The Model 100's cassette connector cable consists of three leads. One writes the data to tape, one reads the data back into the computer, and the third controls the recorder motor. The inclusion of the motor-control capability, while making tape easier to use, requires that you use a recorder with connectors for the type of microphone that includes a remote off/on switch. Without this remote motor control, you are unable to save or load data from the newer type of recorders that use a built-in microphone.

Accessories

Tandy plans to support the Model 100 with a comprehensive line of options and accessories. An acoustic coupler is available for those times when a modular phone jack isn't handy. This cable allows you to send

and receive information using a public phone booth or any phone not fitted to the modular system. Also available is a briefcase designed to hold the computer, a cassette recorder, and all associated cables. Connector cables for attaching a parallel printer or serial device are available, as is the null modem.

A 224-page operator's manual, and a smaller, 40-page quick reference guide are included in the purchase price. The former is a hands-on user guide for the Model 100. A series of informative appendices discusses using the modem and the cassette recorder, and interfacing the Model 100 to other computers. The reference guide contains the bulk of the manual and also some technical material.

Software for the Model 100 is already being advertised. At least one national user group is being formed around this computer. If the trend continues, this little wonder could

become a powerful contender in the lap-sized portable market. If you need the convenience of a truly portable computer with the ability to trade information with your PC or PC-compatible machines, the Model 100 deserves serious consideration. ●

Richard Brown is a technical support representative for a company that produces PC-compatible applications software.

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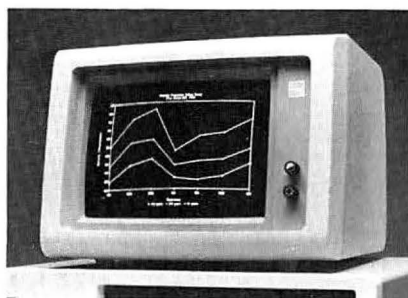
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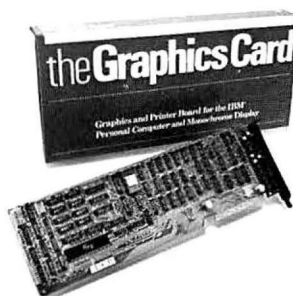
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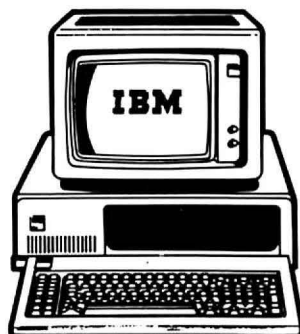
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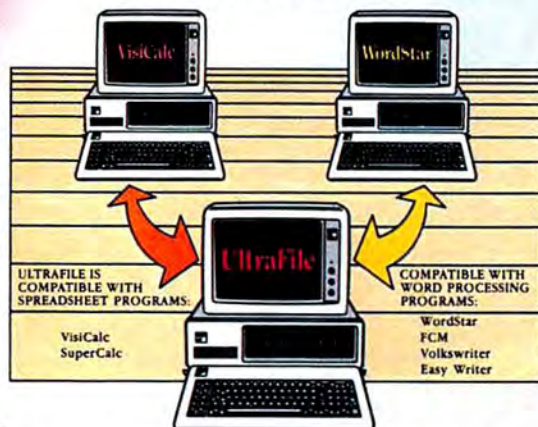


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Smartmodem Gets Smarter

Use this simple program to turn your Hayes Smartmodem into a telephone dialing facility.

Burton L. Alperson

The popular Hayes Smartmodem has capabilities beyond those necessary for communication with other computers. To take advantage of some of these, I wrote PHONE.BAS (see Listing 1), a program that turns the modem into an automatic telephone dialing instrument. The program stores up to 40 names and phone numbers, and the latter may be stored with any necessary long-distance access codes such as those for SPRINT or MCI. To dial a stored number you need only enter the number's one- or two-digit code and press <ENTER>; other telephone numbers may be dialed by entering the number and pressing <ENTER>. PHONE.BAS also features one-key entry of SPRINT or MCI codes, one-key redial of the last number dialed, and automatic repeated redialing of the last number dialed.

Program Operation

Instructions for operating PHONE.BAS appear on the program's screen display (see Figure 1). Dial telephone numbers by typing the appropriate code or the number itself and then pressing <ENTER>. If you make a mistake, simply type an asterisk, press <ENTER>, and then reenter the code or the number. (Be-



cause of programming considerations that I'll explain later, you cannot use <Backspace> to correct errors.)

If you want to use an MCI or SPRINT access code, press <F1> and type in the area code and number you want to dial. You redial a number by pressing the R key. Automatic redialing is invoked by pressing the A key, and this routine is terminated while in progress when you strike any key. The automatic redialing routine makes up to 200 attempts to complete a call, but you can easily change this parameter to several million attempts (over 6 months of continuous dialing). Pressing the E key terminates the program, resets the modem to default status, and returns you to DOS.

The structure of PHONE.BAS is shown in the Warnier-Orr diagram accompanying "More on Warnier-Orrs." The program's most basic structure is simply initialize, get data, print screen, and operate. PHONE.BAS is written in BASIC, but the Warnier-Orr diagram is language independent, so implementing the diagram in most other high-level languages would be easy.

PHONE.BAS has been widely tested in Los Angeles. Telephone service in some areas of the country may be subject to local conditions such as slow dialing speed, so some adjustments may be necessary to make the program work satisfactorily in your area.

Customizing PHONE.BAS

The initialization routine (lines 1000 to 1050) contains some options for tailoring the program to your hardware configuration and local phone conditions. If your modem is attached to your second serial port, the reference in line 1010 should be changed to COM2:.

The statement S11 = 51 in line 1020 controls touch-tone dialing speed. The number 51 generates extremely fast dialing—51 milliseconds (msec) for both tones and intertone intervals. If you find that the program dials too fast for your telephone sys-

tem, try eliminating the speed statement entirely; the Hayes modem will default to S11 = 70. If you still can't dial successfully, try parameters up to 255 msec.

You may also want to change the statement S7 = 10 in line 1020. If you like to dial while the telephone is in its cradle, this parameter gives you only 10 seconds to pick up the phone before the modem hangs up (picking up the phone overrides the modem's

The program stores up to 40 names and phone numbers.

attempt to hang up). You can allow as much as 255 seconds for this parameter if you wish, but I recommend trying the program for a while before you change the value of the S7 register.

The statement S0 = 0 in line 1020 should not be changed. This parameter guarantees that the modem will not enter the auto-answer mode. If the modem is in auto-answer while PHONE.BAS is running, anyone calling your number will be greeted by the squeal of the carrier tone.

PHONE.BAS assumes that you have touch-tone dialing in your area. If this is not the case, change the statement AT M0 DT in line 540 to AT M0 D, and change the statement AT M1 DT in lines 600 and 760 to AT M1 D.

The setting of the modem speaker reflects my personal preferences. The speaker is off on the first attempt to dial any number (M0 in line 540) to prevent the possibility of acoustic feedback between speaker and telephone. During redial and auto-redial operations, the speaker is turned on (M1 in lines 600 and 740). This arrangement enables you to move

around the room and do other work while listening to the progress of your phone call. Use M1 to turn the speaker on and M0 to turn it off if your preferences are different from mine.

The Hayes modem was not designed to be used as a telephone dialer. Consequently the device does not recognize an answering party picking up the phone; it recognizes only a carrier tone generated by another modem. Because of the problems introduced by the lack of this capacity, I had to make some compromises in the auto-redial routine of PHONE.BAS.

One such compromise is that the frequency of attempts to redial a number must be controlled with fixed timing parameters rather than with a busy signal or an answering party. The timing parameters involved are J = 1 TO 2000 in line 770 (test for auto-redial termination for about 13.5 seconds), S7 = 10 in line 1020 (allow 10 seconds after dialing before hanging up), and S6 = 2 (wait 2 seconds for a dial tone before dialing). The S6 parameter is not explicitly stated in the program since it is the Hayes modem default. To change the S6 parameter to a 3-second wait, for example, insert the statement S6 = 3 into the string in line 1020. Do not change line 820, since the modem requires at least a 1-second delay to reset before redialing.

Entering Your Directory

You can store names and telephone numbers in the data statements in lines 3010-3410. This method is less elegant than storing data in external data files, as it eliminates the option of using built-in editing and appending routines. On the other hand, using data statements is appreciably faster than using external files. This is particularly true if the program is on a floppy disk rather than a hard or electronic disk. Since I typically want to load and run PHONE.BAS as quickly as possible, data statements were the appropriate choice; using

CALL:

E: Exit

R: Redial

A: AutoRedial

H: Hang Up

*To Correct Errors

CODE NAME

CODE NAME

1 AAA Auto Service
2 ABC Premiums
3 Adray—Wilshire
4 Allstate Insurance—Greg Ray
5 American Home Security
6 Ametron
7 Amica Insurance
8 Audio Mart—John Romero
9 Computer—Bob Rice
10 Computer—ComputerLand Glendale
11 Computer—ComputerLand Pasadena
12 Computer—IBM Product Center—BH
13 CSU Bookstore
14 CSU Library—Reference
15 Dentist—UCLA Clinic
16 IBM Selectric Service (Zone 0931)
17 INMAC—Mark Brown
18 Mazda Service (Savage)
19 MD—Hamm
20 PC World—Kearney Rietmann

21 Plumber—Major Kramer
22 Restaurant—Anna Maria
23 Restaurant—Any Restaurant
24 Restaurant—Paul Bhalla's
25 Restaurant—The Egg and the Eye
26 Restaurant—Green Jade
27 Restaurant—Mon Grenier
28 Restaurant—Sea Food Bay
29 Restaurant—Sorrentino's
30 Restaurant—Supreme Pizza
31 Restaurant—Sushi Fune
32 Restaurant—Tokyo Kaikan
33 Shiatsu—Jean
34 Sparkletts Water
35 Taxes
36 Zen Carpentry—Bill Jordan
37
38
39
40

TIME: 12:26:11

MCI: F1 + Area Code + Number. UNLISTED NUMBERS: Type number instead of code.

your computer to dial your telephone doesn't make sense if you can do it faster by hand.

An MCI or SPRINT code may be inserted in line 3000. MCI, for example, requires that you dial a telephone access number, wait for a dial tone, then dial an account code before you can dial your number. If your access number were 555-5555 and your account number were 12345, line 3000 would be

3000 KEY 1,"5555555,,12345"

Each comma causes the modem to pause for 2 seconds to wait for a dial tone before entering the account number. The hyphen is not included in the access number because BASIC imposes a 15-character limit on strings assigned to function keys.

If your access code requires more than 15 characters (including commas for timing), you might get around the problem by using the S8

register of the Hayes modem. This register controls the duration of the delay generated by a comma. For example, if line 1020 were written as

1020 PRINT #1,"AT S11=51 S0=0 S7=10
S8=6"

then line 3000 could be written as

3000 KEY 1,"5555555,12345"

If you have several long-distance codes, they can be assigned to function keys 2 through 10 in similar fashion, and appropriate references can be added to the prompt in line 2030.

You can make directory entries for local, long-distance, and long-distance SPRINT or MCI numbers. The following entries are all acceptable.

3010 DATA "PHILISTINE, A.,"999-9999"
3020 DATA "REAGAN, R.,"1 (202) 999-9999"
3030 DATA "HUN, A.,"555-5555,,12345 (999
999-9999"

Keyboard Entry Routine

Most of the code in PHONE.BAS is straightforward and requires little explanation. However, the keyboard entry routine uses some strategies and BASIC operations that may be unfamiliar to many programmers (i.e., dummy variables, case structures, INKEY\$, RIGHT\$, LEN, LINE INPUT, VAL, and ON...GOTO). I used these techniques to minimize the number of keystrokes required for data entry. The keyboard entry routine has to recognize whether the input is a single-character command that begins an operation, an asterisk indicating a correction, the first digit of a code representing a number to be dialed, or the first character of an


```

1 ' Telephone dialing program for 300 or 1200 baud Hayes Smartmodem.
2 ' Written by Burton L. Alperson

10 GOSUB 1000
20 GOSUB 3000
30 GOSUB 2000

100 ACTION%=0
110 ENTRY$=INKEY$:LOCATE 24,65,0:PRINT"TIME: "+TIME$;
    :LOCATE 1,1:PRINT"CALL:";
120 IF ENTRY$="" THEN 110

200 IF ENTRY$="E" OR ENTRY$="e" THEN ACTION%=1
210 IF ENTRY$="H" OR ENTRY$="h" THEN ACTION%=2
220 IF ENTRY$="R" OR ENTRY$="r" THEN ACTION%=3
230 IF ENTRY$="A" OR ENTRY$="a" THEN ACTION%=4
240 IF ACTION%=0 THEN 500
250 ON ACTION% GOTO 300,400,600,700

300 PRINT #1, "AT Z":CLOSE:COLOR 7,0:CLS:SYSTEM

400 PRINT #1,"AT H,":LOCATE 1,1:PRINT STRING$(79,32):GOTO 100

500 LOCATE 1,7:PRINT ENTRY$;:LINE INPUT DUMMY$:DUMMY$=ENTRY$+DUMMY$
510 IF RIGHT$(DUMMY$,1)="*" THEN LOCATE 1,1:PRINT STRING$(79,32):GOTO 100
520 IF LEN(DUMMY$)<3 THEN DIAL$=NUMBER$(VAL(DUMMY$)):LASTNUM$=DIAL$
530 IF LEN(DUMMY$)>2 THEN DIAL$=DUMMY$:LASTNUM$=DIAL$
540 PRINT #1, "AT MO DT"+DIAL$
550 LOCATE 1,1: PRINT STRING$(79,32)
560 LOCATE 1,65-LEN(DIAL$):PRINT "NUMBER DIALED: ";DIAL$;; GOTO 100

600 PRINT #1, "AT M1 DT"+LASTNUM$
610 LOCATE 1,1: PRINT STRING$(79,32)
620 LOCATE 1,69-LEN(LASTNUM$): PRINT "REDIALING: ";LASTNUM$;; GOTO 100

700 FOR I=1 TO 200
710 COLOR 18,0:LOCATE 24,65:PRINT"ATTEMPT NO ";
720 COLOR 15,0:PRINT USING"###";I;
730 COLOR 18,0:LOCATE 1,1:PRINT STRING$(79,32);
740 LOCATE 1,1:PRINT "AUTO REDIAL FOR ";:COLOR 15,0:PRINT LASTNUM$;
750 LOCATE 1,45:COLOR 15,0:PRINT "STRIKE ANY KEY TO ABORT AUTO REDIAL"
760 PRINT #1, "AT M1 DT"+LASTNUM$
770 FOR J=1 TO 2000
780 R$=INKEY$
790 IF R$<>" " THEN LOCATE 1,1:PRINT #1,"ATH":PRINT STRING$(79,32);:GOTO 100
800 NEXT J
810 PRINT #1, "ATH"
820 FOR Y=1 TO 833:NEXT Y
830 NEXT I
840 LOCATE 1,1:PRINT STRING$(79,32);:GOTO 100
1000 KEY OFF
1010 OPEN "COM1:" AS #1
1020 PRINT #1, "AT S11=51 S0=0 S7=10"
1030 DIM NUMBER$(40),PARTY$(40)
1040 CLS
1050 RETURN

```

(continues)

Listing 1: PHONE.BAS


```

2000 CR$=CHR$(17)+CHR$(196)+CHR$(217)
2010 LOCATE 2,1:COLOR 0,7:PRINT "E: Exit      R: Redial";
2020 PRINT "      A: AutoRedial      H: Hang Up      *"+CR$+"
      To Correct Errors";
2030 LOCATE 25,1:PRINT " MCI: Fl + Area Code + Number.  ";
2040 PRINT "UNLISTED NUMBERS: Type number instead of code.":COLOR 7,0
2050 COLOR 9,0:LOCATE 3,1: PRINT "CODE  NAME";STRING$(30,32);"CODE  NAME";
2060 PRINT STRING$(29,32);:COLOR 7,0
2070 FOR I=1 TO 20
2080 LOCATE I+3,1:PRINT USING "####";I;:PRINT "  ";:PRINT PARTY$(I);
2090 LOCATE I+3,41:PRINT USING "####";I+20;:PRINT "  ";:PRINT PARTY$(I+20);
2100 NEXT I
2110 COLOR 15,0
2120 RETURN

3000 KEY 1,"INSERT MCI OR SPRINT CODES HERE"
3005 FOR I=1 TO 40:READ PARTY$(I),NUMBER$(I):NEXT I
3010 DATA "INSERT NAME OF PARTY #1","INSERT PHONE NUMBER OF PARTY #1"
3020 DATA "INSERT NAME OF PARTY #2","INSERT PHONE NUMBER OF PARTY #2"
3030 DATA "",""
3040 DATA "",""
3050 DATA "",""
.
.
.
[NOTE: There must be 40 lines of data statements to make the program
run properly.  If you do not have 40 entries for your phone directory,
use the format shown in lines 3030-3050 and 3380-3400 for blank data
statements.]
.
.
.
3380 DATA "",""
3390 DATA "",""
3400 DATA "",""
3410 RETURN

```

Listing 1 (continued)

actual telephone number. If the entry is the first digit of a code, the rest of the code must be appended to it and the code must be converted to a telephone number. If the entry is the first digit of a telephone number, the rest of the number must be appended to it.

Line 110 traps the first keystroke and defines it as the string constant ENTRY\$. If ENTRY\$ is any of the single-character commands, the program takes immediate action (lines

200 to 230). If ENTRY\$ fails all the tests of lines 200 to 230, it must be a code, a telephone number, or an instruction to correct an entry. Once this has been determined, the rest of the keyboard input is appended to ENTRY\$ and the concatenated string is defined as DUMMY\$ (line 500). DUMMY\$ is then tested for an error-correction instruction (line 510). If DUMMY\$ does not have an error-correction symbol as its right-most character, the program tests the string's length. If DUMMY\$ is less than 3 characters long, it must be a

code; the number the code represents is retrieved and defined as the number to be dialed (line 520). If DUMMY\$ is more than 2 characters long, it must be a telephone number; it is defined as the number to be dialed (line 530).

This routine works well, but using <Backspace> to correct errors disrupts the logic and produces unpredictable results. Instead, you have to use the asterisk to signal correction of input errors.

A Final Word

Like most programs, PHONE.BAS will only be of use to you if it fits your needs and is well integrated into your system. The major considerations for a program like PHONE.BAS are that it be quick and convenient. One way to speed up access to PHONE.BAS is to use a macro-processing program like *ProKey* or *Keynote* to assign command sequences to a single key. In my own system, for example, three versions of PHONE.BAS can be called up quickly by pressing <F5>, <Alt>-<F5>, or <Shift>-<F5>; the commands assigned to these keys are BASICA PHONE-P, BASICA PHONE-B, and BASICA PHONE-E. PHONE-P and PHONE-B are two programs that have personal directories, and PHONE-B contains a directory of numbers that I need for business.

While the usefulness of this dialing program is currently limited to times when your computer isn't otherwise occupied, multitasking and concurrent operation on the PC aren't very far away. When you can press a key and instantly switch operations, and then press another key and resume where you left off, the issue of tying up the computer or interrupting a process will no longer be of concern.

If you use floppy disks, the location of PHONE.BAS on the disk is a critical factor in determining how fast the program can be invoked. If loading speed is important to you, BASICA.COM and PHONE.BAS should be among the first programs you copy onto the disk.

Paying attention to system considerations increases the usefulness of many programs. The kind of system integration described above has made PHONE.BAS one of the most frequently used programs in my library. ●

More on Warnier-Orrs

Warnier-Orr diagrams were first developed by the French computer scientist and logician Jean Dominique Warnier as a part of his efforts to develop a completely automatic procedure for designing computer programs based on mathematical set theory. The techniques Warnier developed are very useful for business applications such as data base management and financial programs. They are less useful for scientific applications, although the procedure can still save time and effort by eliminating superfluous programming.

Warnier's techniques were improved and refined by Ken Orr of the United States. In addition to several conventions that he added to Warnier's diagrams, Orr developed a design technique called Structured Systems Design that is one of the most powerful and elegant methods in the so-called top-down structured programming revolution.

Warnier-Orr diagrams contain an enormous amount of information in a compact format. Labels are descriptive titles for operations to be performed (such as initialize and print screen). A line over a label means that an event has not taken place or an operation is not to be performed. A plus sign is an inclusive "or" (print to the screen, to the printer, or to both). A circled plus sign is an exclusive "or" (abort the routine or don't abort the routine). Repetition is indicated by 1,*n*

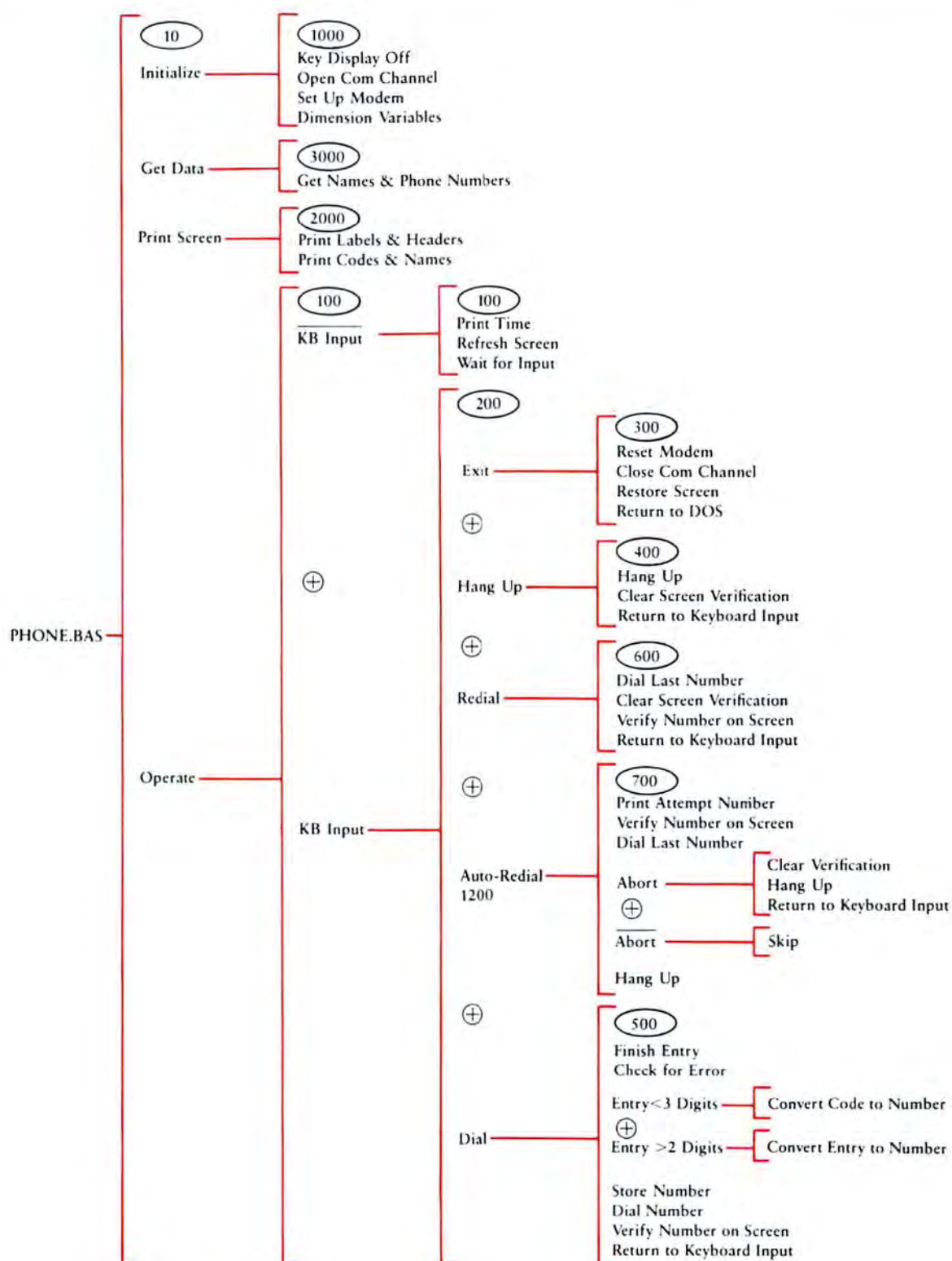
where *n* is the maximum number of repetitions. Orr developed additional conventions (e.g., for representing mathematical operations), but the set described above serves our purposes.

The beauty of this procedure is that a single diagram can immediately tell you the what, when, why, and how of a complete program. Reading the label informs you what function each operation performs. Reading the diagram from top to bottom tells you when operations are performed; reading the diagram from right to left tells you the purpose of each step; and reading the diagram from left to right tells you how to do things.

In the Warnier-Orr diagram of PHONE.BAS, for example, the sequence of events is initialize, get data, print screen, and finally operate. Reading from left to right, you can see that to initialize you must turn the key display off, open a communications channel, set up the modem, and then dimension your variables. If you need to know why you are printing the time, refreshing the screen, and waiting for input, by reading from right to left you can see it's because there has been no keyboard input.

Notice that up to this point nothing has been said about BASIC or any other programming language. Warnier-Orr diagrams

(continues)



Warnier-Orr diagram for PHONE.BAS

Warnier-Orr Diagrams

are language independent. They show the structure of a program and can be implemented in any language.

Strictly speaking, the numbers in the ovals in this diagram are not part of a Warnier-Orr diagram; they are part of what Orr calls the physical implementation of the diagram. These are the line numbers of PHONE.BAS. The initialization routine, for example, begins in line 1000 of Listing 1, the auto-redial routine begins in line 700, and control of the basic structure of PHONE.BAS begins in line 10.

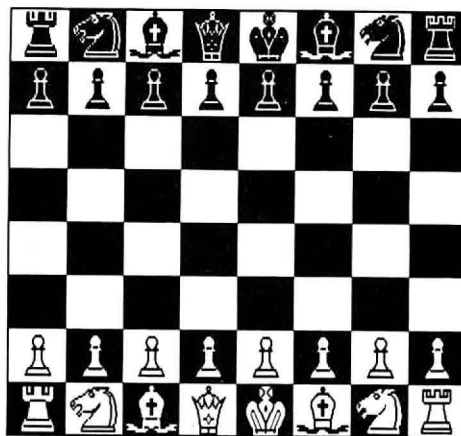
A few experiences with Warnier-Orr programming can produce something akin to a religious conversion. I wrote PHONE.BAS before I knew of this approach to programming, so I decided to revise the program for publication by using Warnier-Orr techniques. Although I was sure I had originally written tight, nonredundant code, application of the Warnier-Orr techniques produced a 23 percent reduction in active program size. An additional benefit is that the program runs better and faster than before.

Many introductory programming texts solemnly inform you that programming should begin with flow charts. Few experienced programmers bother with them, however; they are most frequently used only as expedient devices to impress management. Unlike flow charts, Warnier-Orr diagrams are genuine design tools that can dramatically reduce programming time and effort and improve programs.

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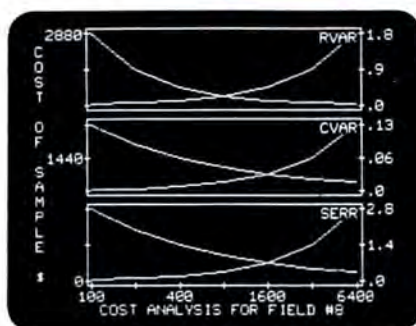
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Karl Koessel

In this month's column we discuss GRAPHICS.COM, the DOS 2.00 external command that gives <Shift>-<PrtSc> (Print Screen) the ability to print graphics display screens on a compatible dot matrix printer, and how to call WordStar so it will automatically open a file for editing. We also have a reader who is looking for a PC-compatible keyboard that has separate cursor control and number pad keys, and another reader who requests the Escape sequences that control his printer's functions to be translated into character strings.

GRAPHICS.COM

Q. *Could you explain how the DOS 2.00 GRAPHICS command works? The manual says that it can be used to print text mode screens, but I get the same output when I use the <Shift>-<PrtSc> (Print Screen) keys without the GRAPHICS command. Also, I don't get a good copy of the screen. For example, I made a double-line box (using ASCII characters 200, 201, etc.), but when I printed it, I got a single-line box. Is the IBM printer not really compatible with the screen?*

One last question. If I use a BASIC program to create a screen, how am I supposed to return to DOS to issue a GRAPHICS command without muddling the screen with a lot of typing?

Michael Trombetta
Manhasset, New York

A. When given the command [d:path]GRAPHICS, DOS searches the (specified) directory for the file GRAPHICS.COM. When found, this file adds instructions to DOS, increasing the resident (in memory) size

of DOS by 688 bytes. These added instructions remain in memory and enable a PC equipped with a color graphics board to print the contents of a graphics mode screen on a compatible dot matrix printer.

In the medium-resolution (320 by 200) color graphics mode, the contents of the screen are printed using different shades of gray to represent the four possible screen colors. In the high-resolution black and white graphics mode, the contents of the screen are printed sideways with the upper-right corner of the screen printed on the upper-left corner of the paper. These graphics mode screen dumps may take as long as 3 minutes.

The DOS 2.00 manual does not say that the GRAPHICS command can be used to print text mode screens. The manual says, "If the screen is in text mode, the text is printed in under 30 seconds." What the manual means is that the graphics mode screen printing instructions are not used for, nor do they interfere with, the operation of <Shift>-<PrtSc> for text mode screens.

In text mode <Shift>-<PrtSc> has the PC send the printer the ASCII codes for the characters on the screen. But the characters that the PC displays on the screen for codes below 32 or above 126 differ from the printer's.

Also, <Shift>-<PrtSc> does not have the PC send the codes that determine the characters' screen attributes (intensify, blink, underline, and invert character for text mode on the monochrome display, and character color and cell color for text mode on the color display). Therefore, it is true that the IBM printer (or any

other printer) cannot reproduce all of what the PC's text mode screen is capable of displaying.

If you are going to do graphics screen dumps from BASIC, you should issue the GRAPHICS command to DOS before you enter BASIC.

Skiping WordStar's Opening Menu

Q. *I use an AUTOEXEC.BAT file to set the date and time, create an emulated disk, and call WordStar. Is there a way I can use AUTOEXEC.BAT to run through to the point of opening a document file for editing (the D command of WordStar's Opening Menu) or even to the point of opening a specific file for editing? I tried adding the file name of the file to be edited to the end of the batch file, but this did not work.*

Percy W. Brower, Jr.
Birmingham, Alabama

A. WordStar will open a specific file for editing when the DOS command WS is followed by the name of the file you wish to edit. For example, A>WS yourfile <ENTER> will call WordStar, skip WordStar's Opening Menu, and open yourfile for editing. If you replace the WS command of your AUTOEXEC.BAT file with the command WS yourfile (as just one line of your batch file), your batch file will always open yourfile for editing. However, I wouldn't recommend this; using the same file name for all your word processing will inevitably lead to problems.

I suggest that you use a batch file parameter instead of a specific file name. Because an AUTOEXEC.BAT file will automatically execute when the PC is turned on, you will not be

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Reader Service #193

The Help Screen

able to supply the batch file with a value (in this case the name of the file you wish to edit) to be used in place of the parameter. Therefore, you need to rename the AUTOEXEC.BAT file. Let's name it PWS.BAT for Percy's WordStar batch file. Now replace the batch command WS with WS %1 (%1 is the parameter).

PWS.BAT is now ready. Simply answer the DOS prompt with PWS *filename* where *filename* is the name of the file you wish to edit. When the batch file executes the WS %1 command, it will replace %1 with *filename*, display A>WS *filename* on the screen, call WordStar, and open *filename* for editing.

You can learn more about the power of using parameters in batch file commands from the section called Batch Processing (now called Batch Commands for DOS 2.00) in the chapter on DOS commands in the DOS manual.

Number Pad vs. Cursor Keys

Q. As a happy PC owner, I have only one major complaint and it has to do with the keyboard; more specifically, the combined number pad and cursor control keys. It turns out that most number entries also involve a lot of cursor movement. I finally gave up and use the numbers in the top row of the keyboard. This was perhaps acceptable in competition with the old Apples and TRS-80s, but it isn't now. It is particularly galling if you are used to the convenience of using the number pad by touch. Do you know of anyone who makes a keyboard that is compatible with the IBM PC and separates these two functions?

*John Black
Camarillo, California*

A. The <NumLock> toggle key has caused a lot of grief, and even the third-party keyboards that have little red indicator lights on the toggle keys are not much help for those who use the number pad by touch. Several software companies are preparing to release programs that use a mouse to control cursor movement (see "To Build a Better Mouse," Lisa B. Stahr, PCW, Vol. 1, No. 2). The mouse may be just the answer to your problem. As for an IBM PC-compatible keyboard that separates the cursor keys and the number pad, no, I don't know of any. If any readers are aware of such, please drop a line to The Help Screen. One possible solution I can suggest, however, is to use a keyboard redefinition program such as ProKey or Keynote to redefine four of the function keys as cursor controls. You'd probably have to find some keys to hold those function keys' previous meanings, but you would free up the numeric keypad for data entry.

Meanwhile, I am told that many people don't realize that they don't have to use the <NumLock> key to access the number pad. Simply hold down the <Shift> key with your left hand while you use the 11 white keys on the right end of the keyboard. They will behave as a number pad. Let the <Shift> key up, and the keys perform their cursor control functions.

Escape Codes Demystified

Q. A year ago I purchased my IBM PC from a ComputerLand in Phoenix. I also purchased a C. Itoh letter quality printer, model FP 1500-45. The book that came with the printer

spoke of Escape codes, but because I am not a programmer, these codes might as well be in Greek. I went back to ComputerLand for assistance in learning how to control the printer (i.e., bidirectional printing, underlining, boldface, etc.). I assumed that they could provide me with LPRINT CHR\$ commands that would allow me access to the functions. The salesman stated that he had no other books or knowledge regarding the C. Itoh printer and thus could not help me. I then contacted the distributor, Leading Edge, in Massachusetts and explained my dilemma. They too were sorry and did not know what LPRINT CHR\$ codes would operate the printer; they only knew ESC codes and could not tell me the exact method to use to activate the functions.

I am totally frustrated. When I use WordStar, all the above modes are functional, yet in trying to do programming and wanting some control over the printer, I am at a total loss.

*Eddie L. Redman
Phoenix, Arizona*

A. When trying to do programming, one must do as the Romans do—speak Greek. All kidding aside, it's not that difficult. But, if you want to have some control over the printer, you need to read the book that comes with the printer.

Before we get into CHR\$ and Escape codes, let's reflect upon the positions of the parties you've mentioned. Salespeople are generally very helpful before you give them your money. But only you know whether you have learned what you wanted to know about the operation of the equipment you intend to purchase.

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The Help Screen

You can't really blame the distributor for being ignorant of the syntax of your particular computer, which is probably one of hundreds that can use the printer.

Now get your printer's manual. The printer's functions are controlled by sending the printer a sequence of characters. The C. Itoh manual divides these functions into two categories: function codes and Escape sequences.

The function codes are simple. For example, to make the printer backspace, you use a function code of 8 such as LPRINT CHR\$(8). You should have no problem learning your printer's function codes as long as you don't confuse decimal and hexadecimal values.

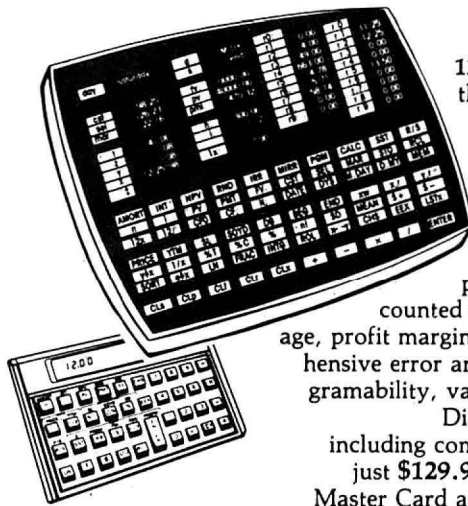
The Escape sequences are just as easy. They are called Escape sequences because they are strings (sequences of ASCII character codes) that begin with CHR\$(27), the ASCII value for the control character ESC (see Appendix G, pages G-1 and G-2 of the BASIC manual). For example, to do a half-line feed down, you use an Escape sequence of ESC D.

LPRINT CHR\$(27) "D"
will do half a line feed. You will also get the same results from
LPRINT CHR\$(27) CHR\$(68)

One last point. The C. Itoh printer you have does not directly support boldface printing. To accomplish this you will have to backspace and reprint. ●

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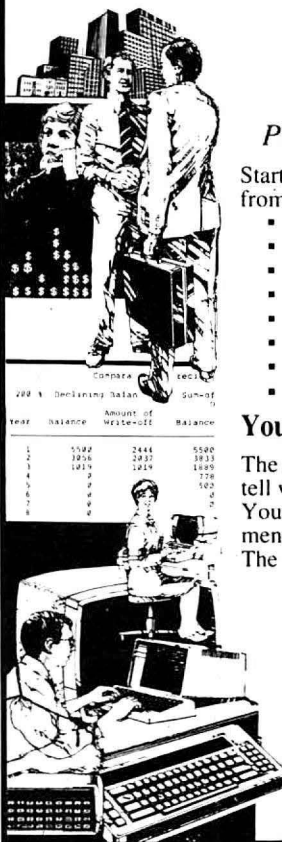
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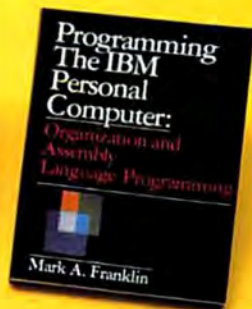
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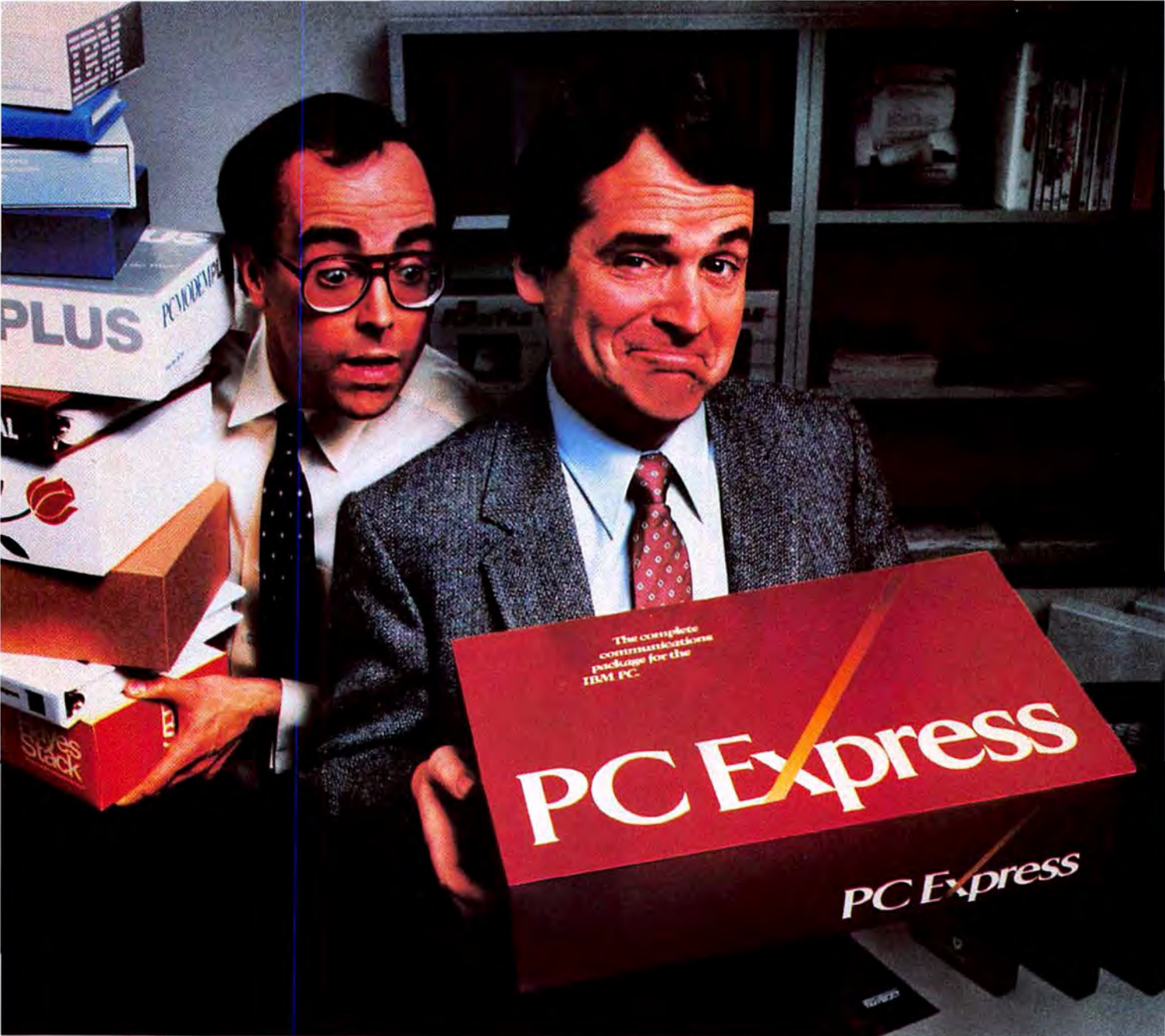
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. Star-Dot-Star

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Edited by Andrew Fluegelman

This department continues to grow in popularity, judging from both our fan mail and the increased number of contributions. We'll keep expanding the space devoted to *.* as long as we receive encouragement to do so.

We've noticed that some of the recent submissions represent "discoveries" that may have already been discovered by other users, but which are very useful. Since there are tens of thousands of new PC users each month, we think it's worthwhile publishing tips that may be old hat to more experienced users.

If you consider yourself a novice PC user, we encourage you to read through these submissions. You'll discover some good advice from users who were novices just a month or so ago. And for the veterans, we'll continue to publish tips that delve deeply into the PC's hidden quirks and treasures.

Our lead item this month does delve deeply but can be put to good use by everyone. It's the latest installment of "The CapsLock Saga," that continuing search for the perfect remedy for the lack of indicator lights on the PC's much maligned keyboard.

Keyflags

I noted in the *.* item "Flip Lock" [*,*, PCW, Vol. 1, No. 4] the complicated approach to the <CapsLock> and <NumLock> problem and came up with the following alternative. KEYFLAGS is a .COM program that intercepts INT 09H (the ROM keyboard routine) and samples the <CapsLock> and <NumLock> flags to see if they are toggled. If they are it displays on the top row of the screen at columns 78 and 79 the symbols @ and # respectively if <CapsLock> or <NumLock> has been toggled. This placement inte-

grates well with the WordStar ruler-line prompts. You could, of course, display the flags anywhere since that feature is under your control; they could also be displayed in any attribute. I've chosen to display them as highlighted. To keep the flags displayed when the screen scrolls, the status is refreshed after every keyboard call.

I have had no problem with this program. It has been tested with BASIC, WordStar, EasyWriter II, VEDIT, and ProKey (though it should be installed after ProKey is installed) and with my virtual disks (those from AST as well as the device driver version installed from DOS 2.00). I put it in an AUTOEXEC.BAT file for installation.

Morton Kaplon

Pomona, New York

You can create KEYFLAGS.COM on your system even if you don't understand how it works. Carefully type and run the BASIC program reproduced in listing "KEYFLAGS.BAS". The program will indicate whether you have successfully created the .COM file and whether there is an error in your DATA statements. For those interested in assembly language programming, the .ASM file for the program is reproduced in listing "KEYFLAGS.ASM."

We found that KEYFLAGS does not mix well with 1-2-3, which does its own monitoring of the keyboard and displays its own keyflags. You should also be careful not to edit the top line of a program when using BASIC; otherwise you'll include the flag symbol in the line and corrupt it beyond repair. Until some reader contributes an "unflag" program, your best bet if you need to get rid of the flags is to reboot.

Mine Field

The program reproduced in listing "MINE.BAT" is for all the readers who plow through mountains of technical information and need the relief of a short game that can be typed into the computer in a few minutes. Here it is.

Name: Mine Field

Object: To proceed as far as possible through the mine field. Your score, which is equal to the number of the mines passed, is kept on the lower-left corner of the screen.

Instructions: You are represented by a down arrow on the screen. Its movement is controlled manually by using the <CursorLeft> and <CursorRight> keys on the numeric keypad. <CursorLeft> moves you one space to the left every time the key is pressed, and <CursorRight> moves you one space to the right.

The mines are represented by stars. The game ends when you collide with a mine. Good luck.

Jean Pickett

Trenton, New Jersey

To start the game, choose the mine field density on a scale from 1 to 10. The game slows down as the density increases, but you'll need all the help you can get.

Wild Card TYPE

The DOS TYPE command doesn't accept wild cards (* or ?). To get around this, you can use the COPY command, which does accept wild cards, to copy the file(s) to the screen. Use this format:

COPY filename CON:

in which you supply the file name,

TITLE TFR24C70.ASM

PAGE 60 ,132

```
;
; This program intercepts the ROM KB interrupt 09H ( Tech
; Manual, A-25, line 1784 ) and tests every KB entry to see
; whether CapsLock or NumLock has been toggled. If CapsLock was
; toggled it displays the symbol @ ,and if NumLock was toggled
; it displays the symbol # both in enhanced video. The location
; of the display is determined by the Equates for row and
; columns respectively for the two flags, and the display
; format is determined by the equate DF for the attribute.
; The status is determined from the flag KB_FLAG of the ROM
; ( TM,A-2, line 69 is location ).
;
;
; This version displays flags after every KB use at row 00, col 78.
;
;
; *** Define Constants Used by Program ***
;
KB_DATA EQU 060H ;8259 Port with KB scancode
KB_CTL EQU 061H ;8259 Port with Control data for port
ROWCAPS EQU 00 ;Row for Caps Display(0-24)
COLCAPS EQU 78 ;Column for Caps display(0-79)
ROWNUMS EQU 00 ;Row for Nums display
COLNUMS EQU 79 ;Column for Nums Display
DF EQU 15 ;Normal Intensified Display format
;
; ***** MACRO SECTION *****
IF1
CSR_SET MACRO ROW,COL ;Sets CSR Pos. on PGE 0
MOV DH,ROW ;sets row
MOV DL,COL ;sets col
MOV BH,0 ;sets pge
MOV AH,2 ;ROM BIOS VIDEO function
INT 010H ;ROM BIOS VIDEO Interrupt
ENDM
CSR_GET MACRO ;Return CSR Pos. on PGE 0
MOV BH,0 ;(DH,DL)=ROW,COL returned
MOV AH,3 ;Function in ROM BIOS Video
INT 010H ;ROM BIOS VIDEO Interrupt
ENDM
ROMVIDEO MACRO CHR,NO_TIMES,ATTR ;INT 10,Fn.10,Disp.Char.at
MOV BH,0 ;current Cursor Pos.BH=Page
MOV AL,CHR ;Char. to be displayed
MOV CX,NO_TIMES ;Char.count
MOV BL,ATTR ;Screen attribute,7normal,15 enhanced
MOV AH,9 ;Function call
INT 10H ;ROM VIDEO Interrupt
ENDM
ENDIF
;
DATA SEGMENT AT 40H ;ROM DATA,TM, A-2,line 59
```

(continues)



```

        ORG      17H                      ;Location in ROM of
KB_FLAG LABEL BYTE                      ;KB_FLAG(see A-2 of Tech Man)
DATA     ENDS

;
CSEG     SEGMENT
        ASSUME  CS:CSEG, DS:DATA
;
        ORG      100H
;
;The block of code below directs interrupt 9H to 5CH in Program Prefix
;rather than the usual location in ROM
;
START:   MOV     DX,5CH                  ;Set DS:DX to locn 5CH in program prefix
        MOV     AL,9H                   ;Set the KB interrupt (9H=9)
        MOV     AH,25H                  ;DOS function call for interrupt
        INT     21H                     ;DOS interrupt for service
        MOV     DI,DX                   ;Move KB routine down so it starts
        MOV     SI,KB_ADDR              ;At locn 5CH in program prefix
        MOV     CX,KB_LNTH              ;This sets count in CX for MOVSB at FINISH
        JMP     FINISH                  ;to include just operative code resident.
;
;KB Interrupt routine. Copy beginning of ROM routine to allow easy
;jump to later ROM code. Copy code from TM, A-25, line 1788(line 1787
;is inserted just before ports are sampled) to line 1808.
;
KB:       PUSH    AX                    ;Save registers used
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    SI
        PUSH    DI
        PUSH    DS
        PUSH    ES
        CLD
        MOV     AX,DATA
        MOV     DS,AX
        STI
        IN      AL,KB_DATA              ;Get key code
        PUSH    AX
        IN      AL,KB_CTL                ;Restore KB
        MOV     AH,AL
        OR      AL,80H
        OUT     KB_CTL,AL
        XCHG    AH,AL
        OUT     KB_CTL,AL
        POP     AX
        MOV     AH,AL                    ;Save keycode
;
;End of copied ROM code. Start own code.(The part of ROM code that follows
;this is just that part which handles the KB interrupt 10H,which is what
;the DOS KB interrupts use.
;
        CMP     AL,OFFH                  ;Overrun?Line 1812 of ROM
        JZ      INTERIM                  ;Resting place for Near Jump

```

KEYFLAGS.ASM (continued)

```

;***** Start of Operable Code *****
;
;**** Routine to Test for Caps Lock and Nums lock Toggle****
PUSH    AX                ;Save registers not saved by Video Int
PUSH    DI
PUSH    SI
MOV      BL,KB_FLAG        ;Status to BL
AND      BL,60H            ;Sets bits for both on
CSR_GET                ;need to save cursor
MOV      CS:ROWSAVED,DH    ;Save cursor locations
MOV      CS:COLSAVED,DL
CMP      BL,60H            ;see if both on, if not then
JNE      TRY1              ;to test for CAPS only on
CSR_SET  ROWCAPS,COLCAPS   ;both on, display
ROMVIDEO ' ',1,DF
CSR_SET  ROWNUMS,COLNUMS
ROMVIDEO '#',1,DF          ;both now displayed
JMP      HOME              ;exit
INTERIM:JMP  ROM_KB        ;needed for near JZ above
TRY1:    CMP      BL,40H    ;is Caps alone on?
JNE      TRY2              ;if not, test for nums only
CSR_SET  ROWCAPS,COLCAPS   ;display just caps only
ROMVIDEO ' ',1,DF
CSR_SET  ROWNUMS,COLNUMS   ;and blanks for nums
ROMVIDEO ' ',1,DF
JMP      HOME              ;exit
TRY2:    CMP      BL,20H    ;see if just nums on
JNE      BOTH_OFF          ;if not, both off
CSR_SET  ROWCAPS,COLCAPS   ;blank for caps
ROMVIDEO ' ',1,DF
CSR_SET  ROWNUMS,COLNUMS   ;and Nums is on alone here
ROMVIDEO '#',1,DF
JMP      HOME              ;exit
BOTH_OFF: CSR_SET  ROWCAPS,COLCAPS
ROMVIDEO ' ',1,DF          ;blank caps spaces
CSR_SET  ROWNUMS,COLNUMS   ;blank nums spaces
ROMVIDEO ' ',1,DF
HOME:    CSR_SET  CS:ROWSAVED,CS:COLSAVED
HOME0:   ;no change if here,exit
POP      SI                ;restore registers
POP      DI
POP      AX
;
ROM_KB:  MOV      AH,AL
JMP      FAR PTR ROM_ADR ;To ROM for processing
;
FINISH:  REP      MOVSB
MOV      DX,DI              ;End program but leave KB resident
INT      27H                ;DOS call for stay resident

```

(continues)



```

;*****Memory for CS must go here and be addressed CS:*****
;
ROWSAVED      DB      ?      ;Row position from DH
COLSAVED      DB      ?      ;Col position from DL
;
KB_END:
;

CSEG          ENDS
;
ROM           SEGMENT AT 0F000H      ;ROM BIOS KB entry points
              ASSUME  CS:ROM
              ORG     0E9A8H        ;This is line 1812 on A-26 of TM
ROM_ADR LABEL FAR                  ;Perform all but initial processing
ROM           ENDS
;
KB_ADDR EQU    (OFFSET KB-OFFSET START)+100H
KB_LNTH EQU    (OFFSET KB_END-OFFSET KB)
;
              END      START

```

KEYFLAGS.ASM (continued)

which can contain wild cards. CON: stands for console; in DOS the console represents the screen for output or the keyboard for input. When this command is issued, all applicable files are printed on the screen, each preceded by a line showing the file's name.

To make this method more convenient, you may want to make a batch file. To represent the first argument to a command in a batch file, DOS uses the variable %1. Thus, you could make a batch file like this:

```
COPY %1 CON:
and call it XTYPE.BAT. Now all you
have to type is
XTYPE filename
```

*Manny Farber
Landenberg, Pennsylvania*

BASIC Unprotect

This series of commands will let you list a program that has been saved with the 'p' option. From DOS type BASICA or BASIC. Once in BASIC type in NEW <ENTER>; then type DEF SEG <ENTER>. Now type BSAVE "UN.P",1124,1 load the protected program; and type BLOAD "UN.P",1124 Now feel free to LIST, SAVE, or EDIT the protected program. To protect a program before saving it type DEF SEG:POKE 1124,255

*Marc-David Seidel
Roslyn, New York*

COMPAQ Clicks

A quick tip to fellow COMPAQ users. Although the key-click volume control commands in the COMPAQ Operations Guide do not work (<Alt>-<GrayPlus> and <Alt>-<GrayMinus>), using the <Ctrl> key in the sequence will have the desired effect. Use <Ctrl>-<Alt>-<GrayMinus> to decrease the key-click volume one step and <Ctrl>-<Alt>-<GrayPlus> to increase the volume. COMPAQ Computer Corp. please take note.

*Robert Rosenbloom
Dallas, Texas*

```

5 ' Run this program and create the file KEYFLAGS.COM
10 CRE$="KEYFLAGS.COM"
15 DEFINT A-Z: DIM A(16): ON ERROR GOTO 85
20 DEF FNHVAL(X$)=VAL("&H"+X$)
25 KILL CRE$
30 OPEN CRE$ AS #1 LEN=1: FIELD #1,1 AS A$
35 PRINT "Building file "; CRE$; "...
40 READ LENFIL: LIN=101
45 WHILE CHKLEN<LENFIL
50 FOR I=1 TO 16: READ X$: A(I)=FNHVAL(X$): CHK=CHK+A(I): NEXT
55 READ CHK$: IF FNHVAL(CHK$)<>CHK THEN 80
60 FOR I=1 TO 16: LSET A$=CHR$(A(I)): PUT #1: NEXT
65 LIN=LIN+1: CHKLEN=CHKLEN+16: CHK=0
70 WEND
75 CLOSE: BEEP: PRINT CRE$; " successfully created.": END
80 CLOSE: BEEP: PRINT "DATA ERROR IN LINE "; LIN: END
85 IF ERL=25 THEN RESUME 30
90 ON ERROR GOTO 0
100 DATA 330
101 DATA BA,5C,00,B0,09,B4,25,CD,21,8B,FA,BE,16,01,90,B9,739
102 DATA 34,01,90,E9,2C,01,50,53,51,52,56,57,1E,06,FC,B8,5A6
103 DATA 40,00,8E,D8,FB,E4,60,50,E4,61,8A,E0,0C,80,E6,61,8B7
104 DATA 86,E0,E6,61,58,8A,E0,3C,FF,74,50,50,57,56,8A,1E,813
105 DATA 17,00,80,E3,60,B7,00,B4,03,CD,10,2E,88,36,48,02,55B
106 DATA 2E,88,16,49,02,80,FB,60,75,34,B6,00,B2,4E,B7,00,608
107 DATA B4,02,CD,10,B7,00,B0,40,B9,01,00,B3,0F,B4,09,CD,640
108 DATA 10,B6,00,B2,4F,B7,00,B4,02,CD,10,B7,00,B0,23,B9,654
109 DATA 01,00,B3,0F,B4,09,CD,10,E9,9D,00,E9,AD,00,80,FB,6F4
110 DATA 40,75,31,B6,00,B2,4E,B7,00,B4,02,CD,10,B7,00,B0,64D
111 DATA 40,B9,01,00,B3,0F,B4,09,CD,10,B6,00,B2,4F,B7,00,5C4
112 DATA B4,02,CD,10,B7,00,B0,20,B9,01,00,B3,0F,B4,09,CD,620
113 DATA 10,EB,65,90,80,FB,20,75,31,B6,00,B2,4E,B7,00,B4,752
114 DATA 02,CD,10,B7,00,B0,20,B9,01,00,B3,0F,B4,09,CD,10,57C
115 DATA B6,00,B2,4F,B7,00,B4,02,CD,10,B7,00,B0,23,B9,01,645
116 DATA 00,B3,0F,B4,09,CD,10,EB,2F,90,B6,00,B2,4E,B7,00,673
117 DATA B4,02,CD,10,B7,00,B0,20,B9,01,00,B3,0F,B4,09,CD,620
118 DATA 10,B6,00,B2,4F,B7,00,B4,02,CD,10,B7,00,B0,20,B9,651
119 DATA 01,00,B3,0F,B4,09,CD,10,2E,8A,36,48,02,2E,8A,16,463
120 DATA 49,02,B7,00,B4,02,CD,10,5E,5F,58,8A,E0,EA,A8,E9,78F
121 DATA 00,F0,F3,A4,8B,D7,CD,27,00,00,00,00,00,00,00,4DD

```

KEYFLAGS.BAS



```

10 DEFINT A-Z:WIDTH 40:KEY OFF:M=1
20 S=20:T=-18:CLS
30 LOCATE 2,1:INPUT "Minefield density (1-10):",M$
40 IF VAL(M$)<>0 THEN M=VAL(M$)
50 COLOR 3,0:LOCATE 23,1:PRINT "|";:LOCATE 23,39:PRINT "|"
60 COLOR 6,0:FOR I=1 TO M:X=RND*36+2:LOCATE 23,X:PRINT CHR$(15);:NEXT
70 T=T+1:LOCATE 25,1:PRINT T:I$=INKEY$
80 IF I$=CHR$(0)+CHR$(77) THEN S=S+1:SOUND 1000,.5 ELSE IF
    I$=CHR$(0)+CHR$(75) THEN S=S-1:SOUND 1000,.5
90 P=SCREEN(5,S):IF P<>32 AND P<>0 THEN 110
100 COLOR 4,0:LOCATE 5,S:SOUND 200,.5:PRINT CHR$(25):GOTO 50
110 IF S>5 THEN S=S-5
120 COLOR 5,0:LOCATE 5,S:PRINT "<<< ZAP! >>>";
130 FOR X=1000 TO 1900 STEP 100:SOUND X,.5:NEXT
140 FOR X=1 TO 10:SOUND 500,.5:SOUND 1000,.5
150 FOR DV=1 TO 100:NEXT DV:NEXT X
160 LOCATE 25,1:COLOR 0,7:PRINT "SCORE:";T;:COLOR 7,0
170 LOCATE 24,1:WHILE INKEY$<>"":WEND
180 PRINT"Press 'P' to play again...";
190 Q$=INKEY$:IF Q$="" THEN 190
200 IF Q$="P" OR Q$="p" THEN 20 ELSE END

```

MINE.BAS

Another Set of WordStar Patches

In the past *. * [PCW, Vol. 1, No. 1, 2, 4, and 6] has provided patches that are extremely helpful in modifying *WordStar* for your custom applications. Here are a few other hints.

Few people know how easy it is to alter the contents of *WordStar* messages provided on the menus. This requires using *DEBUG* in the ways described in *PC World* [Vol. 1, No. 2 and 3]. Most of the messages provided on the *WordStar* menus are contained in file *WSMSG5.OVR*. Just use *DEBUG* to dump (using the D command) the contents of each menu and then change the contents accordingly. For example, typing D162B reveals the hex code for 'Other Ribbon Color' on the Print Menu. If you have patched the P^Y function on your printer for, say, italics, the words "Italics Font" can be substituted into the Print Menu by typ-

ing E162B and then entering the hex code for "Italics Font" (49_74_61_6C_69_63_73_20_66_6F_6E_74_20_20_20_20_20_20). The extra 20s (spaces) must be used to pad out the space previously occupied by the last four letters of 'Other Ribbon Color'. Similarly, typing D406 reveals the code for the opening menu, ridiculously entitled NO-FILE MENU. This can be changed to OPENING MENU (duplicating one of the changes on *WordStar* 3.3) by simply modifying the code.

Another secret of *WordStar* is that if the hex values of displayed characters in *WordStar* menus are changed appropriately, they can be made individually into boldface or normal-intensity characters. I patched my

WordStar to present normal type in normal intensity with blocks represented in high intensity. Intuitively, this seems better; however, one drawback is that the top screen banner (listing file name, page, line, and column numbers, as well as the INSERT ON message) is written entirely in high-intensity characters. This is visually distracting. Using the *DEBUG* techniques described above, you can set these messages in high or normal intensity. For example, I made PAGE, LINE, COL, and INSERT ON normal intensity using the following procedure:

Type *DEBUG WS0VLY1.OVR* (this file contains only a few of the *WordStar* messages). Typing D4320 reveals the hex code for PAGE, LINE, COL, and INSERT ON.

To alter the intensity attribute, find the hex value for each character

```

30000      '                REBOOT
30001      '      This routine will cause an IBM PC
30002      '      to execute a power-on reboot. This has
30003      '      been tested with both DOS 1.10 and 2.00.
30004 DEF SEG=&HF000:RB=&HE05B:CALL RB

```

REBOOT.BAS

when that character's ASCII value is added to 128. For example, standard *WordStar* contains the hex code 50_41_47_45_ for PAGE. Adding 128 to each character's ASCII values and taking the hex value yields D0_C1_C7_C5. These new values

can then be plugged in with DEBUG. I still haven't found the locations for ruler-line generation or for the file name, so perhaps another reader could pass these along.

Alan J. Fridlund
Pleasant Hill, California

BASIC Reboot

*The final item of *.* , contributed by Mark Anaker of Everett, Washington, is a BASIC one-liner that will cause a PC to execute a power-on reboot (see listing "REBOOT.BAS"). We're sure some reader will come up with a practical application for this intriguing program. ●*

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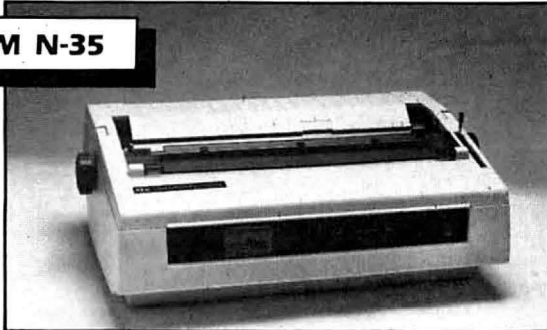
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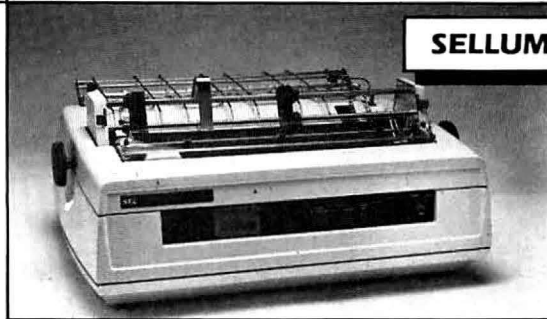


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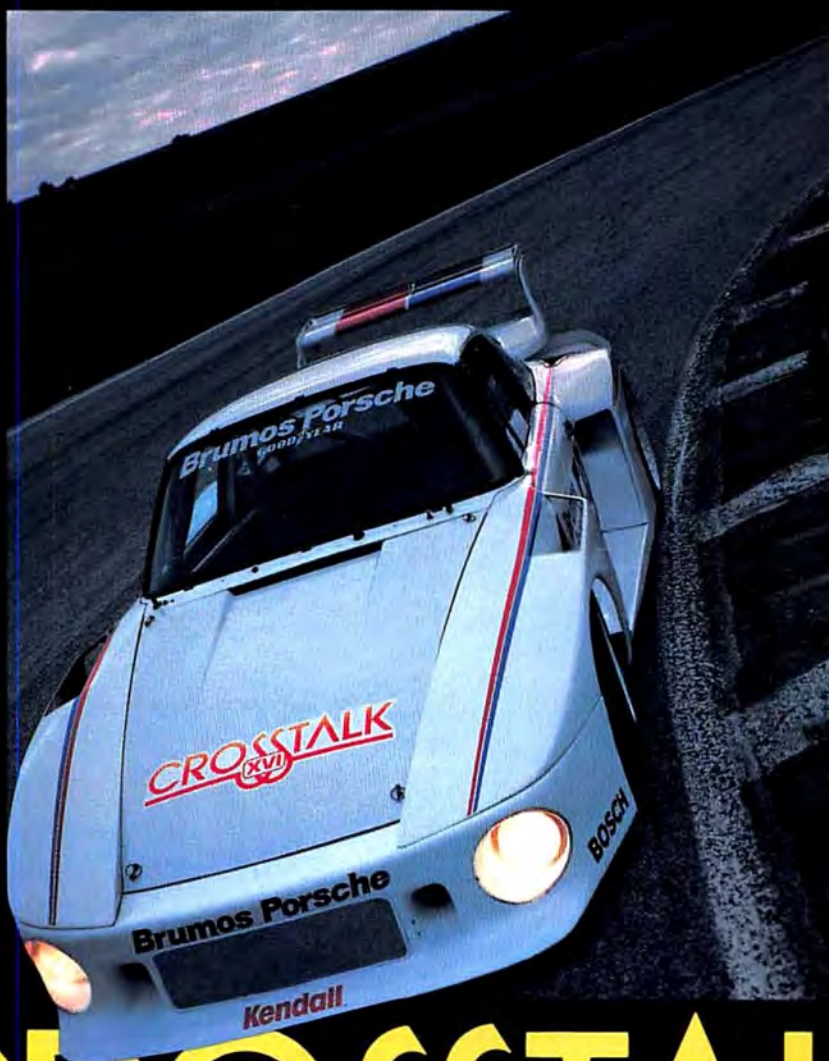
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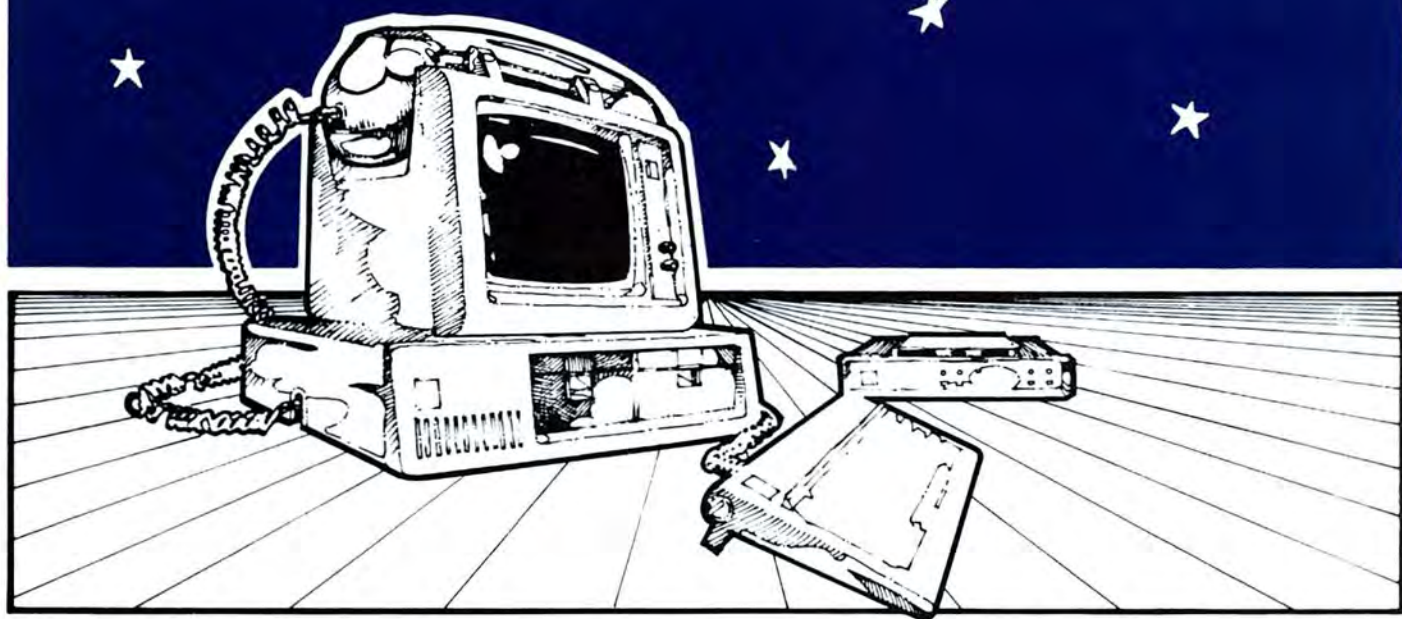
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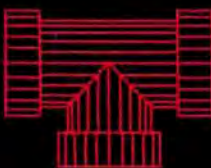
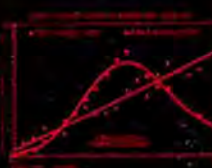



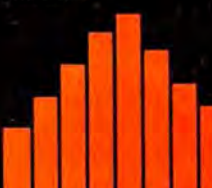


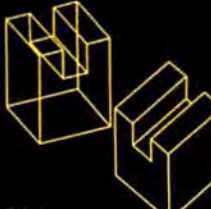

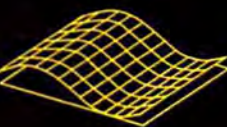

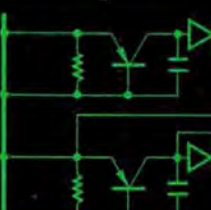
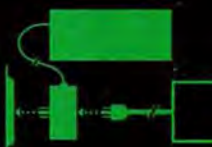

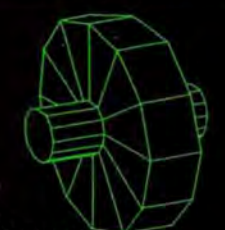




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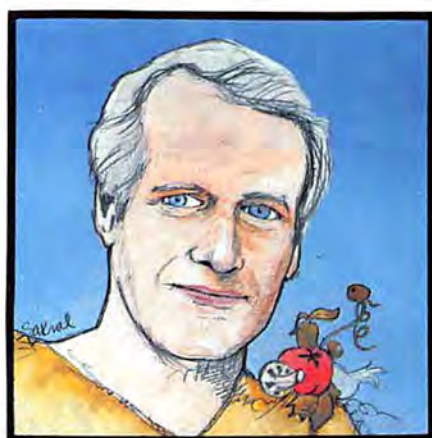
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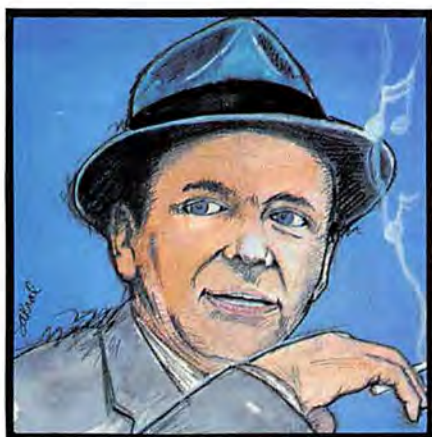
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The Fifth Generation

Mark Seligman

In recent years Japan has gained impressive market shares in several areas of trade, including steel, consumer electronics, and automobiles. It's about to happen again in the computer industry, say Edward Feigenbaum and Pamela McCorduck in their book, The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World. The authors claim that the latest Japanese challenge to United States supremacy must be met or "we may consign our nation to the role of the first great post-industrial agrarian society."

The Japanese national 10-year plan to take control of the computer industry began rolling in April 1982 with the aim of engineering the fifth computer generation. At issue is a potential revolution embodied in a new generation of computers that will transform the way we work.

The fifth generation already! For those not at all sure what the first four were, here's a rapid review. Digital computers need switches. In "on" position, the switches signify the number 1 or the logical value "true"; in "off" position, they stand for 0 or "false." When artfully arranged and interconnected, the switches make the computer compute. In the beginning vacuum tubes were used as switches. They were large, slow, and energy greedy. Second came the much smaller, faster, and more efficient transistors used as individual switches. In the third stage, hundreds or thousands of transistors—switches—were manufactured together in preplanned configurations as integrated circuits. In the fourth, comparable arrangements became microscopic in very-large-scale integrated circuits (VLSI).

The fifth generation will certainly bring continued shrinkage of switching elements. More important, in the Japanese view, will be the qualitative changes made practical by advances in computer hardware: generation five

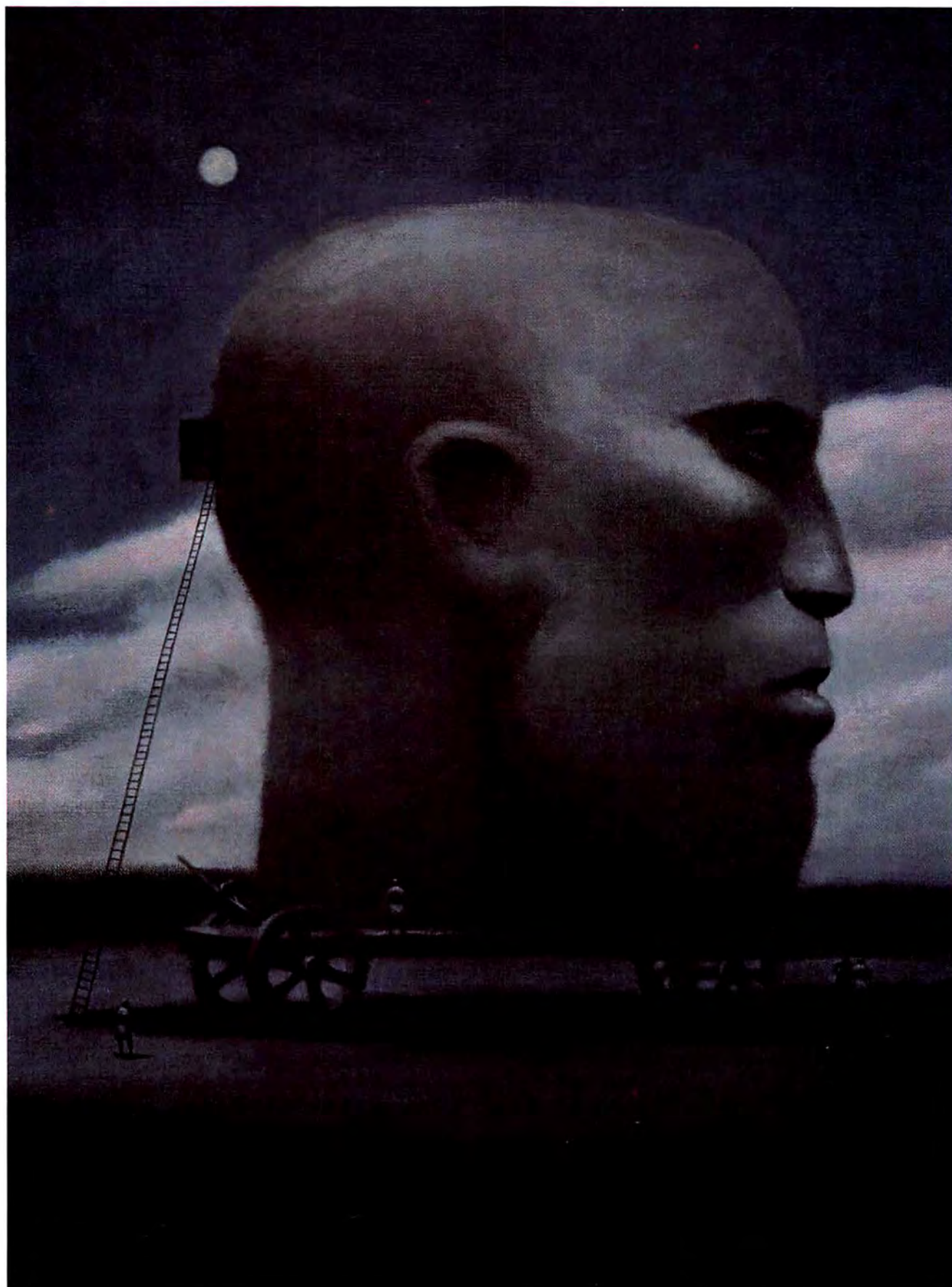
is to bring us supercomputers that run expert system software. The new systems will be conceptually as well as functionally different from the previous generations of computers. As the authors explain, the fifth generation "signals the shift from mere data processing, which is the way present-day computers function, to an *intelligent* processing of knowledge." Fifth-generation systems will be expressly designed to run artificially intelligent programs capable of performing tasks at a level comparable with human experts.

In introducing the reader to expert systems, Feigenbaum, a computer science professor at Stanford University, is playing a song he knows well. In 1965 he produced one of the first expert systems with colleagues

Generation five is to bring us
supercomputers that run expert
system software.

Joshua Lederberg and Carl Djerassi. *Dendral* is an expert system programmed to infer molecular structure when given data available to physical chemists. The program now makes the inferences more reliably than the chemists do and indeed more reliably than its designers.

In Feigenbaum's view, the *Dendral* program marked several significant changes in artificial intelligence research. After *Dendral*, expert system programs increasingly turned away from the ivory chessboard toward real-world problems. At the same time, consensus grew that for solving real-world problems expert systems



required more than abstract problem-solving techniques. Large quantities of real-world knowledge were also needed to develop expert systems.

Medically oriented expert systems contain the most prevalent type of real-world knowledge base. Medical diagnostic aids must be able to reason with method and efficiency; if the system doesn't know which symptoms indicate which diseases, it will reason about nothing, and no amount of cogitation will produce reliable diagnoses. The *Internist/Caduces* expert system at the University of Pittsburgh was designed as a diagnostic aid in internal medicine. Its knowledge base covers more than 500 diseases and 3500 symptoms of disease. To identify the specific illness of a patient, the physician provides the computer with lab test results and patient history, and the program begins to reason about possible diagnoses.

The computer acts as a consultant, asking the physician questions, suggesting tests when crucial information is missing, or explaining its line of reasoning. Diagnoses are accompanied by confidence ratings such as, "There is a 65 percent probability that the patient has bubonic plague," or explanations such as, "Spots before the eyes, ringing in the ears, and halitosis seen in combination could indicate either Tasmanian flu or bubonic plague; however, fuzzy tongue and itching behind the knees would eliminate Tasmanian flu."

Super Logicians

If expert systems already existed as far back as 1965, what are Feigenbaum and McCorduck talking about now? What are the Japanese doing that is so new or threatening? The Japanese are aggressively developing supercomputers optimized to run expert systems, and they are planning mass distribution of expert system use. The authors stress that whoever establishes superiority in knowledge technology will control the balance of world power, regulating both the cost and the availability of knowledge.

The fifth-generation computers envisioned by the Japanese will deal in symbols more than numbers, and with logical operations more than arithmetic ones. Appropriately, their logic processors will be the machine language PROLOG, a logic-oriented programming language developed in Europe. But again, these are to be supercomputers; they will be more powerful and much faster than their predecessors.

The speed of fifth-generation computers will be measured in logical operations per second. The Japanese are aiming for between 100 million and 1 billion operations per second (current speeds are measured in millions of arithmetic operations in the same span). However, the real power of these computers will be in their capacity to reason and expand the boundaries of human intelligence.

Expert Systems

Daniel Farber

Although the knowledge processing industry is still in its infancy, the authors of *The Fifth Generation* point out that expert systems and the knowledge processing technology required to build them had developed a basic framework by the late 1970s (see Figure 1). The main ingredient of an expert system is knowledge—data that has been selected and transformed into the substance of so-called intelligent machines. Feigenbaum and McCorduck explain that two types of knowledge are involved in forming a knowledge base: factual and heuristic.

Factual knowledge includes facts and opinions commonly accepted among experts in a given field such as law, medicine, or geology. Heuristic knowledge, on the other hand, is a more intuitive, trial-and-error type of knowledge that an expert gains through years of experience—knowledge that can't be garnered from the factual data of a textbook. Both types of knowledge are essential to forming an efficient knowledge base.

An expert system also requires a problem-solving strategy, or inference system designed to comprehend and manipulate the knowledge base and the specific problem data input into the system. An inference system provides a method by which lines of reasoning can be constructed using common, step-by-step logical structures such as syllogisms. Since real-world knowledge involves a great deal of imprecise knowledge, some inference systems have uncertainty factors built into them.

Of central importance in the design of an expert system are the way the knowledge base is represented as data structures in the computer and the

Since vast amounts of knowledge will be on file on the new computers, large memory banks must be available to accommodate it. Ultimately, the system should contain 1000 characters worth of knowledge on each of 100 million things—as much knowledge, by one estimate, as is contained in the *Encyclopaedia Britannica*. Tens of thousands of logical rules will be needed to sort through all that lore (e.g., if animal X has warm blood, has hair, and bears live young, then animal X is a mammal). Parallel processing will replace the one-step-at-a-time procedures of the standard von Neumann architecture of today's computers; jobs will be divvied up so that many subjobs can be in the works simultaneously.

way that knowledge base is accessed for problem solving. These tasks are performed by the knowledge engineers and programmers who design the programs that make up an expert system. Knowledge engineers elicit the knowledge from the minds of human experts, shape the knowledge so that programmers can transform it into viable program codes (knowledge bases), and create the inference systems that use a knowledge base to derive specific results.

Feigenbaum and McCorduck relate that acquiring knowledge from human experts poses a major problem in artificial intelligence research. An expert system is only as good as the knowledge represented in the computer. Currently, knowledge engineers must painstakingly extract heuristic knowledge from human experts through a series of interviews. The process of simulating an expert's thought process and erudition is costly and time consuming. Knowledge, like the human mind, is not easily defined; an expert may not be able to articulate clearly or formulate his or her knowledge in a hypothetical situation.

Knowledge engineers usually present a hypothetical problem to an expert as a way of focusing the knowledge acquisition process, but the situation may not bring out all contingencies. Expert systems in operation today are restricted to narrowly defined areas of expertise to maintain a high degree of problem-solving proficiency. Natural language communication between computers and humans must also be improved to allow for more in-depth exchange between programs and users.

Producing knowledge machines that few people can use will not revolutionize the world economy. The Japanese expect that use will be tremendously expanded if people can communicate with the systems in natural languages such as Japanese, English, or Swahili. Accordingly, researchers will put a major research effort into natural language processing.

The subject of natural language processing brings us to the folks at home. You'll be calling on expert systems whenever you need expert advice. According to Feigenbaum, personal computers powerful enough to support today's modest expert systems (about half a megabyte of

Illustration from *The Fifth Generation* by Edward A. Feigenbaum and Pamela McCorduck reprinted with permission from Addison-Wesley Publishing Co.

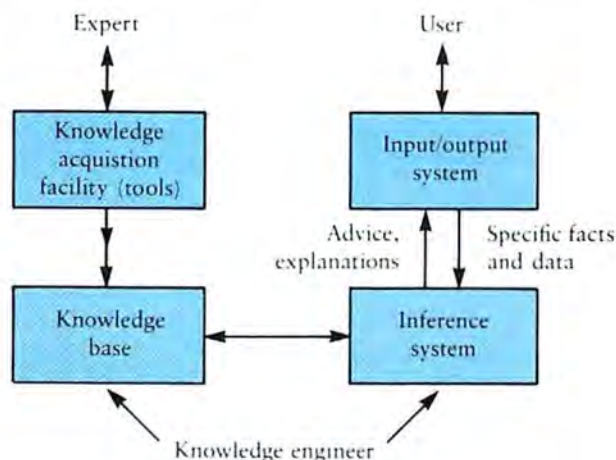


Figure 1: Basic structure of an expert system

Teaching computers to learn—to acquire knowledge independently—is another obstacle. Factors in the human thought process such as emotion, will, and the ability to use errors creatively are as yet beyond the capabilities of an expert system. A computer cannot be said to replicate an expert's knowledge exactly until these design problems are solved. Knowledge acquisitions research is exploring these critical issues in the hope of developing more comprehensive, automatic methods of creating expert systems.

memory) are already on the market—even without the Japanese. Home-oriented software should follow in 2 or 3 years.

Are your plants unaccountably turning yellow? Have you found that even your broker can't keep up with the latest money market options? Are you afraid of doctors and lawyers or too poor to call them in when you need them? Expert systems will be on call day or night, providing instant, specific solutions to your problems.

The Japanese, of course, have concerns beyond diagnosing plant diseases. Resource-poor, they must continually raise productivity to compete. They see working smart as the key, and expect intelligent computing to affect every area of their economy—and the world's.

● Community

An AI Potpourri

More than a report narrowly focused on Japanese enterprise, *The Fifth Generation* is a collection of short essays on the international climate in computational research on artificial intelligence in general, and expert systems in particular. No doubt the essay approach facilitated shared authorship, and it provides bite-sized chunks for easy reading. The format, however, allows a good deal of repetition to creep in and gives the feel of a work made up of pieces that still need to be assembled.

Still, many of the pieces are worth the price of admission. I approached *The Fifth Generation* hoping to find out what Japanese computer technologists are up to. I found out. I got a clear view of the nascent Institute for New Generation Computer Technology (ICOT), its driven director Kazuhiro Fuchi, and the 40 samurai charged with producing a miracle. I learned how the project was organized in the face of Japanese conservatism, how research is being flexibly structured, and how results are to be continually disseminated.

As for expert systems per se, while purposely avoiding details, the book provides a comprehensible introduction to the concepts involved. There is an informative account of the range of expert system applications, such as furnishing drilling advice on remote oil rigs, troubleshooting the design of integrated-circuit chips, helping to customize computer systems, analyzing DNA sequences, and heading off power-grid blackouts.

The real issue is whether humans can maintain a sense of worth as machines increasingly take over intellectual tasks.

How does the know-how get into the software? The authors describe how knowledge engineer H. Penny Nii elicits knowledge from human experts for incorporation into expert systems. To their credit, Feigenbaum and McCorduck are aware of the human side of this interchange; they describe the excitement and the awe of the expert who sees his or her knowledge transmitted piecemeal to a machine. On the other hand, they tell of the pain of the expert who comes to realize that hard won expertise can be reduced to a few hundred rules. "At first he was disbelieving," say the authors. "Then he was depressed. Eventually he departed his field, a chastened and moving figure in his bereavement."

Emotional and philosophical questions are unavoidable in an essentially popular work on "machines who think" (as McCorduck calls them). With some distaste, McCorduck takes on the overworked question of whether machines really can think. The real issue, she feels, is whether humans can maintain a sense of worth as machines increasingly take over intellectual tasks that only humans have done up to now. She quotes Edward Fredkin of MIT on this point: "Humans are okay. I'm glad to be one. I like them in general, but they're only human. It's nothing to complain about. Humans aren't the best ditchdiggers in the world—machines are. There were people whose thing in life was completely physical—John Henry and the steam hammer. Now we're up against the intellectual steam hammer. The intellectual doesn't like the idea of this machine doing it better than he does, but it's no different from the guy who was surpassed physically." McCorduck notes in the conclusion that the arguments adduced these days to prove computers incapable of thought are similar to those brought out a century ago against the intellects of women. Good point.

Whether or not computers can think, McCorduck, a New York-based science writer, apparently can. An engagingly grumpy presence throughout the book, she presents herself as a seasoned cookie who knew artificial intelligence in knee britches. Expressing a personal stake in the Japanese proposal to produce robot geriatric nurses, she made me smile.

Feigenbaum and McCorduck sometimes disagree, most explicitly on the social consequences of increasing the use of expert systems. Both are concerned about the economic and intellectual alienation of the computer illiterate. On balance, however, Feigenbaum expects people to see the way the wind blows and turn computation to their advantage, particularly as costs decrease. McCorduck is skeptical. The importance of print literacy has been recognized for centuries, she observes, and free books abound in public libraries—but illiteracy persists.

Misgivings

During a recent discussion with Feigenbaum, I asked him whether he anticipated legal problems when computers begin giving advice in earnest. "No," he said, there will always be "a human in the loop" taking full responsibility. Expert systems are designed to aid decision makers, not replace them, he insisted. But aren't expert systems sometimes intended to stand in for absent experts, reason more quickly than humans in the face of impending blackouts and meltdowns, or gather together expertise that no one person commands? We'll see.

Is the book's Paul Revere tone justified? Can the Japanese really turn the trick of producing a breakthrough? Feigenbaum and McCorduck examine the criticisms leveled at the fifth-generation project by the American artificial intelligence community—overemphasis on logic at the expense of alternative processing methods, and overemphasis on speed and memory capacity at the expense of software in general. Feigenbaum adds his own observation that where expert systems are concerned the Japanese are still wet behind the ears.

The conclusion, however, is that the fifth-generation project will have dramatic results even if the goals are only partly achieved. The Japanese have the equivalent of a well-supported and beautifully organized space pro-

The real power of these computers will be in their capacity to reason.

gram; they may not reach the moon in years, but in trying they stand to learn enough to undercut us in the knowledge processing industry, as they already have in other markets.

Feigenbaum emphasizes that his concern is not xenophobic but economic. (As a scientist, he says he could take a purely internationalist viewpoint.) In my view, his economic concerns are justified but may not go far enough. Even if we keep our share of high-tech markets, there's ample reason to fear that as automation gallops ahead (spurred on even faster by developments in artificial intelligence and robotics) unemployment will remain a serious problem. It will be small comfort to the American unemployed if the elite who do have jobs are American as well as Japanese. The problem isn't simply the international distribution of jobs—it's the distribution of jobs, period. Feigenbaum and McCorduck hope that knowledge-related employment will take up the slack left by the automation of manufacturing and paper shuffling. I hope so too.

A Call to Arms

What's going on outside Japan? *The Fifth Generation* devotes considerable space to the infighting and stodginess that robbed England of an early lead in the field of artificial intelligence. Research carried out by other Europeans is treated rather sketchily, and the Soviet Union is fairly written off as hogtied by ideology.

Is the United States responding effectively to the Japanese challenge? No, say the authors. The Microelectronics and Computer Technology Corporation (MCC), a research consortium with participation by such firms as DEC, Control Data, and Honeywell, is probing the issues, but antitrust laws limit the extent of the cooperative research allowed and effectively prohibit the participation of giants like IBM, Hewlett-Packard, and Texas Instruments.

Now under consideration in Congress are research proposals from the Department of Defense and the Senate Committee on Labor and Resources (the latter initiated by Edward Kennedy), but these proposals are many votes away from passage. In the past we've seen the GI Bill, The National Defense Student Loan program, and the science buildup after Sputnik. But this time around money is tight.

Feigenbaum and McCorduck advocate the formation of a national knowledge technology lab, operating independently under federal charter. But at the moment no such institution is in view.

"If we continue as we have, [Japan and the United States] will act as guinea pigs for an interesting experiment in planned, as opposed to unplanned, research. At the moment, we Americans are placing our economic and defense bets on a method that has more or less worked for us in the past (though our current economic situation throws some doubt on its utility in a complex post-industrial world). That method, of course, is wholly decentralized planning, cutthroat competition, and a touching faith that the best will win because economic laws work that way."

"We don't like planning," said Feigenbaum at a recent press conference. "It smacks of telling us what to do." The message of *The Fifth Generation*—a timely one as the 1984 elections approach—is that if we Americans refuse to plan while others plan skillfully, we may like the results of not planning even less than we like planning. ●

Mark Seligman is a graduate student in linguistics at the University of California at Berkeley. He is especially interested in artificial intelligence research.

The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World

Edward A. Feigenbaum and Pamela McCorduck
Addison-Wesley Publishing Co., Reading,
Massachusetts, 1983
288 pages; \$15.55



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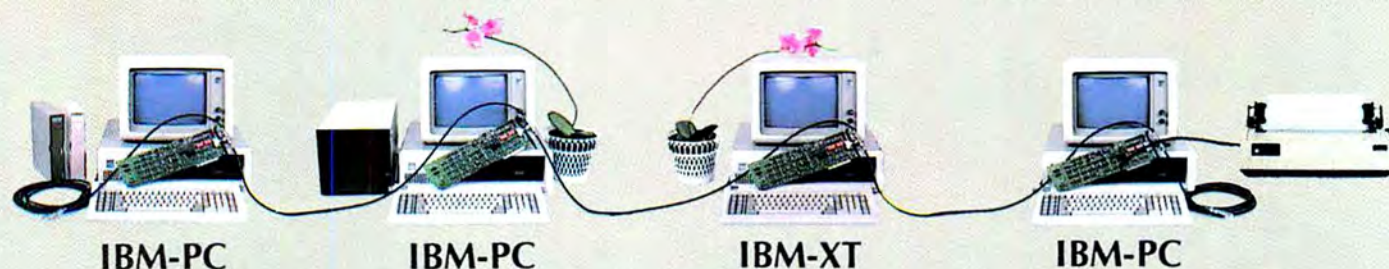
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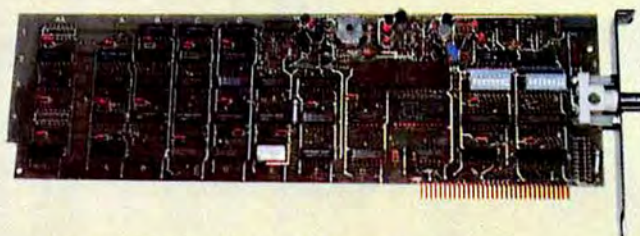
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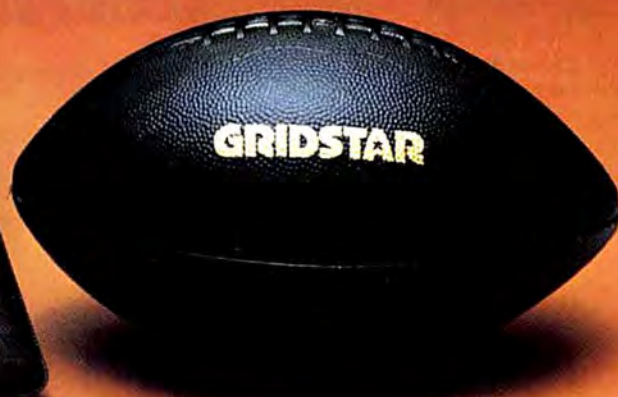
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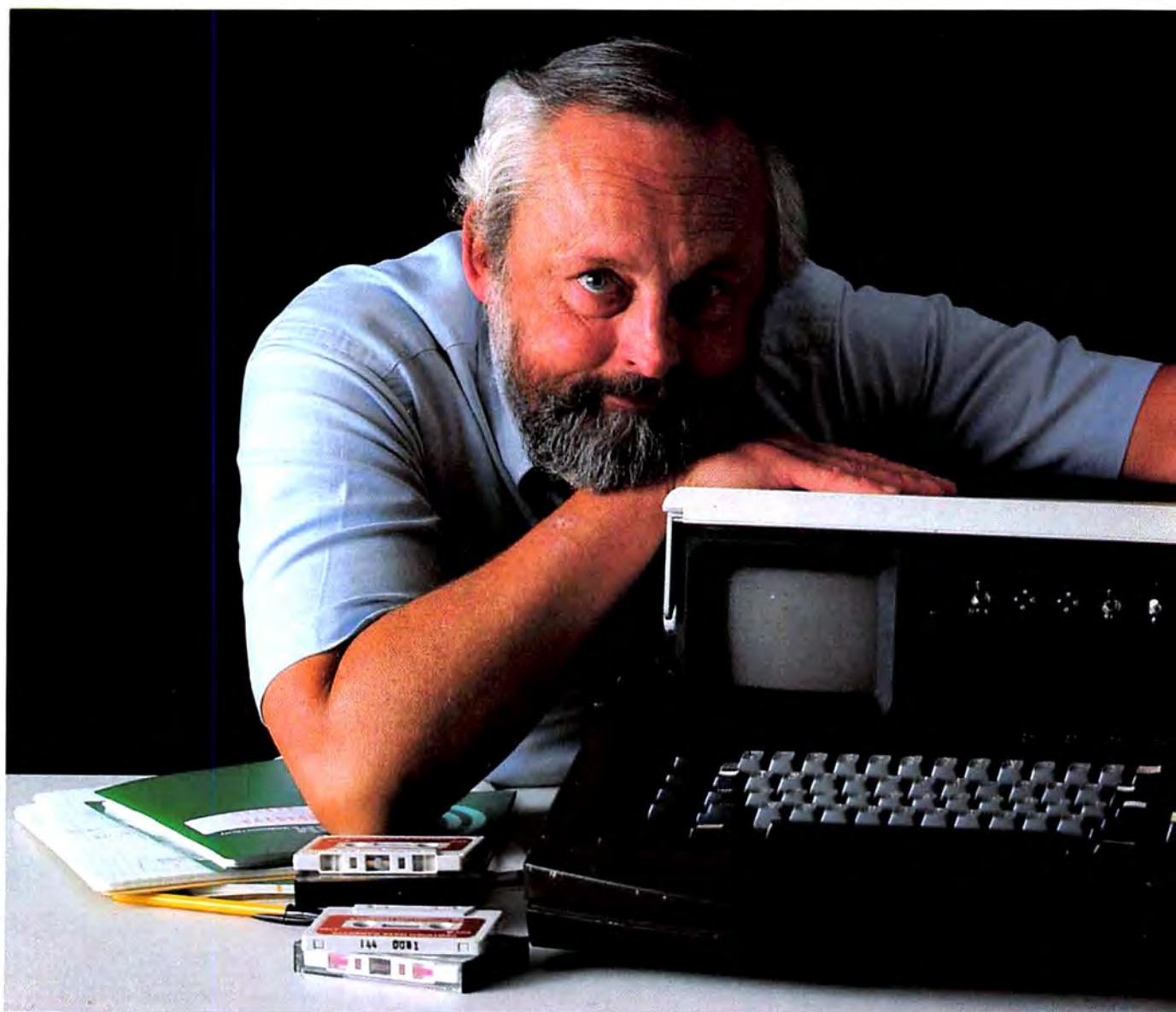
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The First Portable Computer

The genesis of SCAMP, grandfather of the personal computer

Jonathan Littman





History is the last thing that comes to mind when we think of computers. Computers are synonymous with change and obsolescence. Many of us who have grown up with or adapted quickly to computers have forgotten what life was like in the stone age of the typewriter and the hand-held calculator. We sit before our personal computers and, like the man driving a Cadillac, have no idea of what life was like in a Model T with its hand-cranked engine and other curious features.

In 1973, when hand-held calculators were becoming popular, the concept of a portable personal computer did not exist; nor was there a reason why anyone would want such a machine. This was unimportant to Dr. Paul Friedl of the Palo Alto IBM Scientific Center.

Not all computers are built by whiz kids who retire at 30 to live off their investments. Dr. Friedl is 50, a family man with three sons and a daughter about to be married. Friedl did not spend his youth playing video games or punching computer keyboards. Those technologies were years in the future. He played baseball.

Friedl became acquainted with computers in an informal way. He studied chemical engineering at the

Case Institute of Technology, earning his Ph.D. in 1960. One day, as he relates it, "I found a notice on the board that there was going to be a demonstration of an electronic computer. It was an analog computer, and afterward I thought I knew all about computers. Much to my confusion, the next week there was a demonstration of yet another computer—the digital computer." That computer was an IBM 650, and it caught Friedl's fancy.

Friedl began taking computer classes but rarely saw a computer. Students did everything at a desk. They wrote the program and hand debugged it, all with a graduate student peering over their shoulders. When they finally thought they had the program right, they took it up to their favorite keypunch operator who checked it again and then said something like, "Yeah, that should work." Then, as Friedl says, "The great day came when they would even let you into the same room with the machine. You approached it like the Wizard of Oz—big doors opening up, fans going, tapes spinning, and lots of noise. Then someone took your card, put it into the hopper, and hit the button. The machine went 'chun, chun, chun' and the computer operator said, 'Well, that's the right answer...next.' I said, 'Wait a minute, you mean it's done already?' 'Sure, why not?' " Friedl was hooked.

Community

His friends could never understand why he spent so much time with the computer. They asked why he wasn't boiling oil, pulverizing atoms, or doing something "modern." Instead, he started developing a specialty in computers and became interested in the potential of using the computer for process control in chemical engineering.

Friedl never forgot that IBM Wizard of Oz. After graduating he went to work for IBM Advanced System Development, joining a new group that was studying process control. Prophetically, because of the success of his process control work and long before a personal computer even existed, Friedl became known as Mr. PC. After leading several projects in advanced computer control, he joined the fledgling IBM Scientific Center. He became the Project Leader on applying real-time computers to high-energy physics. In the late '60s, he worked on several projects with microprocessors.

Project SCAMP

In December 1972 Friedl was sitting in for his boss when he received a call from the IBM General Systems Division in Atlanta. General Systems wanted to see if it could raise the visibility of APL (A Programming Language) in its division product line. Friedl's name had been advanced as someone who knew about microcomputers. Two executives flew out to California the next day to ask Friedl if he could come up with something using APL. "We don't exactly know what," they said, "maybe something similar to a hand-held calculator." When Friedl told them that he would love to work on the project, they asked when he could come back with a proposal. He said one month.

Friedl had the notion of a portable personal microcomputer, but it wasn't going to be easy to get the



SCAMP, grandfather of the IBM PC

most out of a full-fledged high-level language like APL. The technology didn't seem ready. What was needed was a display, keyboard, printer, and

His friends could never understand why he spent so much time with the computer.

a magnetic data storage device. At this time there were no floppy disks, just big bulky tape drives, and the idea of a portable display was rare.

Friedl had to devise a useful machine, while somehow circumventing the typical five-year development cycle. Says Friedl, "The first thing I did was enlist the help of an excellent programmer-engineer, Pat Smith. We considered a number of IBM and other technologies already in exis-

tence that we could incorporate into the machine. Fortunately, we didn't have to create a new microprocessor for the computer."

IBM manufactured a suitable processor, the PALM microcontroller that was designed to control other elements of a microcomputer. It offered Friedl the flexibility he would need to make an all-purpose machine, incorporating within its architecture the notion of an integrated raster (TV) display. He used a standard IBM keyboard and 64K of RAM (more memory than many of today's computers). Curiously enough, the memory cards were called Snoopy Cards, and since they were 16K each, only four were needed. The last basic piece of hardware was a new I/O card that allowed the computer to hook up to a printer, audio cassette recorder, and keyboard.

On January 22, 1973, with his ideas sketched on paper, Friedl took his plan for a portable computer to



The portable SCAMP prepared for travel

Atlanta. He told IBM executives that the only way to demonstrate the feasibility and uses of a portable computer would be to build one. When asked how long it would take, Friedl said six months.

At 30,000 feet, on the plane back to California, Friedl began to wonder what he had gotten himself into. He already had a full-time job, yet he had just agreed to build something that had never been built before. "I was excited about the project, but I can't figure out why I said six months. I didn't have a single worker or the assurance that it could be built in two years, let alone six months.

Friedl needed an engineering team. He went to see Joe Ma, engineering manager at IBM's Los Gatos Advanced Systems Development Laboratory. Ma had a big blackboard in his office. Friedl said, "Can I erase your board Joe? This is what I want to build...." He sketched the whole

thing out. When he was finished, Joe said, "Boy would that be fun." Joe George, who had been working on a printer adapter for the PALM microcomputer, came in to look at the sketch. Friedl asked him if he thought it could be built. George nodded. Then he asked George how long he thought it would take. George paused and then calmly said, "Six months." Friedl breathed a sigh of relief.

Not only was Friedl blessed with available technology, he was also fortunate to have a tremendous team. Joe George had recently joined the staff of an IBM knight, Roy Harper (IBM "knights" a few of its exalted workers, allowing them to work on virtually any technical project, or "dragon," they wish). Because the knight was between dragons, George was able to work with Friedl. In only two weeks Friedl rounded up five engineers and five programmers. The project was christened SCAMP (Special Computer APL Machine Portable).

That was only the beginning. As Friedl says, "Once everyone else was busy making the system, I started thinking, 'so what! Why would anyone want such a thing? What possible use could a manager have for a portable microcomputer?' I was trying to figure out how to make it more than just a magical black box.

"I was thinking about six months into the future, when SCAMP would be sitting on the executives' desks. I realized that I never wanted them to be faced with a blank screen. The system should tell you all the possible choices you can make. I wanted menus, so that someone who had never used a computer could read the choices, make their decision, and then press the appropriate key. Originally, I thought up four or five possible applications, such as computer-aided instruction, project planning, and financial analysis." Friedl even developed word processing, but the APL implementation of the word processing was, as Friedl says, "horrendously slow." Instead, he created what was probably the first electronic spreadsheet.

A full three years before *VisiCalc* was born, SCAMP was able to do much of the financial modeling found only in today's modern financial programs. Says Friedl, "While the small display allowed you to see only a window of 16 rows down and 64 columns across at any one time, your spreadsheet could actually be much larger. With the power of APL it was a trivial matter to do some of the basic modeling and calculations you find in modern programs." Friedl had an old picture of SCAMP, and sure enough, the display showed the year, 1973, with months going across the screen and financial categories listed in the left corner.

SCAMP's Test Run

Six months after his promise, virtually to the day, Friedl and Joe George were on a plane to Atlanta taking the world's first portable computer on its maiden voyage. While

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Friedl had planned well ahead for this day, it wasn't until he saw the executives staring up at him from the conference table that he realized the enormity of his task. Says Friedl, "I had planned numerous applications for the executives to do on SCAMP. Talk about apprehension. These poor people had either never had typing or the skill had evaporated. And then, all of a sudden, to have something thrust at you—here is the key-board—and your peers waiting for the slightest mistake. It was terrifying for some of these executives. All they had to do was press a letter or number, but there were questions such as, 'Where is the A key?' One man broke into a sweat when I asked him to type his name."

People had difficulty understanding SCAMP. Friedl remembers one executive saying, "Gee, that thing almost does what a computer does!" Says Friedl, "We had to convince him that it was indeed a computer." C.B. (Jack) Rogers, president of the General Systems Division, liked the machine and wanted every manager in the Atlanta headquarters to take part in a demonstration. Everything went well until Friedl got fancy and tried to show them how portable it was: "I reached for the handle and pulled it shut, and said, 'See, now the computing goes with you!' While everyone was clapping and shaking hands, I was wincing inside. I was sure I heard a crunch as I closed SCAMP. I tried to grab Joe George as unobtrusively as possible. We tried repowering the system but got nothing. Joe pulled the back off and announced that it was dead. I said 'What do you mean Joe?' He then explained that I had sliced the cable for the keyboard. The executives were starting to look overly curious, so we asked them if they would give us 20 minutes alone with SCAMP. And so, in a fully enclosed, oak-paneled conference room, we opened SCAMP's guts on the huge walnut table and pulled out the soldering gun—talk about smoke!"

That was not the first time Friedl was concerned about his electronic baby. Before SCAMP left for its maiden voyage, Friedl was called over to the Los Gatos laboratory. The next day he was to fly to Atlanta to give the opening demonstration to Rogers. Says Friedl, "They had made a special wooden case for SCAMP. It was two toned with nice wood and was quite attractive. I was standing there admiring SCAMP when Joe walked up and said, 'Watch this,' and gave SCAMP a little kick. I felt like screaming. The whole project was about to go splat on a hard tile floor."

We opened SCAMP's guts on the huge walnut table and pulled out the soldering gun—talk about smoke!

And then I couldn't believe my eyes. Instead of going crunch, SCAMP just sort of sighed to the floor, rocking back and forth like a baby carriage. Jerry Garvis, an industrial designer, had created a special curve to give it a dampening effect. Of course, nobody had told me."

Excluding the initial cable-slicing incident, Friedl went on to give over 100 trouble free demonstrations. Exhausted, Friedl was at home enjoying his first real weekend in months. The phone rang. It was Atlanta. Friedl was to get on the next plane. It was time for the ultimate demonstration. John Opel, the president of IBM, wanted to meet SCAMP.

By Monday afternoon Friedl was in the conference room of division headquarters in Atlanta. The room

was full of executives peering nervously at the darkening thunder clouds. Friedl describes the situation: "Opel had to give a speech later that evening in Atlanta. He was going to take a company plane to Atlanta and then drive out to headquarters. With the storm gathering, we knew planes would be stacked up over the airport. We started to realize that he wouldn't have time to drive all the way out to headquarters and still get back to Atlanta in time for his speech.

"An IBM vice-president took over. He started pointing at people, saying, 'You get us a room at a hotel at the airport! You get all the flip charts! You pack this machine up! And you, meet him at the airport!' In a couple minutes they were all running down the hall. They had forgotten all about me. I yelled out, 'Where are you going?' and they cried back, 'The Hyatt on Peachtree Street.'"

An hour later, in the middle of a downpour, Friedl had driven down just about every Peachtree Street in Atlanta. Finally, he found the hotel, parked across the street, and ran through a thunder shower to get there. Says Friedl, "I was hoping to give a nice polished demonstration, but I was leaving a trail of water behind me. As I came down the hall, they called out, asking where the heck I'd been. Luckily, there wasn't time for explanations. I powered up SCAMP, and just as the menu came up, Opel walked in." Opel then pulled up a chair, and the two of them sat down next to SCAMP in the middle of a large dining room. SCAMP performed beautifully.

When the demonstration was finished, Opel said, "It's all very interesting." Then Dave Slattery, a vice-president, spoke up, "We'd like to get financial backing to go ahead with the project." There was an agonizing silence. Finally, Opel said, "Don't look at me—I don't have any money." Then, after another lengthy pause, Opel said, "Why don't you just go over budget."

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Community

Ancestor of the PC

IBM went on to develop the progeny of SCAMP, the 5100, consulting with Friedl on a number of issues, including some experimental applications software. With the help of a class of students at Stanford, Friedl developed a set of interactive statistics programs. He devised a menu-driven system that had the capability of capturing each entry, allowing you to see the sequence of keys you pressed. The system was ideal for identifying where you made your mistake.

Some time after the last demonstration for Opel, when all the excitement had died down, Friedl's chief programmer, Pat Smith, returned from a vacation in Hawaii. Friedl called him up and invited him to sit in on one of the demonstrations he had done countless times. Smith accepted. Friedl was running through the different applications and was about to show Smith the hold key, which acted just like an interrupt key. If you were scrolling information up, it would freeze the screen. When you wanted to see more, you just pressed it again. As Friedl reached out to press the hold key, Smith grabbed his hand: "Don't press that key. I was trying to debug that thing before I left, but I just couldn't get it fixed in time. It doesn't work."

Friedl wasn't convinced: "That can't be, Pat. I used it in over 100 demonstrations and never had a problem. Watch." Friedl pressed the key, and the screen went poof—system blowout. He couldn't believe it. The system took over five minutes to reboot. If that had happened during the demonstrations, it would have been the end of SCAMP. They tested the key over and over again, but a blowout happened almost every time. To this day they haven't figured the problem out. As Friedl says, "It must have been a certain sequence that, by some stroke of luck, I didn't repeat in the other 100 demonstrations."

Despite all its triumphs, SCAMP was almost thrown out with the

trash. When the project was finished, Friedl went on with his work and forgot all about the wooden-encased computer that had consumed his life for over six months. He became curious about the whereabouts of SCAMP when a colleague showed him an article proclaiming that the 5100 was the world's first truly portable computer. What the writer didn't know was that the portable computer technology of the 5100 evolved from SCAMP. Says Friedl, "I always felt the work we had done was worthwhile. But with the explosive growth of personal computers, I suddenly thought that perhaps we had played some historical role in that popular movement."

Friedl called up the Los Gatos lab and asked if SCAMP was still there. IBM technicians told him that it was, and if he wanted it he had better come quickly because they were just about to throw out a lot of junk. "I jumped in my car and drove over there. We searched back in the corner of the lab and finally found SCAMP covered with dust and cobwebs behind a work bench. After all that time, we plugged it in and it started right up, a tribute to all the fine people who worked on the project."

And so SCAMP was born, the father of the 5100 and grandfather of the IBM PC. Although SCAMP was based on a technology that preceded the age of floppy drives and 16-bit processors, the lineage is clear. Sometime when you're feeling nostalgic, look at the back of your PC. Right above the power plug are the numbers 5150, child of the 5100, grandchild of SCAMP. ☉

Jonathan Littman is a freelance writer who is working on a book about IBM PC communications. He also conducts training seminars on WordStar and develops educational software.



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Reader Service #388

BBS Watch

A closer look at asynchronous communications

Gene Plantz

A recent attempt at telecommunications by two IBM PC operators was unsuccessful until the receiving operator realized that the sender didn't have his telephone line plugged into the modem. I wish all such problems were as easily solved, but the truth is that asynchronous communications can be confusing. Using your PC to communicate is not as simple as talking on the telephone. The telecommunications parameters of parity, number of data, start and stop bits, and baud rate are among the least standardized in the computer community.

If you understand some of the terms and concepts used in asynchronous communications, you should be able to upload and download files more easily from bulletin boards and access time-sharing systems like The Source and CompuServe.

Transmitting Data

Asynchronous communications is a type of serial communication, which means that the bits that make up a character are transmitted sequentially. In asynchronous communications each character of data is broken down into a series of bits by the sending computer and transmitted over the telephone line to the receiving computer, which puts the bits back together to form the original character.

In such a data transfer 10 or 11 bits are grouped together and transmitted sequentially. One or 2 start bits begin the series; these bits signal the receiving

computer that a new character of data is about to be sent. Seven information bits, representing control and alphanumeric characters, follow; an additional bit is often used for error checking. Bringing up the rear is the stop bit, which signals that an entire character has been transmitted.

The most common way to transmit asynchronous data is via the RS-232C standard developed by the Electronic Industries Association (EIA). This standard specifies a set of signals that are transmitted through a 25-wire cable. Each signal is transmitted through a predetermined wire. When transmitting or receiving data in this format, your IBM PC must be equipped with an RS-232C port, such as the IBM Asynchronous Communications Adapter.

A Universal Asynchronous Receiver Transmitter (UART) chip controls the RS-232C port. The UART chip is the heart of the asynchronous communications process and acts on the commands and parameters that you issue to your communications software. In most PCs the Intel 8250 chip handles the UART duties.

Parity

A method of error detection called parity checking is often used during asynchronous communications. Both the sending and receiving computers must use the same parity setting, which is either even or odd. When parity checking is used, the receiving computer calculates the sum of the bits in each transmitted character. If the parameter setting specifies odd parity, for example, the character's sum must be odd, or the receiving computer will interpret the eighth bit

as bad parity and signal an error. If the sum of a character's bits is even, the sending computer transmits an extra bit with the character to make it conform to the parity setting. If a BBS uses an even parity setting, the computer adds 1 bit to a character if its sum is odd.

If the parity parameter you select does not match the remote computer's setting, the data you see on your monitor during transmission will be garbled. In such a case you should try a different parity setting and attempt to receive the files again.

Although computer hardware and software can detect transmission errors when sending data, most communications programs are written to ignore these errors. Time-sharing services and most bulletin board systems simply send the data to your PC; it is up to your communications program to report parity errors.

Noise or static on the telephone line can cause parity errors during file transfer. Your communications software can only signal that an error exists; it cannot tell you where in the file the error can be found. So if your program reports a parity error, you should upload the entire file again.

Troubles in Parity-dise

When you are transmitting binary files such as .COM or .EXE program files, a no parity setting is used. Because binary (non-ASCII) files make use of the eighth data bit in a character, parity checking cannot be used when they are transmitted. The trouble, of course, is that no error checking takes place during telecommu-



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nications. To solve this problem Ward Christensen (co-creator of the first BBS) developed the Modem/Xmodem file transfer protocol for CP/M systems (see *BBS Watch*, PCW, Vol. 1, No. 3).

With this protocol the sending computer divides the file into 128-character blocks and sends each block with special characters and numbers at the beginning and end. One important piece of information sent with each block is a computed checksum character—the sum of all bits in the 128-character block.

The receiving system accepts each block of data along with the checksum character, performs the same addition calculation, and compares the result to that sent with the data. If the checksum numbers match, the receiving system sends a positive acknowledgment, signaling the sending system to transmit the next block of data. If the numbers do not match, a negative acknowledgment is sent, signaling the sending system to retransmit the same data block. This process continues until the entire file has been sent and the sending system transmits an end-of-file signal.

The Modem/Xmodem protocol has been adapted by several communications programs for the IBM PC. Many BBSs are also beginning to use this file transfer method. The protocol requires the parameter settings of 8 data bits, no parity, and 1 stop bit.

The ability to change parameter settings is an important feature to consider when you are purchasing a communications program. The better communications programs on the

market have this flexibility. Some programs even include directories that enable users to store parameter settings with the phone numbers for each listing.

Standard Parameters

The question "Which settings should I try first?" is difficult to answer because the standard seems to change every few years. In the past the use of 7 data bits, even parity, and 1 stop bit (7E1) was the norm. Now a significant number of popular systems, such as The Source and most IBM PC bulletin boards, are using or switching to 8 data bits, no parity, and 1 stop bit (8N1).

If you have trouble when first calling a system, try again with a different parity and data bit setting. The 7E1 and 8N1 settings are the most common, so try them first.

If you have any trouble, please let me know. Send correspondence to Gene Plantz, P.O. Box 95638, Hoffman Estates, IL 60195. CompuServe EMAIL 70040,245; The Source SMAIL STG476; Delphi MAIL TDCINC.

IBM PC Bulletin Boards

Following is a partial listing of the IBM PC bulletin boards on-line in the United States. The list is updated as the author receives information about new bulletin boards.

203/289-6321
East Hartford, Connecticut
SYSOP: Scott Maentz
6 p.m. to 9 a.m. Mon-Sat, all day Sun, download & upload, messages, 300/1200

213/371-8825
Culver City, California
SYSOP: Marc Schoenberg
24 hrs, download & upload, messages, 300/1200

213/390-3239
Source: TCG147
Santa Monica, California
SYSOP: Marc Schoenberg
24 hrs, download & upload, 10M disk, 300/1200

213/649-1489
Culver City, California
SYSOP: George Peck
24 hrs, download & upload, messages

215/250-0173
Easton, Pennsylvania
SYSOP: Jerry Lotto
24 hrs, download & upload, 300

301/251-6293
Gaithersburg, Maryland
SYSOP: Larry Jordan
24 hrs, communications info (Passwd = IBMPC)

301/949-8848
Rockville, Maryland
SYSOP: Rich Schinnell
24 hrs, download & upload (Passwd = IBMPC)

301/460-0538
Bethesda, Maryland
SYSOP: Ramona Landberg
24 hrs, upload newsletter articles

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messages, 300

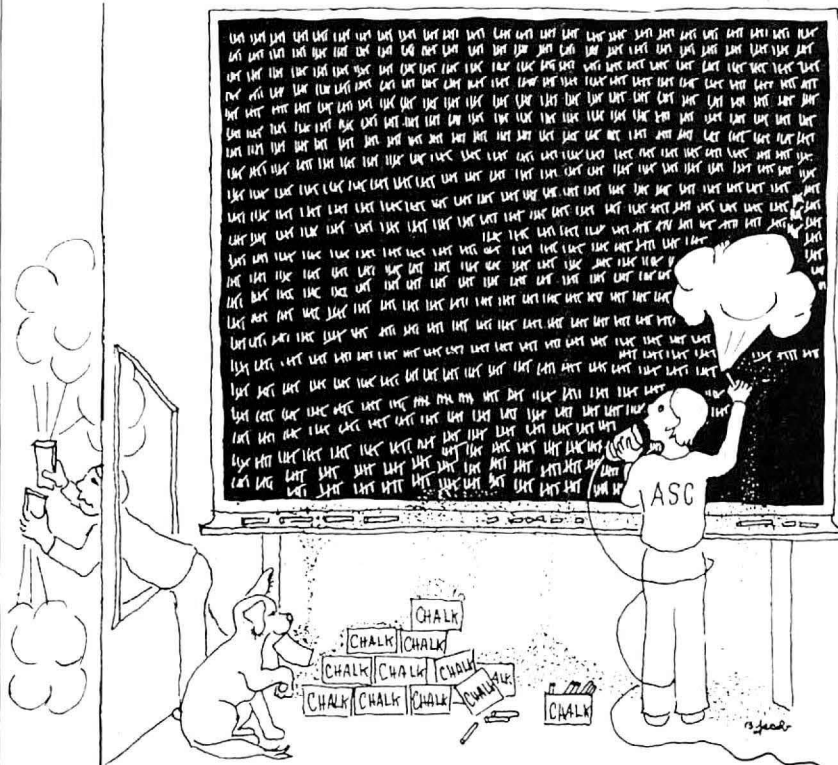
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messages, 300

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SYSOP: Harry Logan
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SYSOP: Doug Peel
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messages, 300/1200

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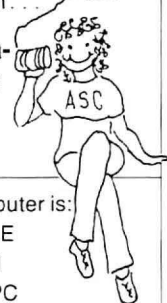
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BBS of the Month

This issue's BBS of the Month is the Rockville, Maryland, Bulletin Board System, 301/949-8848. The following is a partial file transfer list; the bulletin board list may change as the SYSOP adds or deletes items. The listing includes the file size in bytes.

SORT.DOC	5888	SORT documentation
SORTTEST.BAS	8064	SORT demonstration
SCROLLK.BAS	1711	SCROLLK.COM in BASIC
SCROLLK.ASM	11685	Use ScrollLock key for screen display and page advance
PHONE.TXT	5757	IBM PC BBS phone numbers
USERGRP.TXT	2499	IBM PC user groups USA
BBSEVAL.TXT	4736	Jordan's BBS evaluations
PROFILER.BAS	1920	PROFILER in BASIC
GRAFTRAX.DOC	2048	GRAFTRAC2 documentation
GRAFTRAX.HEX	2432	GRAFTRAC2.HEX (improved)
PECOLOR.ASM	11776	Personal Editor color modifications
WSMOD.HEX	19274	WordStar patches for printer support
WSMOD.DOC	4608	WSMOD.COM documentation
WSMOD.ASM	61312	WordStar patches in assembly
VISICOL.ASM	28800	VisiCalc patches for color display
GRAFTRK1.ASM	25216	PrtSc replacement for Epson printers
UNPROT.BAS	1792	Unprotect BASIC programs
DBASE2C1.HEX	17280	Color DBASE2.COM in hex
DBASE2C1.ASM	54656	Color DBASE2 in assembly

716/836-6964
 Buffalo, New York
 SYSOP: Bob Taylor
 9 p.m. to 9 a.m. Tu, W, Th,
 F; 6 p.m. Sa to 9 a.m. Tu;
 download & upload, mes-
 sages, 300

913/842-5749
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919/847-4625
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 sages, 300/1200
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SQUISHER.BAS	4641	BASIC program squisher
CRAYON.FIX	768	PC-crayon circle fix test
UNWS.ASM	8576	UnWordStar in assembly
UNWS.BAS	768	UnWordStar in BASIC
CMD185.DOC	11760	DOS 1.85 documentation
BASICAID.BAS	39358	BASICAID compress programs
BASICAID.DOC	11904	BASICAID documentation
PECOL1.BAS	10752	Personal Editor with color in BASIC
FILEHIDE.BAS	12800	Hides files in BASIC
pe-mod2.txt	1664	Eliminates Personal Editor logo
ADVEN2.BAS	22528	Adventure #2 game
ADVEN2H1.BAS	384	Adventure #2 hint #1
ADVEN2H2.BAS	256	Adventure #2 hint #2
BOOKINV.BAS	6656	Book inventory system
PEMOD2.TXT	1664	Eliminates Personal Editor logo
ADVEN2.BAS	22528	Adventure #2 game
NECSCRN.BAS	5888	NECSCRN in BASIC
LOTUSRNG.001	6144	Lotus 1-2-3 list ranges
VISIC.UN	2688	Unprotect VisiCalc in DEBUG
VISICOM.TXT	2432	Make VisiCalc a .COM file
VDISK.ASM	9091	RAM disk for DOS 2.00 in assembly
VDISK.BAS	2773	RAM disk in BASIC
DMLQ.DOC	918	WordStar printer documentation
NECSCRN.DOC	2048	Print utilities for NEC 8023A printers
KEYS2.BAS	5120	Redefine keys with DOS 2.00

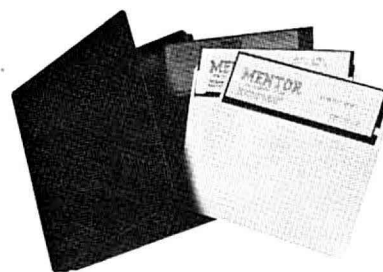
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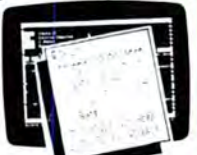
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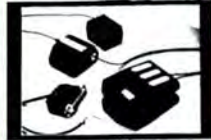
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User Group Dispatch

Running a software exchange

James B. Cookinham

Most user groups manage a software exchange for their members, and International PC Owners, Inc. (IPCO) is no exception. The club's software exchange has been evaluated by members as the most popular service the group offers. The exchange includes approximately 200 programs that have been written by members or translated from other systems. The programs vary in complexity from a 1500-byte mini word processing program to a 30,000-byte statistical regression analysis program.

Even though the exchange programs were written by amateur programmers, they often perform—without any need for modification and at a fraction of the cost—the same functions as commercially available programs.

IPCO first announced its intention to start a software exchange in the December 1981 *IPCO Info*, the group's newsletter. At that time public domain software was not readily available for the IBM PC, so program donations were slow in coming. Many of the group's first public domain programs were translated from other systems.

Although members are willing to donate their programs free of charge, IPCO offers four programs of the author's choice in exchange for each program donated. Programs normally cost members \$3 each.

The Software Library

Once programs are donated they must be organized into the software library. The system of organization should give members easy access to the exchange and make distributing the programs easy for the librarian. We have sorted our programs into seven sequentially numbered categories as follows:

1000	Business and professional
2000	Games
3000	Math and engineering
4000	Graphics and demos
5000	Educational
6000	Home applications
7000	Miscellaneous

The programs are stored by category, each category on a separate disk. For example, program 5010, *Capitals of North America*, is the tenth program in the 5000, or educational, category. Letters are assigned to programs to identify revisions.

The club's software exchange has been evaluated by members as the most popular service the group offers.

Program 2008-B would indicate a revision of 2008-A. File name extensions identify file type. The extensions we use most commonly are shown in Table 1.

Occasionally we receive a program that contains a number of individual files. These programs are identified with the usual number, and each file is identified with an additional name. For example, 2023-A.BAS LUNAR LANDER refers to the Lunar Lander file in game 23. When the program directory is displayed on the monitor, it reads 'LANDER.XXX', with three distinct extenders rather than the assigned IPCO number. We do not renumber all the files in such an involved program to conform to our numbering system for fear that we will make the program unusable.

Distribution

We publish a software exchange catalog every other month in *IPCO Info*. Members can order individual programs from the catalog; consequently, each order must be filled out according to the member's individual request. Since one order may include many programs, each loaded from a different disk, our method is time consuming. But we decided to use it so that members would get only the programs they wanted, rather than a disk full of programs of which they wanted only one or two.

Most user groups have found an easier way to distribute programs. They provide members with disks of programs in the same category. The programs on each disk are chosen by the club librarian or by committee and are recorded on disk. Disk 1, for example, might contain ten games, disk 2 might contain ten educational programs, and disk 3 might contain ten math programs. The librarian can copy a large quantity of disks at one time and store them for later use. When a member places an order, the librarian simply pulls out the right disk and mails it.

Quality Assurance

Before programs are distributed to members, the librarian must make sure that they are free of bugs and are member written, not pirated. Making sure that the programs are bug free is a time-consuming process. Each program we receive is loaded, run, and checked for bugs and ease of use. We reject programs that are not self-explanatory because we assume that software exchange programs will be used by novices. A simple problem can easily become an insurmountable

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obstacle for a novice, and if an elementary level of explanation is not provided, the software exchange is deluged with calls from people who can't get the programs to run.

We found, for example, that a number of novices were using the lowercase *y* or *n* in answer to the 'Do you want instructions?' prompt. If uppercase letters are not used, the program will not continue or the instructions will be ignored. With each disk we distribute we provide a detailed handout that explains how to load a BASIC program and make it run.

We do not accept programs submitted on paper because we have found that entering them is time consuming and introduces an unacceptable number of mistakes, resulting in the need for lengthy debugging.

We try not to modify or renumber the programs sent to us by our members. Renumbering a program can lead to problems: some of the remarks may refer to an invalid line number, or authors may send a letter discussing the contents of a certain line that can no longer be identified.

IPCO offers four programs of the author's choice in exchange for each program donated.

The only time that we find renumbering a program necessary is when we need room for the IPCO logo. Though we request that members start their programs on line 1000, this request is occasionally overlooked. Once a program is renumbered, making sure that the line numbers are consistent throughout the program is important.

We encourage our members to provide good documentation. Some programs are accompanied by a separate file that explains how to use the program, but most commonly the documentation is in the program itself. Some programs require the user to list the program and read the comments to understand how to use it.

We do not accept protected programs for our exchange. Members must be able to list a BASIC program, because one of the main functions of the exchange is to let members see how a program was written. Since programs can be listed, they can easily be modified.

Members have found that changing programs and watching the effect of such changes is a good way to learn about programming.

Software Piracy

User groups should be sensitive to the possibility of piracy. Some members of the microcomputer community do not support user groups because of the software piracy that has occurred too often in the computer field. We warn our members who contribute programs that the programs must be their own work. We review every program for possible copyright statements, and if we find clues pointing to impropriety, we destroy the program.

User-Supported Software

IPCO's software exchange includes user-supported programs. User-supported software authors are professional programmers who avoid heavy marketing costs by distributing their programs free, requesting only that those who receive them and find them useful make a contribution. IPCO now has eight user-supported programs, including a communications program, a data base manager, an assembler, a spreadsheet, and a graphics dump program.

User-supported software has been popular with our members; we have sent out hundreds of the most popular programs. The program authors, however, are not as delighted. We have been in contact with quite a few of these authors and have been told that user group member contributions have been almost nonexistent.

Extension	File Type
.ASM	Assembler source code
.BAS	Program in BASIC
.BAT	Batch file
.COM	IBM COM program
.EXE	IBM EXE program
.DOC	Documentation
.PAS	Pascal source code
.DAT	Program data
.TXT	Text

Table 1: File name extensions

User Group Dispatch

We take every opportunity to encourage those who find user-supported programs useful to send the authors a contribution.

IPCO's software exchange is the most popular aspect of our user group. Our members encourage us to continue this service. Although distributing member-written programs takes time, it is satisfying. Contributors are proud of their efforts, which in some cases spanned several months.

If you have the opportunity to be in charge of a software exchange for your group, accept the challenge but commit to a fixed term. Be prepared to spend time. Organization is the key to a smoothly operating exchange.

James Cookinham is president of International PC Owners.

User Group Directory

PC World publishes a User Group Directory every month. If your group is not in this list but would like to be, send the group's name, address, contact, and other information to *User Group Dispatch*, *PC World*, 555 De Haro St., San Francisco, CA 94107.

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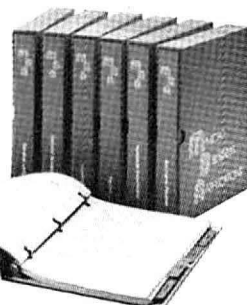
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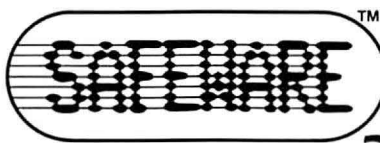
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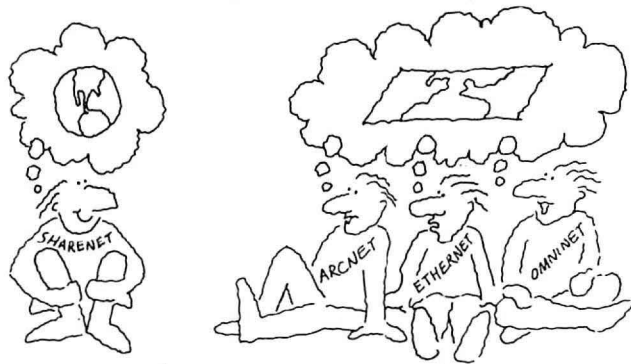
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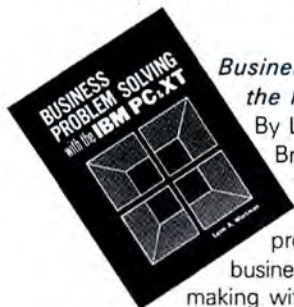
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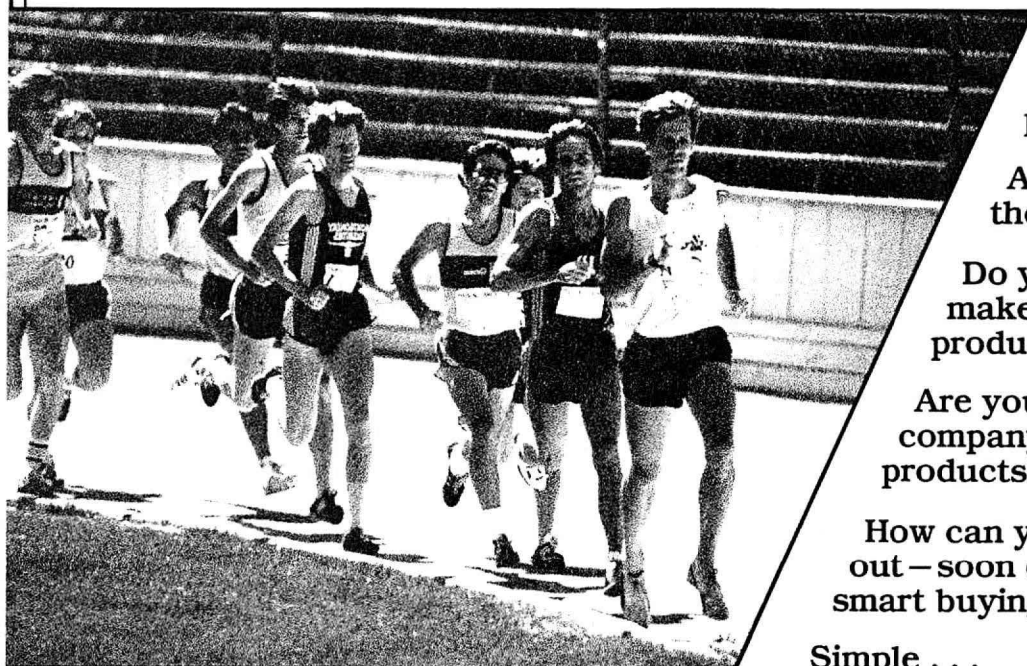
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Computer Products



World Events

A calendar of regional, national, and international events

Edited by Patricia Navone

World Events lists computer-related conferences, conventions, workshops, camps, symposiums, trade fairs, and shows. If you know of an upcoming event, we'd like to hear from you.

September 9-10

PC II International Show and Conference

Skyline Hotel

Toronto, Canada

Approximately 75 exhibitors; four educational seminars daily. Plenary session for user groups.

H.F. McLelland

Personal Computer Association

P.O. Box 251

Ajax, Ontario

LIS 3C3 Canada

Telex 06-986766

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McCormick Place

Chicago

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Graphic Arts Show Co., Inc.

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703/734-8285

September 13-15

Federal Computer Conference

Washington D.C. Convention Center

Aimed at managers of ADP equipment, software, and services from both the federal government and the private sector.

Phyllis Danieli

Federal Computer Conference

P.O. Box 368

Wayland, MA 01778

800/225-5926, 617/358-5181

September 13-15

Midcon/83

O'Hare Exposition Center

Rosemont, Illinois

A high-tech electronics exhibition and conference. Primarily for design, manufacturing, and test engineering.

Jeanie Oldendorph

Electronic Conventions, Inc.

8110 Airport Blvd.

Los Angeles, CA 90045

800/421-6816, 213/772-2965

September 13-15

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San Jose Convention Center

San Jose, California

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San Jose, CA 95117

408/554-6644

September 13-15

Mini/Micro Midwest

O'Hare Exposition Center

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800/421-6816, 213/772-2965

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Indianapolis Convention Center

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Mini and microcomputers, software, word processing, graphics, services, and peripherals.

Trade Show Department

Ernie Kerns and Associates

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Indianapolis, IN 46220

317/259-8111

September 15-18

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Exposition

Minneapolis Auditorium

Minneapolis

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Northeast Expositions

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World Events

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September 19-23

9th World Computer Congress

Palais des Congres

Paris, France

Technical programs, exhibitions, and seminars. Organized by the International Federation for Information Processing.

Registration Center

The Rand Corporation

1700 Main St.

Santa Monica, CA 90406

September 22-24

Second Annual Rocky Mountain

Computer Show & Software

Exposition

Denver Merchandise Mart

Denver

Features microcomputers including business systems, home and personal computers, video games, software, services, and peripherals.

Northeast Expositions

822 Boylston St.

Chestnut Hill, MA 02167

800/841-7000

September 22-25

New York Computer Showcase Expo

New York Coliseum

A regional exposition for business, professional, and corporate users of personal computers and word processing systems. Features hardware, software, peripherals, media, supplies, and services relating to mini and microcomputer environments.

Peter Young

The Interface Group

300 First Ave.

Needham, MA 02194

617/449-6600

September 22-25

Detroit Computer Showcase Expo

Cobo Hall

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Atlanta Computer Showcase Expo

Atlanta Apparel Mart

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September 29-October 1

CP/M '83

Hynes Auditorium

Boston

An international conference and exposition for the CP/M industry and users. Includes manufacturers, software developers, OEMs, venture capitalists, software publishers, distributors, and dealers. Conference program features noted leaders from the software industry.

Northeast Expositions

822 Boylston St.

Chestnut Hill, MA 02167

800/841-7000

September 29-October 2

Computers in Health Care '83

Red Lion Inn

Sacramento, California

A symposium and exhibition for health care professionals. Includes educational software, computer legal and purchasing considerations, data and word processing, biomedical engineering, and case management.

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World Events

September 29-October 2

San Francisco Computer Showcase
Expo

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A regional exposition for business, professional, and corporate users of personal computer and word processing systems. Features hardware, software, peripherals, media, supplies, and services relating to mini and microcomputer environments.

Peter Young

The Interface Group

300 First Ave.

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September 30-October 3

The Norden Home Electronics Fair
Stockholm, Sweden

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Kjell Fagerberg

Computer Sweden

NovaMedia AB

Vartavagen 55

S-115 38 Stockholm, Sweden

46-8-23 42 80

October 5-6

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San Jose, California

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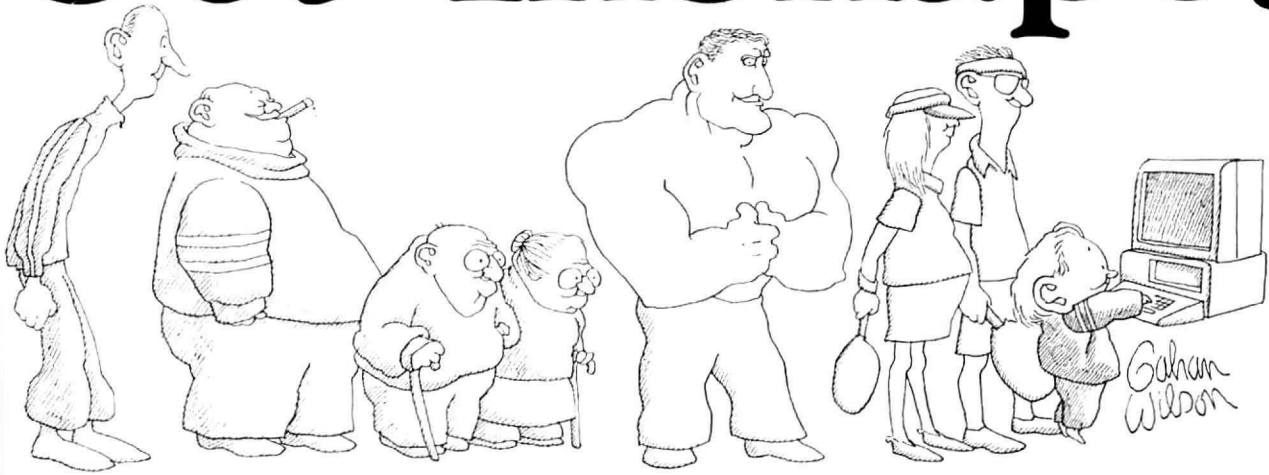
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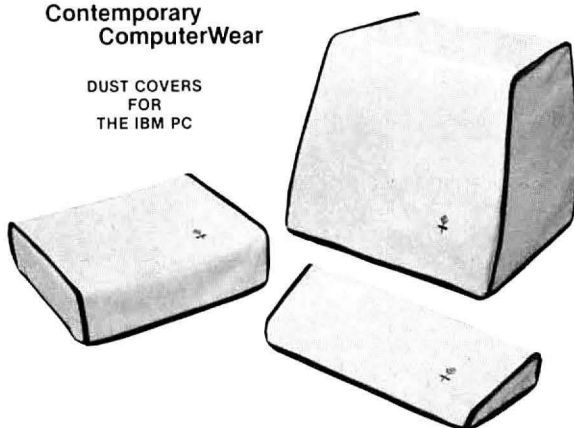
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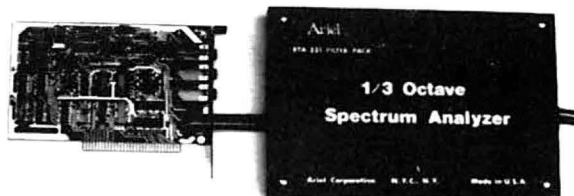
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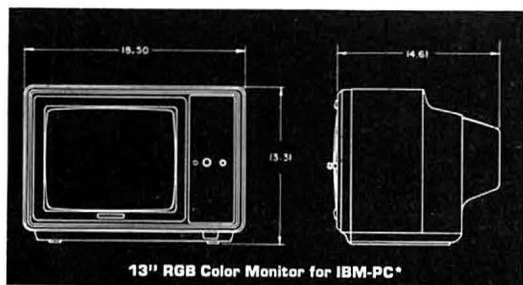
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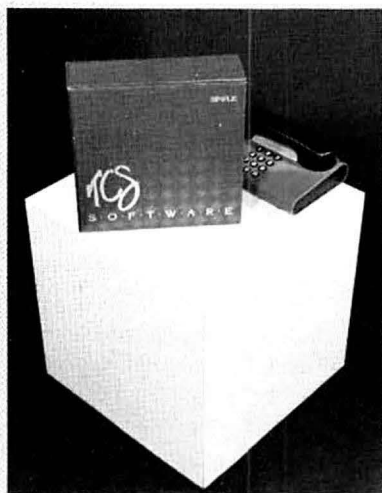
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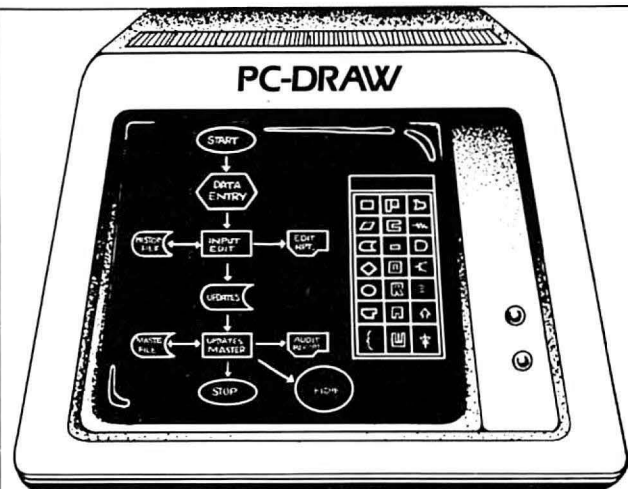
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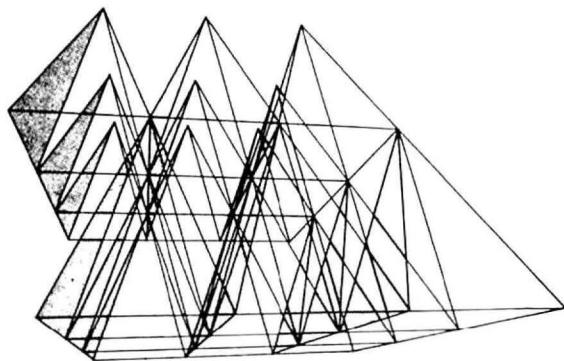
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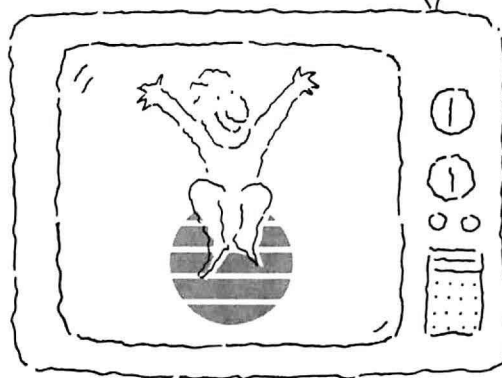
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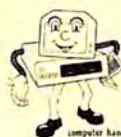
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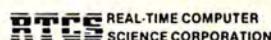


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Provides up to the minute information on key parts of investor's stock account. Market price updates by DOW JONES; easy link to Hayes Smartmodem. Sort by P/E, gain/loss, yield or any item in SPR's 8 useful reports. Friendly menu displays & manual. Requires 128K, 2dd. Demo disk avail. \$179. VISA/MC welcome. *Micro Investment Systems, Inc., P.O. Box 8599, Atlanta, GA 30306, 404/892-3194*



Systems

Multiple Users Under PC-DOS

MultiLink turns PC-DOS into an efficient multi-user multi-tasking operating system. Additional users are supported by attaching inexpensive CRT terminals or modems to serial ports on the PC, and can run normal applications designed for PC-DOS. Includes host communications software for public dial-in. *Software Link, Inc., 6700 23-B Roswell Rd., Atlanta, GA 30328, 404/255-1254*

Tools

One-Key Step-Scroll

BASIC Programmers. This routine replaces the LIST command and steps through your programs forward, backward, or repeats the same lines. EDIT or RUN the program between steps and continue with only one key stroke. Step parameters can be reset at any time. Includes other features. Diskette, \$17. *IRC Associates, 125 Sherrfield Dr. #X9, Saginaw, MI 48603, 517/792-2156*

Master Your EPSON-FX

Touch a key, set a mode! SET-FX™ quickly sets condensed, emphasized and over 50 other modes. Print the "missing" IBM characters! Block graphics, Greek letters, and symbols print in full-speed text mode. Even create your own fonts! IBM owners with Epson FX-80/100 send \$39.95 with order. Dealers inquire. *Softstyle, Inc., 7192 Kalaniana'ole Hwy. #200, Honolulu, HI 96825, 808/396-6368*

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Softtraders™ matches users wanting to exchange original disks and documentation. We offer unlimited trading opportunities thru worldwide network with quarterly directories & monthly updates. Call now or send system description, titles of programs you have & want plus return postage. You get results! *Softtraders International, 1610 Shomaker Dr., Murphysboro, IL 62966, 618/687-4799*

Utilities

IDIR for the PC & XT

Replaces the DOS prompt with an interactive command system that eliminates the need to type commands and filenames on the command line. Easy to use. IDIR enables you to load files and run programs by positioning the FILE and COMMAND CURSORS and pressing the <Enter>key. Retail \$95. *Bourbaki Inc.™, P.O. Box 2867, Boise, ID 83702, 208/342-5849*

Peeks'n Pokes for IBM PC

BASIC and Pascal programmers - discover the secrets of the PC! Find out how to access and modify configuration, keyboard, disk, printer, communications, and monitor status. Perform DOS and BIOS function calls! Learn how to find more Peeks'n Pokes. Disk (\$8 programs)

and manual - Only \$30 plus \$2.50 shipping. MC/VISA accepted. *Data Base Decisions, 14 Bonnie Lane, Atlanta, GA 30328, 404/256-3860*

PC Disk ID

Eliminate the need under PC-DOS 2.0, to reformat disks in order to add, change or delete volume labels. Prints sorted list of files (including hidden files) from disk directory to labels or to a listing. Also allows recovery of files erased inadvertently. Requires PC-DOS 2.0, 1 disk. \$30. *ErgoSoft, P.O. Box 454, Oakhurst, NJ 07755, 201/493-8352*

ARCHIVES V Disk Backup

Reduces diskette backup costs by 90 percent. The PCs' built-in cassette interface can save six full diskettes on one ninety minute audio cassette. The utilities process only required information reducing transfer time and tape usage. Specify 64K or 96K version when ordering; \$39.95. MC/VISA. *Indiana Digital Corporation, P.O. Box 3755, South Bend, IN 46619, 219/288-7280*

ARCHIVES V

PC Padlock

Unique encryption scheme protects EXE-COM programs from running after unauthorized duplication. Copy programs such as COPYPC will not copy after running this easy to use program on your products disk. Protect your software investment & valuable market place. Works with all DOS versions. \$99. VISA/MC. *Glenco Engineering, 915 E. Carpenter, Palatine, IL 60067, 312/537-4200*

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A NECESSARY organizational tool. EASY and TIME SAVING. ADD, DELETE, EDIT, UPDATE, LIST volumes on screen, printer, or disk file in several formats. Supports user comments on volumes and files. Maintain up to 150 volumes on one 320K disk. Will run from Hard Disk. Req: 96K-DOS 2.0. Visa/MC, MO, check, COD. Only \$34.95. *MultiPro, Dept. PC-1, P.O. Box 342, Saline, MI 48176, 313/429-2344*

Enhance WS

A powerful utility program which allows the user to customize WordStar. All of the function keys, the home, end and del keys can be redefined, 25 power up default parameters can be changed and the installation of special printer features: subscripts, superscripts, compressed print, etc. on any printer. *Enhance WS, 1020 Sagamore Parkway, West Lafayette, IN 47906, 317/463-3546*

PC File Compare

Compare disk files & get meaningful results. See the difference when a non-compare occurs. PC File Compare displays actual records that fail to compare, not just the offset into the files. Compares files of different lengths, individual files, or allows specification of Global filename characters. \$50. NJ add 6%. MC/VISA. *ErgoSoft, P.O. Box 454, Oakhurst, NJ 07755, 201/493-8352*

640K Mem Access Old PCs

You don't have to buy a new PC to access more than 544K of memory. With the SET-MEM utility, DOS recognizes

up to 640K of memory on your current PC. Need to know if your programs run on small PCs? SETMEM can also reduce your DOS-recognized memory without re-setting DIP switches. \$35. *Tyler Software, 233 Rodney Circle, Bryn Mawr, PA 19010, 215/525-5478 (after 6)*

Industrial Strength Basic

Line Number Remover. Unreferenced line numbers use memory & prevent full optimization. Remove unwanted line numbers with /N. Give the BASIC Compiler a chance to give you tighter, faster code. Give yourself the chance to include better error handling. Your users will thank you. \$30. (Check or money order.) *Sherborn Software Systems, 226 Western Ave., Sherborn, MA 01770, 617/655-6543*

KEYTOOLS

For BASIC Programmers. Powerful productivity builders from the toolkits of the pros, made easy to use. Formatted data entry; screen painter (one keystroke color changes); brilliant text graphics; and more. Commented, compact and compiled versions of each, plus interactive tutorials. Copyable. Need PC-DOS 1.1, 64K, one drive. \$40. *Key-1 Computer Systems, 178 Spring Street, Newport, RI 02840, 401/849-4562*

EZdBASE

Introducing the ultimate formatting utility for use with dBASE II. EZdBASE generates dBASE menus and screens in 1/10 the usual time at 1/3 of competitor's cost. Simply draw your screen using all 256 characters on IBM PC. EZdBASE creates screens with

up to 64 fields. Guaranteed. \$95 + \$5 shipping. *EZdBASE Introductory Offer. EZSoft of Atlanta, 11 Palace Green Place, Atlanta, GA 30318, 404/351-8358*

Backup Program

Copy 11 PC copies protected and unprotected software without modifying data and verifies the disks it creates. Available memory is fully utilized to minimize diskette duplication time. In addition, Copy 11 PC includes a drive speed utility that can pinpoint drive problems. See our ad in this issue! \$39.95. Add \$2 s/h. *Central Point Software, P.O. Box 19730 - #203, Portland, OR 97219, 503/244-5782*

IBM XT & DOS 2.0 Users

DOSshell - enhances DOS 2.0. Features: Creates a user-friendly "shell" surrounding your system/Automates commands/Organizes programs & data by Menus/Online help at all levels/Utilizes function keys. Includes: disk archive, data search & more. Extensive manual makes sense of DOS 2.0. Disk and manual: \$49.95. *XTC Software, P.O. Box 902, Santa Barbara, CA 93102, 805/967-7837*

Print-Screen (Text/Graphics)

SHIFT-PRTSCL calls an assembly language printing procedure for text, medium & high resolution graphics screens. Language independent. May also be easily called from a BASIC program. For PROWRITER, PROWRITER II, and NEC 8023A printers. Price includes extensive manual and shipping. \$35. *Soft & Friendly, Route 2, Box 65, Solsberry, IN 47459, 812/825-7384*

Word Processing

VisiWord & VisiSpell

SAVE \$335 when you buy the VisiWord and VisiSpell programs for the IBM PC. We will give you a free VisiSpell program when you buy VisiWord at our low price of \$264.50. Offer good only while supplies last. Call 800/235-4137 to order. In CA call 800/592-5935. *Pacific Exchanges, 100 Foothill Blvd., San Luis Obispo, CA 93401*

DynaWriter

Easy to use Word Processor that provides all the capabilities individuals or offices need for correspondence & report writing. Choice of format & print size; Edit in text mode; Move blocks of text between pages; Address envelopes; Word count & search; Alphabetize; etc. Works w/mono or color display & multiple printers. \$100. *IntelSoft, Inc., 1259 El Camino Real #164, Menlo Park, CA 94025, 415/854-2777*

User Groups

The PC Club Connection

For individuals, groups & businesses
* The PC Club Connection Newsletter
* Newsletter/Software Exchange
* Hardware/Software search service
* Discount buys, contests
* PC Consumer Action Service
* Soon: PCCC Bulletin Board System
Charter Membership \$10. *The PC Club Connection, P.O. Box 1720, Morgan Hill, CA 95037, 408/779-8913 (collect)*

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Used to produce dedicated disk or ROM based applications. No license fee for compiled programs. Choose target micro-processor from Z-80, 8080, 8086/88, 68000, LSI-11, or 6502.

Extension packages

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"Starting FORTH" tutorial . . \$ 16.00

PC/FORTH requires 48 kbytes RAM and 1 disk drive. Cross-Compilers require 64 kbytes RAM. All software distributed on single-sided double density soft sector diskettes. Prices include shipping by first class mail or UPS within USA and Canada. California residents add appropriate sales tax. When ordering, specify PC-DOS, CP/M-86*, or Concurrent CP/M-86 please!

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Reader Service #89

Just Announced

The wide world of PC products

Edited by Anna Bunker

In the fast-paced personal computer marketplace *Just Announced* acts as an alert service to keep you abreast of the latest developments in IBM PC and compatible technology. Information for this department is provided by manufacturers; these write-ups are not reviews. Many of these descriptions will be followed up by reviews in this or future issues.

Hardware

Boards

MicroGate, MicroGate II

IBM 2780/3780 data terminal emulators that require 64K, one disk drive, and a modem. The controller fits into any available slot. The products include a serial communications controller, communications software, and a modem cable. They enable the PC to communicate with other micros and mainframes that support the bisync communications protocol. Both products operate with asynchronous and synchronous modems.

MicroGate features remote command, transparent and nontransparent communications, interactive and batch processing, and file concatenation, allowing sets of files to be transmitted as a single file.

MicroGate II interfaces with MS-COBOL; it enables the PC to communicate with a remote computer within a user-written application. The user need not exit from the applications program to begin communications.

List price: MicroGate \$895, MicroGate II \$895. Gateway Microsystems, Inc., P.O. Box 10998 #542, Austin, TX 78766, 512/250-9795.

Computers

USS 8/16

A multiuser system that runs applications software under PC-DOS, MS-DOS, CP/M-86, and CP/M-80 simultaneously. The system can support up to eight terminals. Two versions of the computer are available: the USS 8/16 with a Z-80 microprocessor for 8-bit CP/M applications and an 8086 for 16-bit applications, and the USS 8/16+ with a Z-80 and Intel's new 286 microprocessor. The 286 is a faster superset of the 8086 that includes memory management and virtual memory. Two math co-processors, the 8087 and the 287, are available as options.

The USS 8/16+ comes with up to 4 megabytes of on-board RAM, 5¼-inch and 8-inch floppy disk drives, and either a 20- or 40-megabyte hard disk drive. Both versions include a revised Key Tronic keyboard with the Shift and ENTER keys in the traditional typewriter positions.

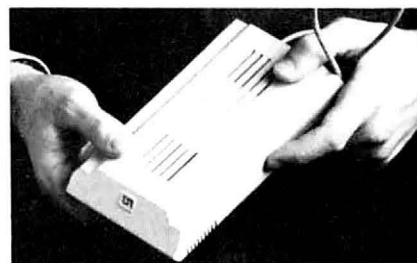
As a complete eight-user system, the USS 8/16 includes eight serial ports, six parallel ports, 64K of user-programmable ROM, and either a 20- or a 40-megabyte 5¼-inch Winchester hard disk. When used with the 8086, microprocessor addressable RAM capacity goes up to 1 full megabyte; with the 286, RAM can reach 4 megabytes. Files can be transferred between 5¼-inch and 8-inch floppies.

List price: base machine with 256K, four serial ports, two parallel ports, 5¼-inch and 8-inch floppy disk drives \$4795; terminals \$1000 each; 20-megabyte hard disk \$2500; each additional ¼ megabyte \$475. Octagon Computer Systems, 151 Bernal #5, San Jose, CA 95119, 408/262-7777.

Modems

Password with Telpac

A 300/1200 baud direct-connect, auto-dial auto-answer modem with supporting communications software. Password uses the PC's serial port. It weighs approximately 1 pound and is 6 inches long, 4 inches wide, and 1 inch high. Its circuitry uses only 12 ICs. Password features programmable auto-dial and auto-answer capabilities, auto-mode and auto-speed select functions, and an audio phone line monitor.



Password direct-connect modem, U.S. Robotics

Telpac is communications software that supports unattended operation. It requires 64K and one disk drive. It directs the computer through log-on and log-off procedures. *Telpac* enables the user to set up a directory of frequently used numbers for one- or two-touch dialing and can be used to set up passwords for limiting access. List price: Password \$449, *Telpac* \$79. U.S. Robotics, Inc., 1123 W. Washington Blvd., Chicago, IL 60607, 312/733-0497.

Network Devices

PCnet

A local area network product designed specifically for the IBM PC and MS-DOS. Its adapter fits into a single I/O slot. It requires 64K and one disk drive. The transmission media is a standard 75-ohm CATV coaxial cable that can run a maximum of 7000 feet. PCnet is a CSMA/CD network and transmits data at a rate of 1 megabit per second. PCnet software features include disk sharing, which allows PCs to share disks and printers, and file locking, which allows single-user applications to be converted to multiuser applications. It supports a variety of hard disks. List price: \$695. AST Research, Inc., 2372 Morse Ave., Irvine, CA 92714, 714/540-1333.

Printers

DP-9725A

A dot matrix color printer that has graphics capabilities and four print quality modes: near-letter quality, correspondence quality, data processing quality, and condensed printing. The DP-9725A attaches via a parallel port or an RS-232C serial port. It features a four-color ribbon of red, yellow, blue, and black.

Because a different color can be selected for each pass of the printer, various color combinations are possible. The DP-9725A prints bar charts and curves with either 144 by 144 or 72 by 72 resolution. It prints 100 to 150 cps in correspondence quality mode and 200 cps in data processing mode. Condensed printing speeds are 150 and 164 cps at 15 and 16.4 cpi respectively.

The DP-9725A includes seven International Standard Organization (ISO) character sets as well as the standard 96-character ASCII set. It comes with a standard 1.5K buffer, and a 2K buffer is optional. The printer uses tractor paper feed and has a noise level of less than 55 dBA. Other features include left, right, and full justification; title centering; and proportional spacing. Options include subscript, superscript, scientific fonts, and bar codes. List price: \$2350. Anadex, 9825 De Soto Ave., Chatsworth, CA 91311, 213/998-8010, TWX: 910-494-2761.

DP-6500

A dot matrix printer that employs an 18-needle printhead (two vertical columns of nine needles each) to achieve a print speed of 500 cps at 10 cpi.



DP-6500 dot matrix printer, Anadex

The DP-6500 can be attached to a PC via either a parallel printer port or an RS-232C serial port. It is capable of printing in a correspondence quality mode.

The printer includes seven International Standards Organization (ISO) character sets in addition to the standard 96-character ASCII set. A 4K buffer can be expanded in 4K increments to 16K. Either friction or trac-

tor paper feed is available. The noise level is less than 60 dBA. List price: \$2995. Anadex, 9825 De Soto Ave., Chatsworth, CA 91311, 213/998-8010, TWX: 910-494-2761.

Storage Devices

The Bank

A tape memory system designed to work with OmniNet that is capable of storing up to 200 megabytes of data. It requires a transporter board that fits into an I/O slot and 64K for initialization. The Bank's media is a continuous loop of 100-track magnetic tape encased in a cartridge and is available in 100- and 200-megabyte sizes.

The Bank uses the random access method of retrieving data. It can be used with one IBM PC or as part of an OmniNet network, as a backup system, or as a replacement for other types of mass storage. It has an average data access time of 10 seconds and a transfer rate of up to 1 megabyte per second. List price: \$2195. Corvus Systems, 2029 O'Toole Ave., San Jose, CA 95131, 408/946-7700.

Magnabyte 10

A 10-megabyte add-on chassis that comes with a host adapter and uses any IBM PC slot. The Magnabyte 10 includes a disk controller, a power supply, a 10-megabyte Shugart hard disk drive, and a bay for an additional 10-megabyte hard disk. The supporting software includes a DOS 1.10 patch, a DOS 2.00 device driver,

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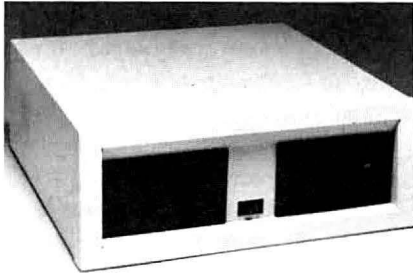
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Offer expires Oct 15, 1983.

Just Announced



Magnabyte 10 hard disk drive,
Great Lakes Computer Peripherals

and a CP/M-86 patch. List price: \$995. Great Lakes Computer Peripherals Company, P.O. Box 94789, Schaumburg, IL 60194, 312/961-9011.

Miscellaneous

Data Entry: Mouse, Voice, O.C.R. Mouse Data Entry, Voice Data Entry, and O.C.R. (Optical Character Recognition) Data Entry are alternative entry devices that interface with Key Tronic's new IBM PC plug-compatible intelligent keyboard. Data entered with any of the three devices is transparent to the host because it is processed by the keyboard's 8088 microprocessor. The intelligent keyboard allows the devices to be used with any applications software.

The mouse comes in two versions: mechanical and optical. The optical mouse is operated on a special pad. The user trains the Voice Data Entry device to recognize one voice and a given vocabulary. The user also determines what string of characters is sent to the host computer for every word in the vocabulary.

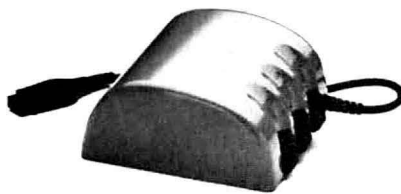
The O.C.R. is designed to be used primarily in the banking industry, as it is programmed to recognize font on checks and magnetic coding on credit cards.

Both the Mouse Data Entry and the Voice Data Entry will be available during the last quarter of 1983. The O.C.R. Data Entry is currently available.

List price: O.C.R. \$1400 without keyboard; combination package of Mouse Data Entry, Voice Data Entry, and keyboard \$1200. Key Tronic Corporation, P.O. Box 14687, Spokane, WA 99214, 509/928-8000, TWX: 510-773-1885.

Command Control Mouse

An optically encoded mechanical mouse that can be used to edit, draw, or select menu choices. It requires a controller interface board. The user moves the cursor to any point on the display by sliding the hand-held mouse across a desktop surface. The three multifunction buttons are user assigned.



Command Control Mouse,
WICO Corporation

The Command Control Mouse can be used with a word processor to add, delete, or reposition copy or to edit or scroll with a spreadsheet program. The mouse can also perform as an input device, a graphics plotter, or a game controller. It will be available during the last quarter of 1983. List price: \$129.95. WICO Corporation, 6400 Gross Point Rd., Niles, IL 60648, 312/647-7500.

Polaroid Palette

A computer image recorder that produces presentation-quality color or black-and-white 35mm slides and instant photographs of PC graphics. The Palette plugs into the PC's serial port. It includes an exposure system, supporting software, an auto-advance 35mm camera back and adapter plate, a Polaroid 3¼ by 4¼ instant-print camera back, and a Polaroid/35mm auto-process transparency system hardware. It will be available during the last quarter of 1983. List price: Under \$1500.

Polaroid, 575 Technology Square, Cambridge, MA 02139, 617/577-2000.



Polaroid Palette computer image recorder,
Polaroid

Systems Software *Languages*

FORTH-32 2.0

A new version of the programming language that now runs under DOS 1.0, 1.10, and 2.00. FORTH-32 2.0 is three times as fast as the old program and has added utilities. It requires 64K, one disk drive, and a color graphics board for graphics applications. FORTH-32 uses a 32-bit ad-

Just Announced

programming system that gives the user the ability to program over the entire megabyte of memory addressed by the 8086/8088 processor. It can be used as either an interpreter or a compiled language.

FORTH-32 allows users to define the input and output of the system; FORTH-32 will accept input from the keyboard or remotely from a serial port and direct output to the CRT, the serial port, or the parallel port. It performs both 16- and 32-bit computations, assuring numerical accuracy. The FORTH-32 floating point extensions provide the interface to an 8087 processor required to perform floating-point arithmetic.

Graphics commands allow the user to draw pictures, plot bar charts, create line graphs, or paint a closed curve. Sound generation and light pen/joystick interfaces are provided for developing games and music. Two screens can be edited simultaneously with the FORTH-32 dual-screen editor. List price: \$185. Quest Research, Inc., 303 Williams Ave., Huntsville, AL 35801, 800/558-8088, 205/533-9405.

Logo

An interactive language that helps the user become familiar with programming concepts and logical, mathematical, and geometrical relationships. It requires 128K and one disk drive. The user can develop tutorials and demonstrations for learning purposes as well as applications that include graphics, mathematics, text handling, file manipulation, and assembly subroutines. Logo's turtle graphics, designed for young children (preschool through elementary), requires a color graphics monitor.

Logo features color turtle graphics, file handling, floating-point decimal mathematics, musical tone production, an assembly language interface, a full-screen editor, and two-display support. Text, graphics, or a mixture of both can be displayed on screen. Joysticks and paddles are supported. Logo will be available in December 1983. List price: \$175. IBM, Systems Products Division, P.O. Box 1328, Boca Raton, FL 33432.

Utilities

LSH Package

Five integrated programs—*LSH*, *LXI*, *LED*, *LTF*, and *LMK*—that create a UNIX-like environment within the PC-DOS system. *LSH* is a UNIX-like command processor that implements a hierarchical file system in which files are organized by category. It requires 96K and two disk drives. DOS applications software can be used under *LSH*. The user can easily switch between DOS and *LSH*.

LXI makes 16 UNIX utilities, including *grep*, which can search the contents of several files for a specified text pattern available under PC-DOS. It requires 64K and one disk drive. *LXI* utilities can sort as well as search files, and debug programs.

LED is a UNIX-like line editor that has two modes, beginning and advanced. It requires 64K and one disk drive. In the advanced, or Magic, mode certain characters are given special meanings. *LED* can be used to edit programs, files, and text.

LTF is a text formatter that has a structure similar to *nroff*, the UNIX text formatter. It requires 64K and one disk drive. Text is keyed in, free form, with *LED* and formatted with *LTF* in accordance with the control

commands the user embeds in the text file. *LTF* features boldface, underlining, centering, margins, headers, and footers.

LMK maintains multimodule projects such as manuals or programs. It requires 64K and one disk drive. The user specifies the aspects of the project, how they are related, and the action needed to complete the project. When an action is completed in one module, *LMK* updates the effect the action has on the other modules.

List price: complete package \$229, *LSH* \$99, *LXI* \$54, *LED* \$79, *LTF* \$79, *LMK* \$99. LXI Inc., P.O. Box 3032, West Lafayette, IN 47906, 317/423-2080.

Memory/Shift

A utility that creates a multitasking environment by loading up to nine programs into memory simultaneously. It requires 128K and one disk drive. Data from one program can be transferred to another. *Memory/Shift* supports two monitors simultaneously, enabling the user to view two programs at once. List price: \$99. North American Business Systems, Inc., 642 Office Pkwy., St. Louis, MO 63141-7103, 800/325-1485, 314/432-6106.

Applications Software

Accounting and Inventory

Solomon III

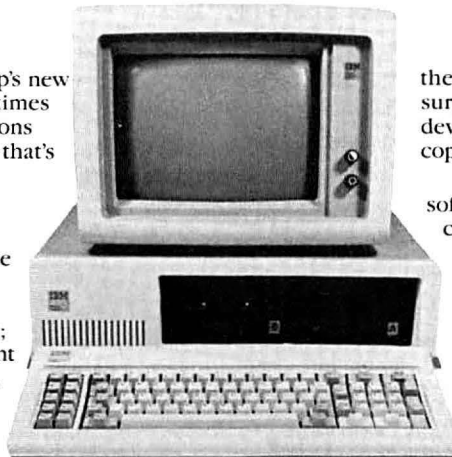
A general ledger package written in C that requires 256K, two double-sided disk drives, and a 132-column printer. It features user-definable charts of accounts and journal types with no listing limitation. It also fea-

How to get a fast 300% return on your IBM-PC investment.

Compared with COBOL interpreters, mbp's new COBOL Compiler runs programs four times faster. With mbp on your IBM-PC, applications that used to take four hours now take one; that's like a 300% return on investment.

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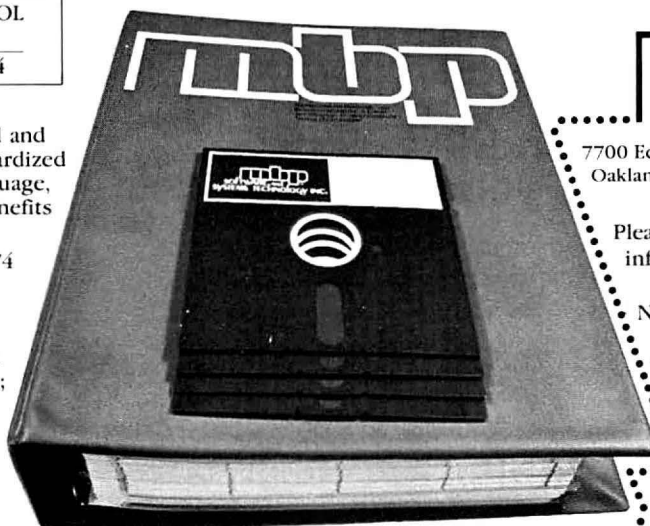
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Business Management

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An integrated package of five programs: *Execu/File*, *Execu/Writer*, *Execu/Reporter*, *Execu/Model*, and *Execu/Plot*. It requires 128K (192 on the IBM PC XT) and two disk drives or a hard disk system. Data from any program can be integrated with any other program without reformatting or copying.

Execu/File is a data management program. *Execu/Writer* can be used for memos, letters, technical reports, and documents. Its editing capabilities include indentation and numbering of itemized lists and blocks of text, centering, underlining, and boldface. Names and addresses from *Execu/File* or *Execu/Model* can be used in form letters written in *Execu/Writer*.

Execu/Reporter sorts and selects data from *Execu/File* and formats reports according to the user's specifications. With *Execu/Model* the user can construct worksheets for budget-

ing, cost analysis, and planning requirements. *Execu/Plot* creates charts and graphs from the data in either *Execu/File* or *Execu/Model*.

List price: *Execu/File* and *Execu/Writer* \$450, *Execu/Model* \$200, *Execu/Reporter* \$200, *Execu/Plot* price not announced. Executec Corporation, 12200 Park Central Dr., Dallas, TX 75251, 214/239-8080.

Communications

Personal Computer Data Interface (PCDI)

A multifunction communications program that provides telecommunications, data management, and graphic analysis. It requires 256K, one hard disk drive, a Hayes Smartmodem, and a color graphics board. *PCDI* is configured to communicate with IBM's VM/370 operating system and automatically retrieves data from the Compustat data base from Standard & Poors. It can be modified to access other data bases and operating systems.

PCDI is available in two versions: corporate and individual. The corporate version includes mainframe software and features automatic data retrieval. Data variables are menu selectable. *PCDI* automatically dials in and logs on to the mainframe. Data is transmitted back to the PC at either 300 or 1200 baud. The data management facility allows the user to manipulate data. The full-screen editor allows scrolling, global editing, and subsetting. The system tracks the user's data files. Data from *PCDI* can be translated into DIF format for use with *VisiCalc* and other DIF format applications. Up to 208 periods of data can be included in pie

charts and histograms that are scrolled for viewing. Colors can be toggled and text can be incorporated.

The individual version is controlled manually. The user has to dial in to the data base and know how to list and retrieve data. Console spooling allows the data to be captured to disk.

List price: corporate version with a one-time license fee that allows as many copies as needed for use within the company \$30,000; individual version \$250 per copy. Applied Microsystems, Inc., P.O. Box 832, Roswell, GA 30077, 404/475-0832, 371-0832.

ReadiTerm

A package that provides communications with mainframes, The Source, CompuServe, Dow Jones, IBM PCs, and other micros. It requires 64K, one disk drive, a serial port, and a modem. With *ReadiTerm* the PC becomes a smart terminal capable of automatic dialing and log on, issuing predefined commands, capturing output, uploading, and downloading. *ReadiTerm* uses a universal protocol. Communications parameters can be customized and saved for future use. List price: \$50. ReadWare Systems, P.O. Box 680, West Redding, CT 06896, 203/431-3521.

SmarTerm/PC, TE400-FT

A Data General D100, D200, or D400 terminal emulator that requires 96K, two disk drives, and an asynchronous communications adapter. *SmarTerm/PC* allows the user to communicate with both minicomputers and other PCs. The user can transfer program and data files between the PC and the host computer system at speeds of up to 9600 baud.

The TE400-FT implements most of the Data General terminal's features, including multiple-display windows with independent vertical scrolling and window erase. It also implements character-display attributes such as underline, blink, dim, and reverse video.

The file transfer functions allow the user to capture data onto a disk file and transfer ASCII data to the host. The TE400-FT employs an error-free transmission protocol. It does not implement the D400's horizontal scrolling, compressed-character display, or foreign word processing character sets. Communications parameters are easily modified. List price: \$125. Persoft, Inc., 2740 Ski Ln., Madison, WI 53713, 608/233-1000.

VisiAnswer and Answer/DB

A multiuser mainframe application that translates mainframe data into *VisiCalc* format. It requires 128K, two disk drives, and a communications board. *VisiAnswer* is installed in each IBM PC. *Answer/DB* is installed in the mainframe. The user is able to specify what mainframe data is needed for the task at hand by file, field, and range. *Answer/DB* extracts the specified data and sends it back to the PC, and *VisiAnswer* translates the data to a *VisiCalc* format. List price: \$45,000 for a 50-station system. VisiCorp, 2895 Zanker Rd., San Jose, CA 95134, 408/946-9000.

Data Management

Data Base Manager II

A data management program that is compatible with *VisiCalc*, 1-2-3, *Multiplan*, and *WordStar*. It requires 128K and one double-sided disk drive. Data can be transferred from

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2. **Carefully.** Study comparison charts and function lists until your eyes glass over and your jaw goes slack--it's called Feature Shock. [After all that, they still look pretty much the same on paper.]
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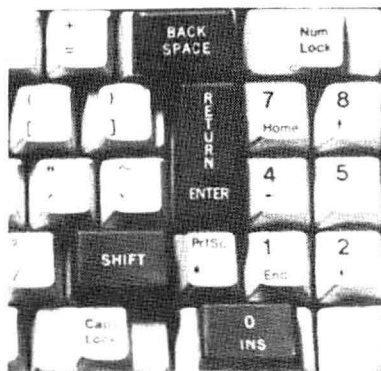
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the above applications programs to *Data Base Manager II* or from *Data Base Manager II* back to the applications program. Each record can hold up to 40 fields of 60 characters each. The program produces formatted reports automatically. It can merge partial or entire data bases.

According to the manufacturer *Data Base Manager II*'s sorting capabilities are disk oriented, which allows users to sort files larger than available memory. List price: \$295. Alpha Software Corporation, 6 New England Executive Park, Burlington, MA 01803, 617/229-2924.

Entertainment

Big Top

An arcade-style one-player game that requires 64K, one disk drive, and a color graphics board. The player maneuvers Wendell the acrobat through a multiple-ring circus. Wendell climbs ladders, jumps over beach balls, and ducks cannonballs and knives while trying to capture the ringmaster's hat. A joystick is optional. Several skill levels are available, and the highest score is saved to disk. The keyboard is user configurable. List price: \$39.95. Funtastic, Inc., 5-12 Wilde Ave., Drexel Hill, PA 19026, 215/622-5716.

Enchanter

A prose adventure game that requires 64K and one disk drive. Players journey through an abandoned castle while skill, logic, and the help of uncovered spell scrolls aid the player in overcoming Krill, the evil warlock. As time passes during the game, the players must eat, drink, and sleep or

their powers will begin to fail. Infocom plans to make *Enchanter* the first in a trilogy of magical fantasy games. List price: \$49.95. Infocom, Inc., 55 Wheeler St., Cambridge, MA 02138, 617/492-1031.

Planetfall

A prose adventure science fiction game that requires 64K and one disk drive. Players become members of a stellar patrol responsible for saving a planet. List price: \$49.95. Infocom, Inc., 55 Wheeler St., Cambridge, MA 02138, 617/492-1031.

Pick That Tune

A tune-identification game that contains 100 pop, country and western, and children's tunes. It requires 64K and one disk drive. Players bid the number of notes they think they will need to identify a tune. Using the sound generator *Pick That Tune* plays the number of notes each player has bid, beginning with the lowest, until the tune has been picked. Up to ten people can play. Ten player files are automatically stored to disk. Additional packages of 100 tunes each are available. List price: \$29.95.

Swearingen Software, 6312 W. Little York # 197, Houston, TX 77088, 713/937-6410.

Graphics

Halo

A software development tool that has a number of color graphics subroutines written in assembly language. It requires 64K, one disk drive, and a graphics board. *Halo* is compatible with four add-on color graphics boards—the Scion, the Orchid, the Amdek, and the IBM Color/Graphics Adapter.

Halo's color graphics subroutines include line, plot, arc, box, circle, ellipse, and point primitives and single commands that create bar and pie charts. It interfaces with six programming languages: BASIC (Interpretive or Compiled), PASCAL, Lattice C, FORTRAN, and Assembly.

With *Halo*'s Pattern Fill and Dithering commands, which allow mixing of colors at one point, the user has a wide choice of textures and color mixes. The World Coordinates function allows the user to define a coordinate system that can differ from the coordinate system on the graphics board. *Halo*'s data compression techniques make animation and on-screen "slide shows" possible.

List price: \$150 with one language interface, \$100 for each additional interface, \$200 for a BASIC interpreter/compiler combination, \$350 for all six interfaces. Lifeboat Associates, 1651 Third Ave., New York, NY 10028, 212/860-0300, Telex: 640693, TWX: 710-581-2524.

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Best-Crop

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List price: \$695. Agricultural Software Systems, Inc., 1216 Dawson Rd. #109, Albany, GA 31707, 912/431-1113.

LawSearch

A communications package for lawyers and accountants that gives the user access to Westlaw, a legal data base offered by West Publishing Company of St. Paul, Minnesota. It requires 96K, one disk drive, an RS-232C port, and a 1200 baud modem. *LawSearch* also emulates the Hazeltine 1520 terminal. With *LawSearch* the user can download and convert files to ASCII text format for word processing. It features forward and reverse scrolling. Communications parameters may be modified. List price: \$350. Direct.Aid, 695-C S. Broadway, Boulder, CO 80303, 303/494-8265.

Word Processing

Blue

A multiwindow word processor that allows the user to edit and transfer data among eight files simultaneously. It requires 64K and one disk drive and works on either a monochrome or a color monitor. Each window's color, size, shape, and location are user definable. Keystroke macros let the user combine a commonly used sequence of commands and execute it as one command. Format macros let the user define frequently used formats and execute them with one command.

Blue's formatting features include right justification, automatic word wrap, search and replace, block and line move, copy, delete, and auto-

matic pagination. List price: \$150. Symmetric Software, 1805 Clemson St., San Bernardino, CA 92407, 714/887-8595.

VisiWord/VisiSpell

A word processor/spelling checker that is compatible with VisiCorp's other "Visi" programs: *VisiCalc*, *VisiFile*, and *Visi/ON*. It requires 192K, one disk drive, and DOS 1.10 or 2.00. A split-screen window feature allows the user to move or copy data from one document to another, such as from a *VisiCalc* print model to a *VisiWord* report. *VisiWord's* format features include automatic word wrap, automatic pagination, headers and footers, block move/copy, delete, global search and replace, and micro-space justification. Spooling enables the user to print one document while editing another.

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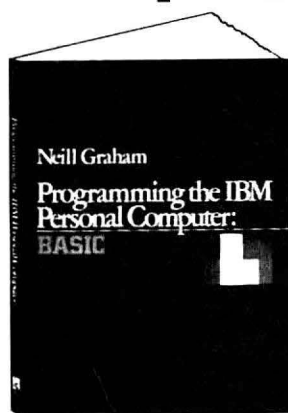
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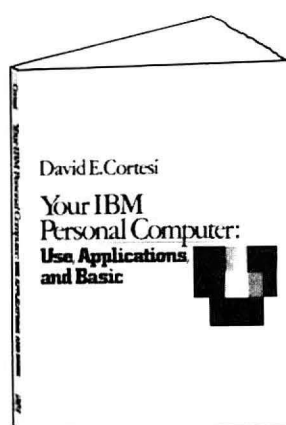
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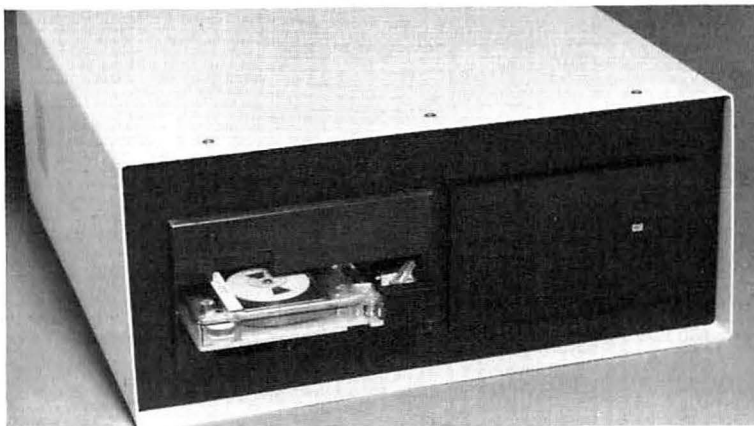
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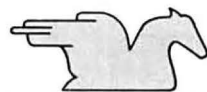
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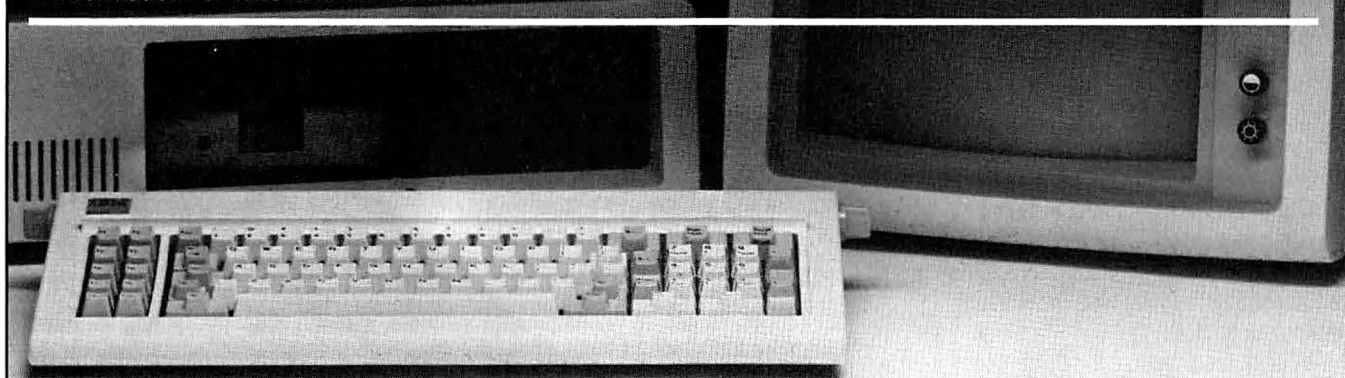
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About Our Gatefold

The image inside the gatefold cover was created by artist Mike Sullivan using an IBM PC, the Plantronics COLORPLUS card, and the *Color-Magic* graphics processor.

Mike is presently working as graphics director of International Software Marketing Limited, creator of *Color-Magic*, where he tests and demonstrates graphics on 13 different computers.

In creating this image, Mike began with a simple outline of Reggie Jackson at Yankee Stadium and used one of the special features of *Color-Magic*, the zoom mode, to enlarge sections of the screen up to 12 times the original size. The zoom mode helped display patterns and detail, such as the added reflection in Reggie's glasses. To perfect Reggie's stride Mike used the block option, which allowed him to pick up the bat and hand and move the image about an inch to the left. Once a section of the screen has been blocked off, the artist can also change the color with a choice of 16 true colors and a selection of pattern modes that can later be saved to disk for future work.

The Plantronics gatefold is a regular feature of *PC World*. Each month we ask an artist, an architect, or a designer to experiment with the system and create an image. At the end of the year a *PC World* blue-ribbon panel will evaluate the series and award a cash prize and a plaque to the artist who makes the most dazzling use of COLORPLUS. If you would like to be considered for the contest, please contact our editorial department.

October 1983

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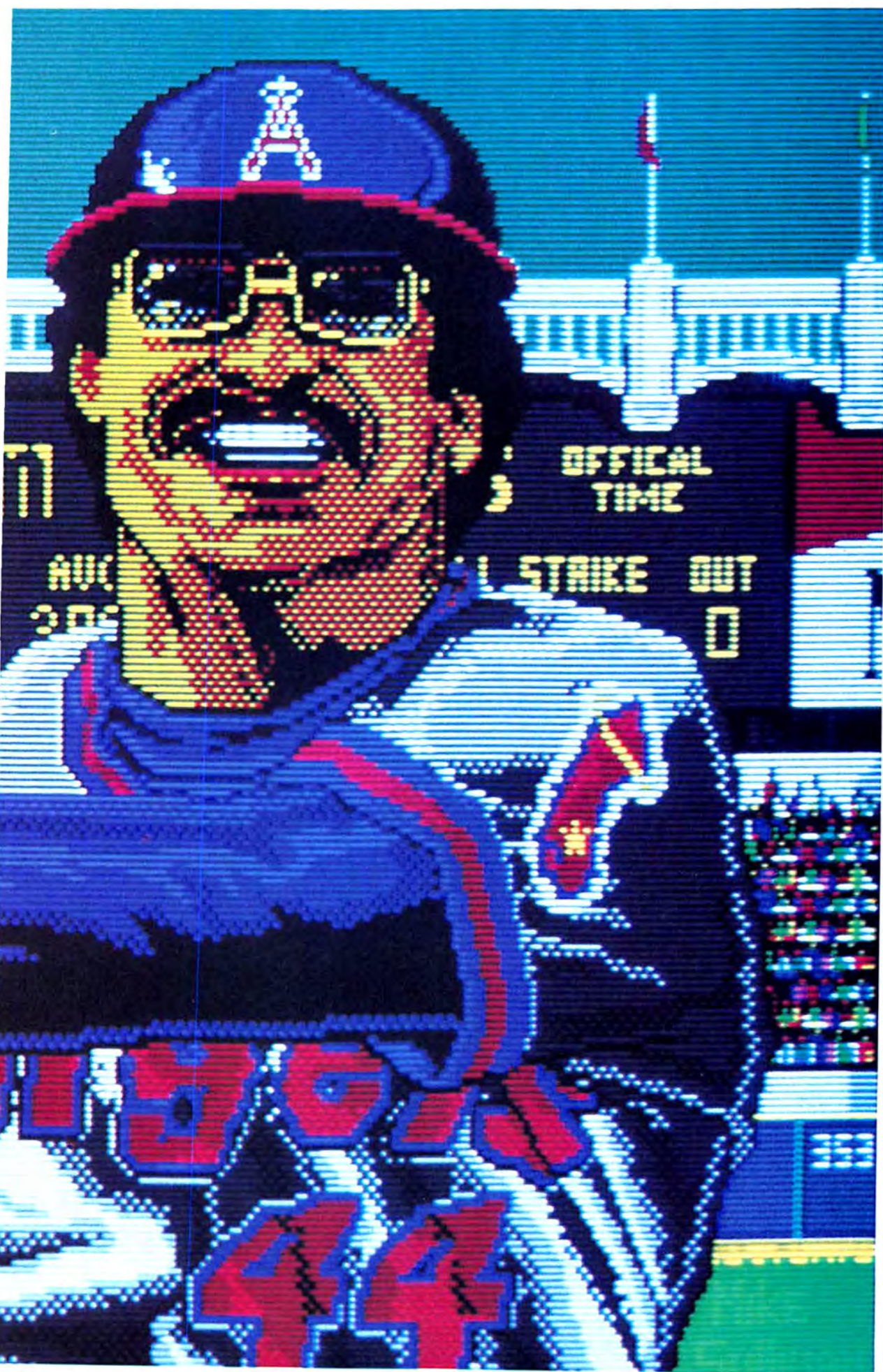
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