COVER PC STORY

PC vs. MAC: AN UNFAIR MATCH?

Is Apple's Macintosh a serious contender in the business applications arena or merely a brash pretender to the PC's throne? Read on—the results of our benchmarks may surprise you.

DIANE BURNS AND S. VENIT

Apple's claims aside, the Macintosh will never really replace the PC as a serious business machine, right? If you believe this, you're probably one of the many PC users who have never really seen or touched a Macintosh. Or maybe you formed this opinion before the 512K memory, hard disk drives, and the many business software packages were available for the Mac.

Today, Apple Computer is waging an accelerated campaign that is aimed at selling the Macintosh to business users. In the pages that follow, *PC Magazine* takes a serious look at Apple's claims and compares the Macintosh to the PC as a viable business machine. To separate the facts from the myths, we subjected these two major-league contenders to a series of tests with seven basic applications that are available for both machines: word processing, spreadsheets, database managers, business graphics, drawing, programming, and telecommunications.

Photograph: Rebecca Blossom

Unfair to the PC, you say? How can we match the PC's 16-bit processor against the Macintosh's 32-bit configuration? Although you'd expect the 32-bit machine to run faster, you've all heard how slow the Mac's operating system is with disk I/O. And if you are accustomed to working with other computers, you may laugh as you hum along with the Mac's disk drive, waiting for files to open or close. Have you heard the one about how Apple provided these pauses to give you a moment for thought? Unfair to the Macintosh, you say? How can we put the 4-year-old child of a giant in the same ring with a 1-year-old baby whose parents started out in a garage? If you've been thinking along these lines, you may be surprised at some of our test results. Once we began, we honestly had to ask ourselves whether the PC is as "mature" as we thought it was, or whether it is actually becoming outdated? Is the Macintosh a fad, or is it the direction of the future? We've had to acknowledge, too, that 3 years ago the PC suffered from the same lack of software that now hinders the Macintosh, but this is a discrepancy that time will resolve.

Here's a list of the applications and related products that we compared:

PC	Mac
Word Processing	
Microsoft Word	*Microsoft Word*
Spreadsheets	
Lotus's *1-2-3*	*Crunch*
Database Managers	
Powerbase	*Omnis3*
Business Graphics	
Microsoft Chart	*Microsoft Chart*
Drawing	
DR Draw	*MacDraw*
Programming	
Microsoft BASIC 2.0	*Microsoft BASIC 2.1*
Telecommunications	
Hayes's Smartcom II	*Hayes's Smartcom II*

Wherever possible, we used the same manufacturer's software on each machine. We found, however, that a package with the same name and manufacturer does not necessarily mean the same product. Sometimes, for example, handy features implemented for one machine were inexplicably missing in the program released for the other. In other words, sometimes a program's limitations related less to differences in the hardware's capabilities than to the incomplete design of the software.

This brings up an important issue: how long a product has been on the market. The longer it's been out, the more comments and criticisms have come back to the manufacturer, and the more it's likely that later versions have eliminated annoyances and incorporated improvements.

Product maturity, therefore, applies not only to the machines themselves but to the software, too. So, as we uncover our findings, bear the age difference in mind.

The design principles behind the two machines are radically different. The IBM is expandable by design. With its built-in expansion slots, the possibilities for configuring it are almost limitless.

Almost anything you add to the Macintosh, however, is literally an extra attachment. The Mac is a closed "black box." And even opening the Mac's outer casing voids Apple's warranty on the equipment.

The Testing Methods

As you will notice in the tests that follow, we strove to compare like features similarly implemented and to avoid comparing widely different aspects of the programs. For instance, we do not discuss installation procedures.

In all cases, the standard tests simply timed the execution of three common operations: loading a program, saving a file, and opening a saved file. We also noted the number of keystrokes required for a particular operation, and, in some cases, the actual time it took to enter the keystrokes. The time it took to execute the stated task is given to the tenth of a second.

In addition, we selected two or more characteristic operations for each application and presented the comparative results for each. For example, we timed a search-and-replace operation using word processors and a recalculation using spreadsheets.

When counting keystrokes, we simply counted a "mousestroke," or double-click, as a keystroke command. A mousestroke typically takes more time and movement than a keystroke, and there is inevitably a variation in operator speed. Because of this variation and because the time it took to enter a keystroke often made no significant difference, we finally chose to present only the execution times in the charts, which we averaged over three trials.

We used a color monitor and graphics card with the PC to display graphics but made no attempt to compare the full range of output devices available for the two machines. For example, we did not take into account the many options already available for PC output to color printers and plotters, 35-mm film cameras, and video output. Similarly, we did not compare the PC's "best possible" output to a laser printer against the Mac's refined type styles—available through Apple's LaserWriter printer, which incorporates typesetting fonts such as Times Roman and Helvetica.

Those who have had no prior experience with computers—or those whose opinions are based on media coverage—often see the Mac as friendly and the PC as intimidating. Indeed, there are many significant differences between the two machines that fall outside the realm of benchmark testing. With this in mind, we dispersed subjective evaluations throughout our discussion.

We began by comparing the nuts and bolts of each machine. In what follows we discuss the hardware components feature by feature and sum up the results in a chart. What, then, is the difference between a 512K PC and 512K Macintosh?

The Technical Specs

To compare the PC and the Mac as closely as possible, we used 512K machines in each case, then added a mouse, a graphics card, and a color monitor to the PC to run the graphics programs. We also attached a modem to each machine, which required us to add an AST board to the PC (see chart). The remaining differences in hardware result from the different guiding principles behind their initial designs and the different prevailing state of technology at that time.

Photograph: Roberto Bovsun

The Physical Design

In one area especially, the design principles behind the two machines are radically different—something that quickly becomes apparent when a user needs to expand his system beyond the manufacturer's basic configuration. The IBM is expandable by design. With its built-in expansion slots, the possibilities for configuring the machine are practically limitless. Almost anything you add to the Macintosh, however, is literally an extra attachment. Even opening the Mac's outer casing voids Apple's warranty on the equipment.

Is the Macintosh's closed "black box" what users want? We've passed the stage in the industry where most users loved tinkering with the insides of a machine. After all, how many of us would really tackle installing an internal hard disk? On the other hand, who can spare the time lost when the machine is at the shop getting an expansion? Why can't we just pick up the needed unit and plug it in like a stereo component?

Chip Technology

While open architecture remains a subject for debate, the superiority of the Mac's underlying chip technology cannot be denied. Inside the IBM PC throbs an Intel 8088, while a Motorola 68000 races inside the Macintosh. Apple touts the 68000 as a 32-bit processor, but it's actually an advanced 16-bit processor for most operations. Likewise, IBM called the 8088 a 16-bit processor from the start, while Intel's technical literature describes it as an 8-bit processor. (It has a 16-bit register but uses an 8-bit bus.)

Newer and more advanced, the Motorola chip has a larger instruction set that processes more work with less code. Much of its power supports the Mac's considerable graphics overhead.

The Intel 8088 chip, however, has been around longer, and a great deal more is known about how to make it perform to its fullest capacity. For this reason, it will be around for some time to come—supported by the large and still increasing number of 8088-based systems in use.

The PC AT's 80286 would have made a better comparison against the 68000, but the AT isn't exactly the desktop norm.

Memory

Most IBM PCs in regular business use now have a minimum of 256K, and 512K is common. Some damage was done to the Mac's reputation as a business machine by its introduction as a featherweight 128K RAM machine. Now that the Mac has a higher memory capacity, the question is how soon will even more memory be affordably available for both machines. Numerous companies are interested in seeing the PC function comfortably with a megabyte or more of RAM, but there is considerable interest in giving the Mac a megamemory, too.

The question of ROM, or internal built-in memory, is slightly different. While the PC's internal 40K ROM provides a sophisticated structure for addressing the machine's various components, the Macintosh's slightly larger 64K ROM helps it support the extensive memory overhead that the easy-to-use graphics interface demands. In fact, developers trying to produce a Macintosh-like interface for the PC find the job more complicated because of the PC's CPU and ROM deficiencies.

Disk Drives

Like its chip technology, the Mac's more advanced disk drives reap direct benefits from technological advances made since the PC was originally designed. The Mac's 3 1/2-inch Sony drives read their tiny, data-packed disks at variable speeds. One single-sided 3 1/2-inch floppy stores more data than a double-sided 5 1/4-inch floppy and fits into a shirt pocket. The 3 1/2-inch floppy is encased in a rigid, nonremovable plastic sleeve with a sliding metal shield over the accessible part of the disk's magnetic surface. These disks are far more rugged than the 5 1/4-inch floppy. Furthermore, experience has convinced us that approximately 1 out of 20 new 5 1/4-inch floppies are not usable because of BDOS errors in the formatting step. In addition, we have formatted almost 100 of the Macintosh's floppy disks, and every one of them worked the first time and is still usable.

The Mouse and the Keyboard

The Macintosh comes with a mouse, of course, and for all of our tests we used Microsoft's mouse on the PC with those programs that were capable of supporting a mouse. Generally, cursor movement by mouse tends to be rather jumpy on the PC screen; whereas it is smooth on the Mac.

However, the difference didn't bother us very often since most of the programs we tested on the PC could not be used with a mouse, anyway.

While the Mac's stripped-down keyboard is important for the machine's transportability, the mouse alone does not match all of the advantages of the PC's function keys and a numeric keypad (although you can attach one separately to the Mac). Moreover, the Mac's screen is rather slow to display characters as they are typed in through the keyboard. Speed typists will prefer the PC keyboard, which offers a far more satisfying tactile response and displays typed characters far more quickly on the screen.

The Screen

There is virtually no comparison in screen resolution between a standard PC and a Macintosh. Viewing the Macintosh's 512 × 342 pixel resolution next to the PC's 80-column by 25-line screen makes the PC's screen look crude in either the text or the graphics mode. We used a standard IBM graphics adapter and an IBM color monitor for normal graphics on

PC

Processor:
Intel 8088 (16 bit)

Clock speed:
4.77 MHz

RAM:
512 KB (256K on AST board)

ROM:
40 KB

Video display:
11″ color, 640 × 200 pixels

Disk storage: 5¼″ diskette, double-sided/360K

Serial ports:
One with AST board (add-on)

Fan:
Yes

System unit (HxWxD):
16.5″ × 20″ × 16″

System unit weight:
45 lbs.

Keyboard (HxWxD):
2″ × 20″ × 8″ (83 keys)

Keyboard weight:
6 lbs.

MAC

Processor:
Motorola 68000 (32 bit)

Clock speed:
7.83 MHz

RAM:
512 KB (built in)

ROM:
64 KB

Video display:
9″ black & white, 512 × 342 pixels

Disk storage:
3½″ diskette, single-sided/400K

Serial ports:
Two RS-232/RS 422 (built in)

Fan:
No

System unit (HxWxD):
13.5″ × 9.7″ × 10.9″*

System unit weight:
16 lb. 8 oz.

Keyboard (HxWxD):
2.6″ × 13.2″ × 5.8″ (58 keys)

Keyboard weight:
2 lb. 5 oz.**

*Does not include external drive
**Does not include num key pad

the PC, though we could have gotten higher resolution with IBM's Enhanced Graphics Adapter and Monitor, however, the EGA has a long, long way to go before it becomes the hardware and software standard for the PC.

The other obvious difference between the two machines is their screen size. Although the Mac's 9-inch screen can seem rather cramped at times, the size is less troublesome than it might be on a lower-resolution screen. You can choose to view more of a file on one screen by selecting a smaller type size for text or spreadsheet entries, and with *MacDraw* you can scale the image down to fit a full 8½- by 11-inch printout, or you can create a larger image on the small screen.

Running Software

Although facts and figures are one thing, performance is quite another. That's the reason why we will next take a look at both the measurable and subjective differences between the PC and the Macintosh as they run some of the most commonly used business software available on today's market.

Photograph: Roberto Bossan

WORD PROCESSING

IN EVERY TIMED TEST THE RESULTS WERE RATHER CLOSE.

Since word processing is probably the most common application for personal computers, a slow or awkward program affects overall productivity. Because word processing, for most people, is part of their daily work, we chose it to begin our comparison.

Product Selection

We were able to test word processing with the same product on both machines: *Microsoft Word*. The PC version of *Word* was first released in November 1983; in these tests we used the latest version, 2.0 which, along with the Microsoft mouse, was released in January 1985. The first Macintosh version of *Word*, released that same month, was the one we used for our tests here.

What We Did

To test word processing abilities, we built the same three-page, 11,538-character (11K) document on each machine. Besides the standard tests (load program, save data, open saved file), we measured the time and keystrokes required to search and replace a string of text and to change the margins for the whole document.

PC Product	Macintosh Product
Microsoft Word 2.0	***Microsoft Word 1.0***
Microsoft Corp.	Microsoft Corp.
10700 Northup Way	10700 Northup Way
Bellevue, WA 98004	Bellevue, WA 98004
(206) 828-8080	(206) 828-8080
List Price: $375	**List Price:** $195
Requires: 256K.	**Requires:** 128K.
CIRCLE 647 ON READER SERVICE CARD	CIRCLE 646 ON READER SERVICE CARD

***Word* on the PC: The screen only displays generic fonts.**

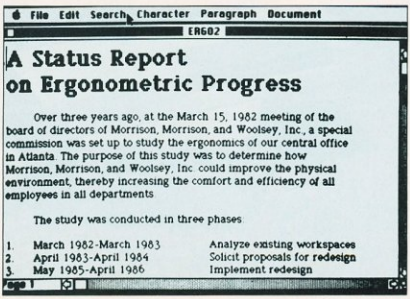
Data Entry

The data entry process was fairly straightforward on both of the machines: Once the program was loaded, we simply began typing. Both machines offer some common formatting commands (bold and italics, for instance) as menu selections. The PC version, however, also lets you override the menu and key in the command. Truly useful programs should offer both of these options: a helpful menu for beginners, with keyed command alternatives for more experienced typists who may not want to use the mouse.

The fact that these common formatting commands are available only through a menu on the Macintosh is a limitation of the word processor's program code rather than a fault of the hardware. (*MacWrite*, for example, includes keyboard command alternatives to the menu for bold and italics.) Perhaps later versions of *Word* for the Mac will incorporate some of these missing conveniences.

Other Features

Although *Microsoft Word*, as designed for the PC, allows you to select different type sizes and styles, what you see on the screen is not necessarily what you get in print. For example, ital-



***Word* on the Macintosh: The display shows custom fonts.**

Photographs: Robin Upward

ics and boldface may appear as such on the screen only if you have a graphics card. Even with a graphics card, all fonts appear as the standard serifed font you are accustomed to seeing on the screen, and all type sizes appear to be the standard screen character height until they are printed. On the Macintosh, not only do you see each type style displayed exactly as it is, but you also have a wider range of styles and sizes to choose from. Because of its built-in Clipboard cut-and-paste facility and bit-mapped screen, text documents on the Macintosh can include charts and pictures pasted in from charting and drawing programs. This capability is still not widely available on the PC; *Enable* is one of the few PC programs that can do it.

On the other hand, while the Macintosh version of *Word* does have full print-merge capabilities—an absolute necessity in our view—it does not contain a spelling checker. Some potential Mac users would miss the excellent *Spell* program in the PC version. Though both versions offer a wide variety of output device drivers, the list for the PC is much longer.

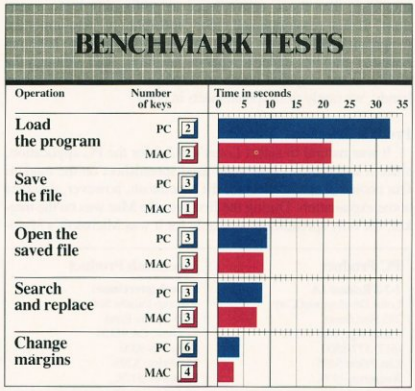
It's possible to send a text file from the PC to the Mac and vice versa, but the transfer is not as direct as you might expect. On the Macintosh, you must first save the file as "text only"—that is, none of the character formats available through *Word* are preserved, and the file is sent as a simple ASCII file. To obtain an ASCII file with the PC version, you must print the file to disk with the printer type "PLAIN" selected.

Because of its built-in Clipboard cut-and-paste facility and bit-mapped screen, text documents on the Macintosh can include charts and pictures pasted in from charting and drawing programs. This capability is still not widely available on the PC. On the other hand, although both versions offer a wide variety of output device drivers, the list for the PC is much longer.

Conclusion

We were surprised to find that in every timed test the two machines were rather close, with the Macintosh coming in slightly faster on most tests. Furthermore, since *Word* for the PC is moused, most common operations were equally easy to perform on either machine. Finding the two machines comparable, we would stay with whichever one we started out on—neither system offered anything worth switching for.

BENCHMARK TESTS



In all the word processing tests, the longest operation was loading the *Word* program itself. It also showed the biggest difference in time between the two machines: 33.67 seconds on the PC versus 22.00 seconds on the Macintosh. Saving the final text file was the second-longest operation, taking three keystrokes plus an average of 25.61 seconds on the PC, and one keystroke plus 22.03 seconds on the Macintosh. Once we saved the file, we opened the saved file from within the program. In both cases this operation required three keystrokes, but once again the Macintosh came out slightly ahead in time: 9.16 seconds for the PC versus 8.88 seconds for the Mac.

When it came to performing the margin resetting task, the Macintosh came out ahead on two counts. On the PC this task took six keystrokes (12 seconds keying time) plus 4.26 seconds execution time. On the Macintosh, the same operation required four keystrokes (with a keying time of 9 seconds) plus a 3.13-second execution time. In the search-and-replace test the PC took longer to execute the command (8.55 seconds). It required three keystrokes plus the search/replace string characters (an 8.17-second keying time). Like the PC, the Macintosh required three keystrokes but took an average of 10.19 seconds to key the search/replace string characters, plus a 7.52-second execution time. The net effect was that although the Mac's execution time was faster, keying may take so long that the PC comes out ahead.

Photograph: Roberto Brosan

SPREADSHEETS

THE PC MAY BE IN FOR SOME STIFF COMPETITION.

Along with word processing, spreadsheets are one of the most commonly used applications on any personal computer. Because these applications are used so frequently, speed can become more important than menu convenience in performing basic operations. Screen resolution and color capabilities are less important to spreadsheets (at least in this comparison, where we have put business graphics under a separate heading). And although the ability to see negative numbers displayed in red is sometimes handy, we rarely print spreadsheets in color.

Product Selection

It was natural to select Lotus's *1-2-3* for the PC application, since it is the most commonly used spreadsheet on the market. Our choice of spreadsheet for the Macintosh, however, deserves some explanation. During the first year the Mac was on the market, the only spreadsheet available for it was Microsoft's *Multiplan*. When we began conducting these tests, a number of other spreadsheets were about to be released, including Lotus's version of *1-2-3* for the Mac, *Jazz*, and Microsoft's *Excel* for the Mac. To compete with the heavyweight *1-2-3*, we wanted as powerful a package as possible. We looked for one with a large number of built-in functions as well as speed. Visicorp-Paladin's *Crunch* seemed to fill the bill, with its 74 built-in mathematical functions and its 250-column by 9,999-row worksheet.

Like *1-2-3*, *Crunch* includes both graphing and database management functions, which we did not test for this review. Although the prerelease version we used still contained some frustrating bugs, it was able to complete the necessary tests.

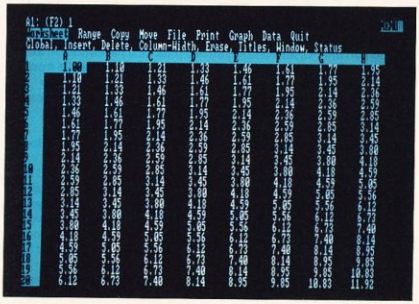
PC Product	Macintosh Product
***1-2-3* Release 1A** Lotus Development Corp. 245 First Street Cambridge, MA 02142 (617) 577-8500 **List Price:** $495 **Requires:** 192K.	***Crunch* (prerelease)** Visicorp-Paladin Software 2895 Zanker Road San Jose, CA 95134 (408) 946-9000 **List Price:** $295 **Requires:** 512K.
CIRCLE 645 ON READER SERVICE CARD	CIRCLE 644 ON READER SERVICE CARD

What We Did

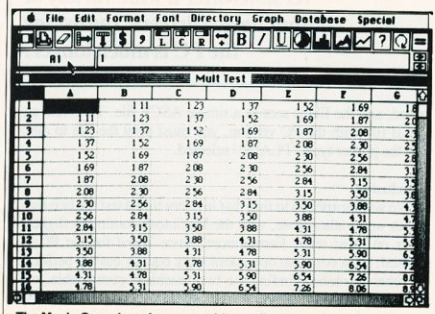
In addition to the standard tests (load program, save data, load saved data), we measured recalculation speed for two spreadsheets on each machine. Each spreadsheet consisted of a 25-row by 25-column matrix of entries: One included only addition formulas; the other, only multiplication. In both cases, the result in each cell depended on the value calculated for the immediately preceding cell.

Data Entry

We found the Mac's mouse very handy for selecting cells and making spreadsheet entries, although on the PC similar cell selection could be accomplished by using the four arrow keys. *Crunch* made full use of the Mac's iconographic menu capabili-



Lotus's *1-2-3* for the PC uses fast keyboard commands.



The Mac's *Crunch* performs graphics well with command icons.

Photographs: Robin Upward

ties, letting you fill down or fill right with a single mouse click. The Mac's small screen can be a disadvantage in building large spreadsheets, but to fit more cells on the screen, *Crunch* lets you select from a wide range of type styles in sizes as small as 9 points. Scrolling with the Mac was slower than using the Pg Up/Pg Dn keys on the PC. For many users, a numeric key-pad is a must for convenient data entry. Such a keypad, although not standard on the Mac, is available separately as a peripheral. It works almost identically to that on the PC.

Other Features

Although we compared charting abilities using a standalone graphics package under a different heading in this article, it's worth mentioning here that it is much simpler to create a graph with data from *Crunch* than from *1-2-3*. With *Crunch*, you simply select the cells to be graphed and click the mouse on one of the chart icons shown in a menu bar across the top of the screen. With *1-2-3*, selecting the cells to be graphed is more cumbersome, and you need to change disks in order to view the graph.

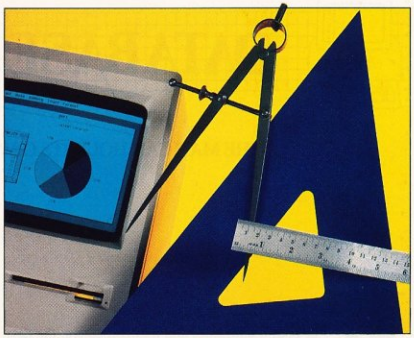
You can transfer spreadsheet data between the two machines and load it from almost any originating spreadsheet package into almost any target package. It's conceivable, therefore, that a large office could use different machines and still merge spreadsheet data when necessary, but the conversion is cumbersome. In all cases the spreadsheet data must first be converted to DIF, SYLK, or ASCII formats before it is transmitted, then converted back to spreadsheet format at the other end.

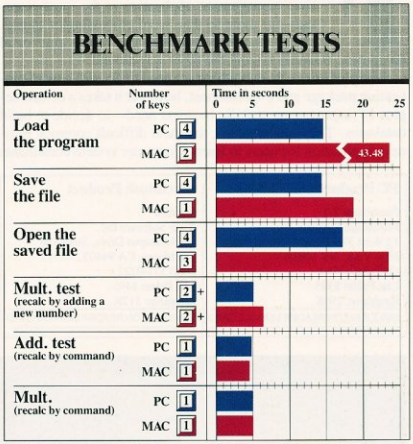
Our early results indicate that the PC may be in for some stiff competition in the spreadsheet arena, especially if spreadsheets on the Mac eliminate the extensive training needed to learn 1-2-3 on the PC.

We found that the Macintosh's mouse is very handy for selecting cells and making spreadsheet entries, although on the PC similar cell selection could be accomplished by using the machine's four arrow keys.

Conclusion

Spreadsheets on the Macintosh can be more powerful and easier to use than on the PC. Our preliminary results indicate that the PC may be in for some stiff competition in the spreadsheet arena, especially if spreadsheets on the Mac are able to eliminate the one- or two-day training period required for the novice user to learn *1-2-3* on the PC.





Lotus's *1-2-3* loaded into the PC 3 times faster than *Crunch* loaded into the Macintosh: 14 seconds on the PC versus 45 seconds on the Mac. Saving the data required only one mouse click on the Mac (0.4 seconds) plus 19 seconds of execution time. On the PC it took four keystrokes or 2 seconds to enter the Save command, but the save operation was completed within 14.5 seconds, giving the PC a net lead over the Macintosh. The last of our standard tests—loading the saved file—required 17.25 seconds on the PC and 23.5 seconds on the Mac.

On both machines, the Recalculation command required only a single keystroke, though the PC's keystroke took less time to perform than the Mac's mouse click equivalent (0.13 seconds versus 0.65 seconds). Once the command was entered, execution times for recalculation were nearly identical on both machines for addition and multiplication: roughly 5 seconds in all cases.

Photograph: Roberto Braun

DATABASE MANAGERS

THE MAC CAN HOLD ITS OWN IN DATABASE MANAGEMENT.

For both mainframes and minicomputers, the database management application is the most essential—far more so than word processing or spreadsheet number crunching. With personal computers, it seems to work the other way around.

Many of us can do everything we need to do with a word processing package and a spreadsheet, however it takes a certain degree of maturity—or specific business need—to decide to build databases. They are, after all, the most difficult common business application for users to learn. Computer system consultants are often called in to design the database, generally with the intention of making the program easier for the office staff to use. We were especially curious, then, to see how the Mac's acclaimed "friendliness" carried over into this highly complex application.

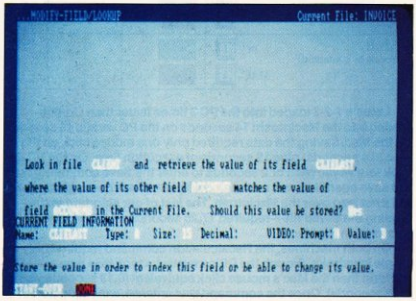
PC Product	Macintosh Product
***Powerbase* 2.1** Powerbase Systems, Inc. 12 West 37th Street New York, NY 10018 (212) 947-3590 **List Price:** $595 **Requires:** 256K.	**Omnis3** Blyth Software Inc. 2655 Campus Drive, Suite 150 San Mateo, CA 94403 (415) 571-0222 **List Price:** $495 **Requires:** 512K.
CIRCLE 643 ON READER SERVICE CARD	CIRCLE 642 ON READER SERVICE CARD

Product Selection

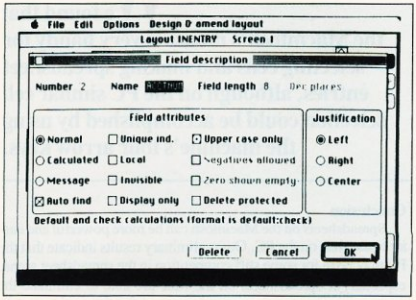
We selected *Powerbase* for the PC because it is graphically oriented, powerful, and easy to use. For the Macintosh, we chose *Omnis3*, a powerful hierarchical database—and one of the first full database systems available for the Mac.

What We Did

We built a relatively simple database on each of the machines: an invoice file for a dentist's office. The database was designed to pull in data from both the client file and from a file that listed all of the dentist's available services and their charges. We entered 30 client records in each system, 10 services, and a dozen invoices. These data files required 15,504 bytes on the PC, 15,360 on the Mac. In addition to the standard tests, we measured the



Entering a record is standard fare on both machines, but the PC's color display helps clarify entry fields.



***Omnis3* takes advantage of the Mac's dialog box, which allows a simple click of the mouse to designate choices.**

Photographs: Robin Upward

time required to find a record and the time required to save a new record.

Data Entry and Manipulation

Both these packages enlist an elaborate system of menus and prompts to help you design your database. It was easy to set up the invoice file so that it automatically pulled data from the client and services files as you billed a client. Once the database itself was designed and in place, screen entry was easy and straightforward on both systems. Some keying conventions took a while to get used to; for example *Powerbase* uses the F9 and F10 keys instead of the arrow keys to move around on the menu bar, and *Omnis3* forces you to press the Tab key to move from field to field during entry, since the Return key signifies that you are finished with the record. These are peculiarities of the programs that we used themselves, however, rather than any special limitations in the hardware.

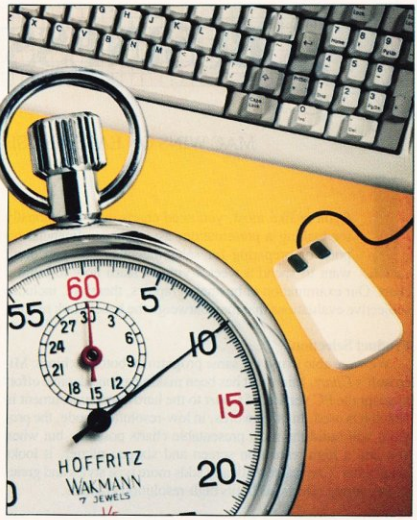
We compared the times required to search the database for a particular record. The Mac was faster in both the keying time and the search time, though the two machines can be judged comparable: The Mac took 1.5 seconds to locate the record; the PC took 2.4 seconds. The test of saving a record proved to be an even match: each machine clocked in with a keying time that was under 1 second, and an execution time of approximately 4 seconds.

Although Omnis3 proves the Mac can handle comprehensive business systems, few DMBS products are now available for the Mac. We need to wait for a popular consensus to put new products through more-rigorous tests.

It takes a certain degree of business maturity to decide to build databases. They are the most difficult business application to learn, so we were curious to see how the Mac's friendliness carried over to this application.

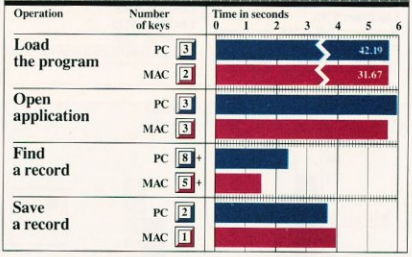
Conclusion

Although there have been many complaints about the lack of, or limitations in, database management programs available on the market for the Macintosh, *Omnis3* proves that there is no reason why the Mac can't handle the DBMS demands of comprehensive business systems. Nevertheless, few products are still available for the Mac in this category, and we still need to wait for the popular consensus to put new products like *Omnis3* through more-rigorous tests than ours.



Photograph: Roberto Bonsan

BENCHMARK TESTS



The Macintosh took less time to load *Omnis3* than the PC took to load *Powerbase:* two mouse clicks requiring 0.32 seconds, plus 31 seconds for the command to execute. On the PC, the three keystrokes took 1 second, followed by 42 seconds to load the program. Both database packages save records as they are entered, so we couldn't time saving a file as we did for other applications. Once a database structure is built, however, it can be opened directly. Opening required only three keystrokes in each case, and the execution times were very close: 5.65 seconds on the Mac, 5.89 seconds on the PC.

BUSINESS GRAPHICS

MAC WINS ON EASE OF USE—IF YOU DON'T NEED COLOR.

If you're like most, you need charts only occasionally for making a presentation, assembling a financial report, or preparing for sales meetings—so you don't want to spend a week trying to learn how to build a chart. Our examination of business graphics, therefore, includes subjective evaluations that may outweigh the benchmark results.

Product Selection

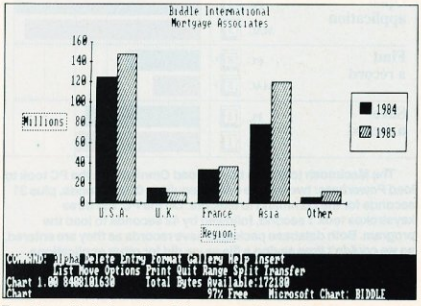
We were able to use the same program on both machines: Microsoft's *Chart*. Microsoft has been making a considerable effort to adapt the PC version of *Chart* to the hardware environment in which it is used. In other words, in low-resolution mode, the program will build the most presentable charts possible, but when you add a high-resolution screen and six-pen plotter, it looks even better: *Chart* automatically adds more type styles and greater smoothing effects, as befits high-resolution graphics.

PC Product

Microsoft Chart 1.0
Microsoft Corp.
10700 Northup Way
Bellevue, WA 98004
(206) 828-8080
List Price: $250
Requires: 128K (256K recommended); graphics monitor.
CIRCLE 641 ON READER SERVICE CARD

Macintosh Product

Microsoft Chart 1.0
Microsoft Corp.
10700 Northup Way
Bellevue, WA 98004
(206) 828-8080
List Price: $125
Requires: 128K.
CIRCLE 640 ON READER SERVICE CARD



For data series information, PC users must switch screens.

This test brought us head-on to one of the biggest limitations of the Macintosh: a screen that's black and white only, with (so far) no color output device capabilities. The Mac's high-resolution screen allows for the full range of *Chart*'s type styles and shading options, but only the PC version can output in color. The Mac's high-resolution screen is a big plus, and we personally preferred it to the PC's crude resolution in color. In fact, on a standard PC, *Chart* is best run in the monochromatic mode.

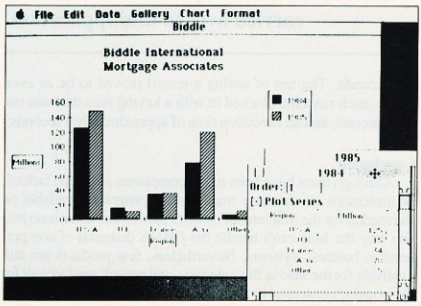
Many camera devices for producing slides or video presentations directly are available for the PC but not for the Mac. This aside, and bearing in mind that color can be one of the most important elements in business graphics, we confined our examination to the chart-building process and the way it looked on the screen, rather than comparing the printed output capabilities of the two machines.

What We Did

Using *Chart* on each machine, we built a bar chart that incorporated two data series: 1984 versus 1985 sales in five regional sales areas. Besides the standard disk I/O tests, we measured the time and keystrokes required to change a bar pattern, switch from a bar chart to a column chart, and redraw the chart after changing one or more data entries.

Data Entry

One nice feature of *Chart* on the Mac is that you can see both the data series and the chart at the same time. Although it is re-



Mac windows show chart and data series information together.

Photographs: Robin Upward

warding to see the chart change as you enter or alter the data, this feature is time-consuming. Experienced chartists will want to work with the automatic redraw feature turned off. Without the redraw feature, charting on the Mac is more like working on the PC, which doesn't let you view the chart and data simultaneously or watch your creation change.

Another major difference between the two implementations is that the PC version does not use a mouse. Instead, for all operations including menu selection, it uses the arrow keys to move the cursor. Our keystroke time trials showed that the Mac's double-click mousestrokes took longer than the PC's commands in several cases, but subjectively we felt that using the mouse made it simpler to, say, select part of a chart, move the legend, or change the typeface of a label.

Other Features

We did not test another of the Mac's unique features against the PC: its ability to cut and paste between applications easily through its built-in Clipboard facility. On the Mac, copying data from *Multiplan* to *Chart*, or copying a graph from *Chart* to *Word*, requires only two or three mousestrokes at each end of the operation. Since the PC not only requires more steps to copy *Multiplan* data to *Chart* but cannot copy a chart into a text file, the Mac makes integrated report production a simpler task. This compensates somewhat for its limitations in producing color presentations.

Charts saved in SYLK format on either machine can be telecommunicated to any other machine's *Chart* program, so the PC and Mac should be able to exchange data quite easily by using *Chart*. However, we did not test this feature either.

With Chart on the Mac, you can see both the data series and the chart at the same time.

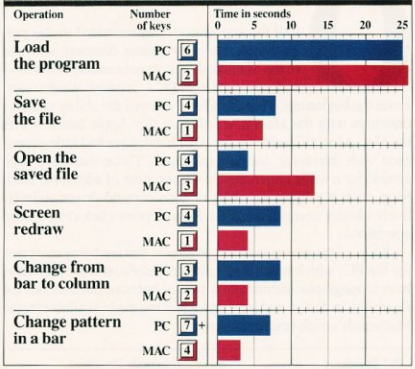
Many camera devices for creating slides or video shows are available for the PC.

Conclusion

Our purpose here was to compare two versions of a standalone business graphics package rather than the charting functions of a spreadsheet program. To do so, we consciously sacrificed the convenient direct connection with spreadsheet data in favor of better-looking, presentation-quality graphics. Of course, both versions of *Chart* let you link a data series to a *Multiplan* file, but one feature we missed on both machines was the ability to enter formulas directly as part of a data series for a chart.

If we had to choose between the two machines on ease of operation alone, we would certainly choose the Macintosh for chart building. However, if we wanted color presentations, we would stick with the PC.

BENCHMARK TESTS



As with the other applications, the longest single operation is loading the program from disk. The loading times themselves were close, ranging between 24.67 and 25.55 seconds on the PC and between 23.76 and 28.56 seconds on the Mac. In number of keystrokes and keying time, however, the Macintosh came out significantly ahead, with two keystrokes that took an average of 0.2 seconds against the PC's six in 1.1 seconds. In saving data, too, the Macintosh beat the PC in time and keystrokes: four keystrokes required an average of 2.71 seconds on the PC, followed by 7.81 seconds of execution time; the Mac's single mouse move required half that time (1.4 seconds), followed by 6.15 seconds for execution.

When it came to opening a saved chart file, however, the PC was phenomenally faster. But its speed reflects the fact that on the PC, the opening screen displays the data series lists only, whereas the Mac's opening screen includes a drawing of the chart, too. The simpler the chart, the faster the Mac's chart file will load.

To convert the chart from a horizontal bar to a vertical column required only three quick keystrokes (1.98 seconds) on the PC, as opposed to the Mac's two mouse clicks with a forced wait between them, which required 3.8 seconds. After new data was entered, the Mac required only 4.07 seconds to redraw the chart on the screen. This contrasts sharply with the PC's 8.48 seconds.

The time needed to change a fill pattern in a bar was one case where the PC's 7 to 12 keystrokes—depending on which pattern you selected with the arrow keys—consistently took less time than the Mac's four mouse clicks. The Mac, however, made up for lost time during the execution of the command. Its ability to redraw graphics on the screen faster than the PC is a direct result of the hardware itself: Apple incorporated the screen-building code directly into the Mac's ROM, whereas Microsoft had to include additional quick-draw coding in *Chart* to push the PC screen to its limits.

Photograph: Roberto Brosan

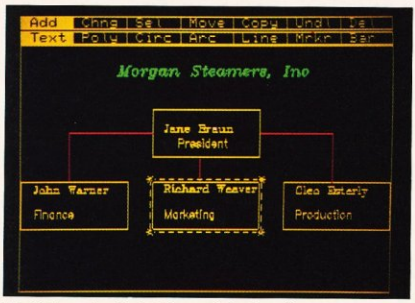
DRAWING PROGRAMS

THE MAC'S MOUSE AND MENUS MAKE DRAWING A BREEZE.

Of all the applications that we tested in this project, the drawing programs demonstrate some of the Macintosh's most outstanding features—and some of the PC's greatest weaknesses. From the beginning, Mac users have enjoyed the ability to create drawings with the *MacPaint* software that Apple bundles with the Mac. Most PC users, on the other hand, have had little experience with free-form drawing packages. Those that have been around for a while either require the purchase of additional hardware, such as a digitizing tablet, or are command-driven and relatively clunky compared to *MacPaint*'s point-click-drag mouse operations.

Some of the newer drawing programs that are being marketed for the PC, which attempt to emulate *MacPaint* and *MacDraw*, have iconographic menus and a mouse, but none has matched the flexibility in design and type styles that are made available by the Macintosh's high-resolution screen.

PC Product	Macintosh Product
DR Draw 1.0	***MacDraw 1.7***
Digital Research Inc.	Apple Computer, Inc.
P.O. Box 579	20525 Mariani Ave.
Pacific Grove, CA 93950	Cupertino, CA 95014
(408) 649-3896	(408) 996-1010
List Price: $295	**List Price:** $195
Requires: 128K; graphics card	**Requires:** 128K
CIRCLE 639 ON READER SERVICE CARD	CIRCLE 638 ON READER SERVICE CARD



The PC draws in color, but the resolution is medium.

Photographs: Robin Upward

Product Selection

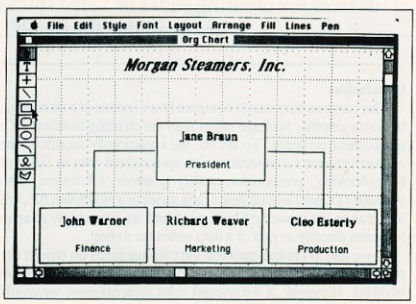
For this comparison, we chose *MacDraw* rather than *MacPaint*, since *MacDraw* is an object-oriented drawing program that lets you rearrange text and graphics on the screen easily. For the PC, we selected *DR Draw* by Digital Research because its features and operation are more similar to *MacDraw*'s than are those of any other PC package available. *DR Draw,* which has been out since January 1984, still carries the original release number, 1.0. *MacDraw* was not released until March 1985, but its predecessor, *LisaDraw,* had been around for several years. Earlier beta versions of *MacDraw* have been around for so long that the first official release is, in fact, Version 1.7.

What We Did

We used each program to draw a simple four-person organization chart. In addition to conducting the standard tests, we measured the amount of time and number of keystrokes required to change the orientation for the printed image from "tall" to "wide," turn the grid or ruler on, move a box on the screen, and change the size of the type in a heading.

Data Entry

The drawing process itself was much faster and simpler with the Mac. Menu selection functions that required one step on the Mac required one or more additional submenu selections on the PC. On the Mac, we could move an object on the screen by simply clicking and dragging the mouse, whereas *DR Draw* required



Mac draws with high resolution, but in black and white.

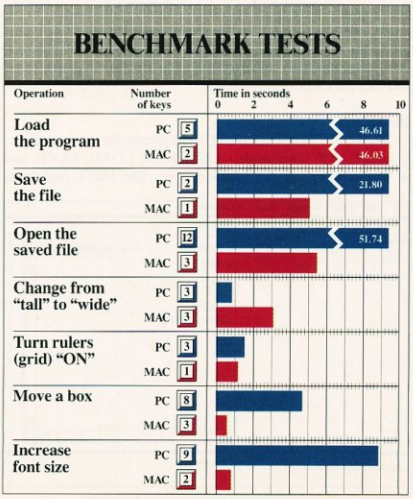
us to mark the target coordinates and then wait for the program to move the object.

Thus the Mac's greater ease in drawing translates into greater artistic freedom and power for the user. For instance, the Mac prints the entire drawing, no matter how many pages it requires. *DR Draw* prints only those parts of the image that fall within the page outline. When you select tall or wide print orientation, the corresponding outline is dropped in over the screen image; the part of your image that falls outside the outline simply does not print. Moreover, it's much easier to rearrange or resize the full drawing on the Mac than on the PC.

Other Features

Although the Mac has a wider range of fill patterns to choose from, the PC—with *DR Draw*—allows at least a limited color display and output. On-screen, *DR Draw* let us select among only three different colors (plus black). Since color is important for most presentation graphics, the Mac's black-and-white restriction is a significant limitation for many artists. Some color output capabilities are promised for the Mac soon, but none were available for this comparison. The Mac offers a wider selection of type styles. However, type size is another question: here *DR Draw* lets you define an area to be filled by the text, letting you create an "infinite" number of type sizes, as opposed to the Mac's nine (or fewer) point sizes.

The Mac lets you copy drawings into text files and print out whole documents that include the graphics in stream with text.



Some page layout applications for the Mac even let you compose multicolumn page layouts with graphics. No drawing packages for the PC are as fully integrated with text as are those available for the Mac. Currently, the Mac and the PC have no drawing programs in common, and there is no way to transfer graphics images between the two machines.

Conclusion

Of all the different types of programs tested in this comparison, the drawing programs gave rise to the widest differences in subjective experience. There was no question that creating an organization chart was faster and simpler with the Macintosh, and the final printout was generally more attractive. This last judgment may be debated if we compared the Mac's black-and-white output to *DR Draw*'s printout on a color plotter; but, as we noted in our introductory notes, we made no attempt to evaluate the differences between color and black and white.

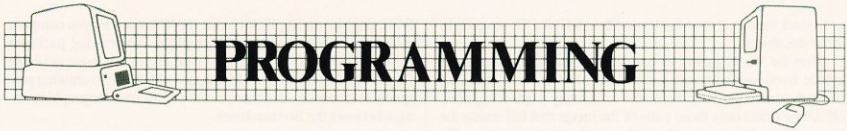
In choosing between the two, we would stick with the PC if color were important, but the Mac is the only machine we know of that can produce full black-and-white printed documents that incorporate both text (in various type styles and sizes) and graphics. *MacDraw* makes it possible for almost anyone to create charts, diagrams, and business forms easily—you don't have to be an artist, programmer, or typesetting code specialist. Coupled with the high-quality output of Apple's LaserWriter printer, *MacDraw*'s ease of use could have a tremendous impact on corporate in-house production and publishing.

Although it took a few more keystrokes to load *DR Draw* on the PC than to bring up *MacDraw* on the Mac, the two programs required about the same amount of time to execute the Load command: an average of 46 seconds. This relatively long loading time is because both programs create rather elaborate screen images in the process.

The Mac was more than 4 times faster in saving the file—5 seconds versus the PC's 22 seconds—and could open the saved file nearly 10 times faster than the PC—5 seconds versus the PC's long 52 seconds. Opening the file required as many as 12 keystrokes on the PC, but the actual keying time turned out to be faster than the Mac's three mouse clicks. The screen-building speed that these tests reflect demonstrates the advantage of the Mac's built-in screen processing over *DR Draw*'s need to include a lot of the screen processing in the program code.

The Mac took much longer to perform a change of page orientation from tall to wide: 4 seconds keying time plus 3 seconds of execution time versus the PC's 3 seconds keying time plus 1-second execution. The difference can be accounted for by the fact that the Mac redraws the entire screen after this command, whereas *DR Draw* simply drops an outline of the page boundaries over the drawing without redrawing the screen.

The Mac won the test for turning the grid or ruler on: one mouse click or 1.5 seconds keying time plus 1.2 seconds execution, as opposed to the PC's three keystrokes or 3.2 seconds keying time plus 1.6 seconds execution. The Mac also won the time tests for moving a box from one location to another on the screen: a simple click-and-drag operation with the mouse took 0.6 seconds versus the PC's eight keystrokes or 12.5-second keying time plus 4.8-second execution. Finally, the Mac was much more efficient in changing the type size for a label: two mouse clicks or 3 seconds of keying time plus 0.83 seconds of execution. To change type size, the PC required nine keystrokes or 12 seconds of keying time plus 9 seconds for execution.



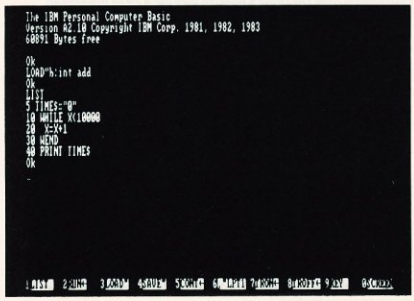
MAC'S MENUS CAN IMPEDE EXPERIENCED PROGRAMMERS.

When we ran seven short programs coded in Microsoft BASIC on each machine to measure internal processing time, we were able to throw out the stopwatch and let the programs count the seconds themselves. Not surprisingly, the Mac's 32-bit processor handled every operation (except one, noted below) twice as fast as did the PC's 16-bit chip.

Product Selection

Microsoft Corporation has written the BASIC version that you will find on virtually every personal computer on the market.

PC Product	Macintosh Product
Microsoft BASIC 2.0 Microsoft Corp. 10700 Northup Way Bellevue, WA 98004 (206) 828-8080 **List Price:** $395 **Requires:** 64K CIRCLE 637 ON READER SERVICE CARD	*Microsoft BASIC 2.1* Microsoft Corp. 10700 Northup Way Bellevue, WA 98004 (206) 828-8080 **List Price:** $150 **Requires:** 128K CIRCLE 636 ON READER SERVICE CARD



Listing a program in PC BASIC: plain vanilla.

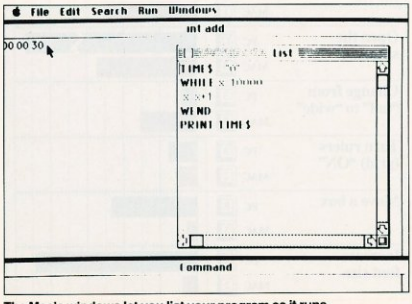
We used the latest versions available: Version 2.0 for the PC, and a prerelease (beta copy) of Version 2.1 for the Macintosh that specifically improved processing speed over the previous version. BASIC on the Mac includes some special graphics and sound commands that are not available on the PC, but the commands used in these tests work the same way on both machines.

What We Did

In the standard tests, we measured the time needed to load BASIC and to save an already coded program. However, we did not record the time it took to open a coded program because all our programs were so short that it took only milliseconds. In addition, our programs tracked their own times for executing multiple loops to test integer addition, floating-point calculations, string concatenation, internal data table lookup, an empty loop, and data file create/read/update.

Data Entry

We found it handy that the PC incorporates the most commonly used BASIC commands—LIST, RUN, LOAD, SAVE, and so forth—in one-stroke function keys. The Mac's pull-down



The Mac's windows let you list your program as it runs.

Photographs: Robin Upward

menus include some of these same commands, but the menu process can impede experienced programmers. The fact that the Mac shows you a list of the programs available when you initiate the LOAD command seems convenient at first, especially considering that the PC version forces you to use the FILES command. But after you load the same program several times, you begin to realize that the Mac's menus slow you down considerably. On the other hand, unlike BASIC programs on the PC or any other machine we can think of, BASIC programs on the Mac do not require the use of line numbers. This makes coding much simpler on the Mac.

Other Features

One advantage of the Mac's BASIC against the PC's is that you can view several windows at once. For instance, you can view the code in one window and watch the results of the program as it is running in another window. If the Mac discovers an error in your code, it displays the full line of code framed in a black box along with the lines immediately preceding and following the error. You can edit the line directly.

In contrast, the current PC version tells you what line number has an error, but leaves the next step to you; you have to enter a command to display and edit that line. The good news is that a windowed version of BASIC for the PC is on its way, probably in conjunction with Microsoft's expected release of *Windows* later this year.

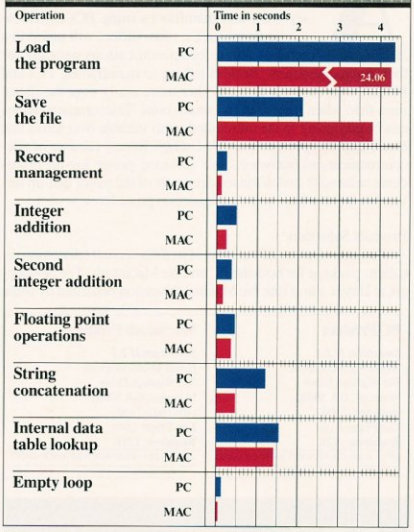
If the Mac discovers an error in your code, it will display the full line of code framed in a black box along with the lines immediately preceding and following the error. You can edit the line directly.

The most current version of PC BASIC tells you what line number has an error, but you have to enter a command to display and edit that line. A windowed version of PC BASIC is on its way later this year.

Conclusion

BASIC is not the type of application that would sway our choice between two machines. Obviously, we would use whatever version of BASIC was available for the machine that we selected on the basis of other considerations. It's clear, however, that BASIC for the Mac is a more evolved product, and the PC version has some catching up to do.

BENCHMARK TESTS



The PC was 8 times faster than the Mac in loading the BASIC program, partly because the Mac version builds several windows on the screen in addition to loading BASIC into memory, while most of the PC version is already in ROM. It simply loads the rest of BASIC into memory and displays "Ok."

PC BASIC required seven keystrokes, plus 4.37 seconds to load; the Mac version required a double click of the mouse plus 24.06 seconds. Similarly, the PC was faster in saving a program: It required only two keystrokes plus the name of the file, followed by 2.10 seconds of execution time. The Mac required four keystrokes plus the name of the file, followed by 3.81 seconds of execution time before the screen was ready for the next command or entry.

The Mac was faster on all six tests of BASIC functions. In general, the Mac was at least twice as fast on all measures, with the exception of internal data table lookup. This operation took almost 1.5 seconds on both machines. We ran each program three times on each machine; oddly, some of the Mac's times varied between trials, but not by more than 0.02 seconds. The PC's times were the same on all.

Photograph: Roberto Braun

TELECOMMUNICATIONS

WITH THE NEW TECHNOLOGY, WE NEED A NEW MINDSET.

As the number of dial-up networks, information services, and mainframes using PCs as remote terminals increases, more offices will invest in a modem and telecommunications package for their microcomputers. Besides talking to mainframes, PCs and Macintoshes can talk to each other more easily over the phone lines than when they're in the same room. Telecommunications can be confusing to the uninitiated, who stumble over terms like *baud, stop bit, protocol,* and *X-On/Off.* Recent releases of telecommunications software have included preset log-on procedures tailored to match the requirements of the major dial-up services in an effort to simplify connection procedures.

Product Selection

Hayes has produced versions of its *Smartcom II* telecommunications package for both the PC and the Macintosh. The developers at Hayes admit that the Macintosh version benefited by some of the lessons they learned in developing the PC version, and that later versions for the PC will probably benefit by what they learned from the Macintosh. Both versions include standard features of telecommunications such as sending and receiving at 1200 baud, printing while on-line, saving to disk as the file is received, auto-dial capabilities, and preset auto-dial files for commonly used services.

We used the Hayes Smartmodem 1200 with both machines. To accommodate the modem, the PC required a serial port, which we added with SixPak Plus from AST Research. The Mac, on its part, required a special cable to connect its compact RS-232/422 port to the Smartmodem's standard RS-232 port: We used Microsoft's MacEnhancer—a piece of hardware that gives the Mac two standard RS-232 ports and a parallel port.

PC Product	Macintosh Product
Smartcom II 2.1	***Smartcom II 2.1***
Hayes Microcomputer	Hayes Microcomputer
705 Westech Drive	705 Westech Drive
Norcross, GA 30092	Norcross, GA 30092
(404) 662-7100	(404) 662-7100
List Price: $149	**List Price:** $149
Requires: 192K	**Requires:** 128K
CIRCLE 635 ON READER SERVICE CARD	CIRCLE 634 ON READER SERVICE CARD

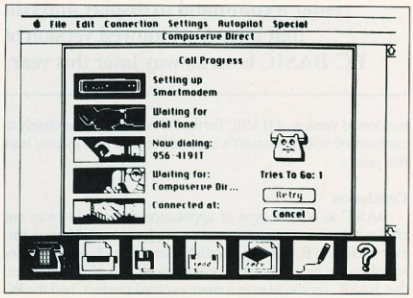
What We Did

We built an autodial procedure using *Smartcom II* on each machine to dial up one of the major information networks (CompuServe Information System). We timed only two procedures: loading the telecommunications program and dialing up CIS with an auto-dial sequence.

Data Entry

We found no difference in the type of information required. You can enter phone numbers, log-on codes, and passwords into each program actively as part of the dial-up procedure or enter the information into an auto-dial-up listing that can be saved and in-

The PC's screen doesn't help you monitor the dialing out process.



The Mac keeps you on top of your call's status.

Photographs: Robin Upward

voked from the menu. Auto-dial procedures can include macros to take you through the main menus of an information service. They can look up a stock quote, for example, download the data, and log off. All *Smartcom II* entries are guided by a series of prompts in plain English that anyone can follow. By using one of the preset auto-dial files, we didn't have to know anything about baud rates or protocols.

One advantage of the Mac's iconographic menus is that we could see and make a selection more quickly than with the PC's text menu. There is no question that the brain can assimilate the meaning of a clear picture more quickly than it can decipher the meaning of a phrase of text. *Smartcom II* on the Mac, more than any other package we tested, was so graphic that an absolutely illiterate operator could bring up the program and activate an auto-dial sequence.

Other Features

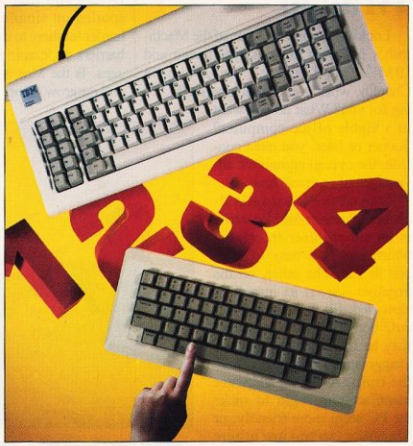
Once the connection to a service is made, there is no significant difference between the two machines. The Mac displays incoming data in a plain type style, and the keyboard commands accepted by information services are not presented in a menu. If you are dialing up one Macintosh from another, however, you can use *Smartcom II*'s pencil icon to call up a "canvas" on which you can create *MacDraw*-like pictures that the party at the other end can see and edit in an interactive drawing session. You can also send *MacPaint* images and other graphics Mac-to-Mac. No such facility is available through the PC; only graphics images stored in a command language can be transmitted between PCs using the same graphics package.

Only graphics images stored in a command language can be transmitted between PCs using the same graphics package.

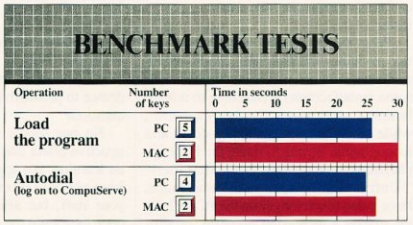
On the Mac you can call up a "canvas" on which you can create pictures that the party at the other end can see and edit.

Conclusion

We believe that telecommunications are becoming easier on the PC, but the *Smartcom II*'s amusing graphics on the Mac make the few minutes it takes to connect go by quickly. Icons representing the stages of the process line up on the screen, and a telephone with moving eyes watches as each active stage is highlighted in sequence. After this entertaining start, your interaction with the computer at the other end of the line may seem rather dull as rows and rows of words begin to scroll across the screen. A totally iconographic new language may be evolving here, but if so, the process is going to be slow. For the time being, too many offices and information services are locked into equipment that is designed to handle words, not pictures, and the transition to graphics will require some changes in how we view information—a new mindset to go with the new technology.



Photograph: Roberto Brosan



The PC was a few seconds faster in loading the program: 25.9 seconds versus 30.3. The PC also checks the modem during the loading process, whereas the Mac version does not check the modem until the dialing procedure is initiated. The Mac's additional 5 seconds of loading time can therefore be explained by the fact that it builds a set of detailed drawings as menu icons along the bottom of the screen. In contrast, the PC's opening screen is a standard text menu.

After building the same auto-dial and log-on sequence on each machine, we timed the process from the moment the auto-dial comand was invoked to the moment the information service's opening screen appeared (in this case, CompuServe's opening message). Again, the PC beat the Mac by 1.5 seconds (24.97 versus 26.55 seconds).

The Final Wrapup

Looking beyond the hype of the Macintosh's futuristic dragonslayer image and IBM's "good old days" with Charlie Chaplin, what is each machine really doing for you? What do you want in a viable office computer? Sooner or later, you must consider the overall ergonomic advantages of each machine.

One of the most talked-about features of the Macintosh is its simple user interface, which makes it easy to learn and to use. The other, on the negative side, is its incredibly slow disk file I/O. As it turns out, both of these statements may be myths in that they are exaggerated representations of the truth. As some software manufacturers begin to make the PC seem more friendly, or Mac-like, so too are others finding out how to code applications that make the Mac seem faster.

What this statement means is that the two machines and their applications are on a course of convergent evolution, with some manufacturers scrambling to release business applications for the Macintosh, while others are designing pop-down and iconographic menus to make the PC's applications more inviting to first-time users. "Unfriendly" implementations might have lasted much longer on the PC without the market's increasing pressure for simplicity and ease as embodied in the Macintosh. On this score, the Macintosh has an edge over the PC in that its friendly screen designs are built from the inside out. Until a high-resolution screen with built-in processing is available for the PC, much of the "friendly" appearance of its newer programs is simply a face-lift—skin-deep beauty that isn't as easy to work with as you might hope.

Skeptics have tended to dismiss any popular votes made on the basis of friendliness. After all, they say, new users will eventually become experienced and may even become "power users." Others contend that PC users are hardier for having gone through the "boot camp" of learning DOS—and that Macintosh users get spoiled on simple software, making it harder for them to overcome psychological barriers to learning more-complex packages. Is the Mac a machine that its users will outgrow? Does its simplicity of operation mean that only simple functions are available? Will its ostensibly wonderful user interface eventually become a hindrance to productivity? These are difficult questions.

No one should underestimate the destructive effect that intimidation can have on learning. An application that's easy to learn not only takes less training time for your staff, but also makes it likely that once they learn the simpler options they'll explore the more advanced ones on their own. Moreover, the ease-of-use factor may have a more immediate impact at the management level than at the clerical: In large corporations, the support staff has been working with word processing computers for years, but executives who are still working with pens on paper qualify as truly first-time users. Experienced users at all levels would be able to delegate Mac-based tasks to support staff much more quickly than they've been able to delegate similar PC-based functions in the past.

Menu-driven software on any machine may always seem slow compared to software that relies on command languages and keyboard macros. But the slowness of menued commands is often a purely subjective experience, possibly because we don't experience the time passing when actively inputting long commands, while menu operations force us to be idle. The best programs on either machine let advanced users graduate from the helpful menu prompts to keyboard commands in order to gain speed.

The Macintosh, which makes it so easy to create even such complex business graphics as financial diagrams and Gantt charts, then lets you copy them directly into text files, will likely prompt a greater demand for these visual aids from all quarters, including PC users. The IBM PC's support of color, at whatever resolution, is a big plus; color is essential in engineering applications and vital to business presentations. The Macintosh screen does not support color at this time. However, for as long as color monitors have been available, they have had relatively little impact on the office environment, except for presentations.

One subjective judgment that came as a surprise was that the Macintosh's black-on-white screen image is less tiring to read than the darker images of the PC's color monitor. Although we didn't take any exact measures of how long a person could sit at each screen before taking a break, we observed that people using the color monitor needed more breaks than those on the Mac. In verbal reports they attributed this difference directly to eye fatigue. We find that eyestrain associated with using color makes it more of a minus than a plus for many applications like word processing and database management. Finally, there is no really economic way to output color, especially if you need multiple copies.

We didn't look at another one of the strongest categories of tools available for the Mac: thinking tools and planning aids.

Writers Diane Burns and S. Venit set the Mac and PC side by side in their San Francisco office and put them to the test.

Photograph: Robert Phillips

We're likely to see more of this type of application for the PC in the future. Until now, the complexity and slowness of project planning aids on the PC has limited their development to technical fields like engineering and software development.

Of course everyone thinks the Mac is generally more fun—sexier than the PC—but can it ever really replace the PC in the office? There's no question that the Macintosh introduces some incredible possibilities for graphics and typeset-quality text that the IBM cannot duplicate at present and may not be able to match for some time to come. But products like Microsoft's *Word* are gradually adding more type styles that take advantage of PC-compatible laser printers.

Our fantasy for the future is to have the PC and Mac work side by side, each doing what it does best. Until the two technologies have merged, large offices may find it convenient to use both machines.

Meanwhile, our fantasy for the office of the future is to have the PC and Mac work side by side, each doing what it does best. Until the two technologies have truly merged, large offices may find it convenient to use both machines. With the new IBM card that Apple announced at its January 1985 stockholder's meeting, this may not be a fantasy. Is it too soon to judge?

With the growing competition, we can look forward to some amazing developments for both machines. Let us simply concede that as the world changes, so will our view of it—and that this is probably not the last time we will look at the PC versus the Mac. ■

Diane Burns and S. Venit are IBM PC power users as well as Macintosh afficionados who contribute regularly to PC Magazine. *Their book,* Mac at Work, *was recently published by Wiley Press.*

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