



The many facets of a slightly flawed gem

BY BRUCE F. WEBSTER

Few computers—indeed, few consumer items of any kind—have generated such a wide range of opinions as the Macintosh. Criticized as an expensive gimmick and hailed as the liberator of the masses, the Mac is a potentially great system. Whether it lives up to that potential remains to be seen.

Personally, I think the Macintosh is a wonderful machine. I use one daily at work, and then at night I play with the one I have at home. Or, at least, I try to play with it. You see, my wife—who for years resisted all my attempts to introduce her to computers—has fallen in love with the Mac (her words, not mine). She uses it to type up medical reports, notes on her clients, and personal letters. In fact, she's suggested that we get a second Macintosh so that we won't have to fight over the one we have.

The Macintosh is not without its problems. Resources are tight—it needs more memory and disk space—and software has been slow in coming to market. Many have criticized its price (\$2495). In fact, there are indications that Apple considered a lower price (\$1995) and then rejected it. It doesn't seem to have hurt the Mac's market—people are still buying them faster than Apple can make them—but there's the potential for backlash if the machine doesn't deliver on all its promises.

Whatever its problems and limitations, the Mac represents a breakthrough in adapting computers to work with people instead of vice versa. Time and again, I've seen individuals with little or no computer experience sit down in front of a Mac and accomplish useful tasks with it in a matter of minutes. Invariably, they use the same words to describe it: "amazing" and "fun." The question is whether "powerful" can be added to that list.

In an industry rapidly filling up with IBM PC clones, the Macintosh represents a radical departure from the norm. It is a small, lightweight computer with a high-resolution screen, a detached keyboard, and a mouse (see photo 1). It comes with 128K bytes of RAM (random-access read/write memory), 64K bytes of ROM (read-only memory), and a 400K-byte 3½-inch disk drive. If you throw in an Imagewriter printer (see photo 2 and

figure 1) the system costs \$2990. The processor is a Motorola 68000, running a nameless operating system (see the text box, "A Second Opinion" on page 248 for a full description). It has absolutely no IBM PC/MS-DOS compatibility, and it would appear Apple plans none.

THE DISPLAY

The display is small (9-inch diagonal), but it has very high resolution (512 by 342 pixels). Every pixel is crisp. Several things make the display unusual. First, the Macintosh has no "text mode." Instead, the display is always bit-mapped graphics. Second, the display is black-on-white rather than amber-, green-, or color-on-black, giving it an ink-on-paper effect. Third, the pixels are equally dense both horizontally and vertically, eliminating the "aspect-ratio" problem that plagues other graphics systems. (In other words, a box 20 pixels wide and 20 pixels high will be a square.)

The effect is excellent. The display is clear, crisp, easy to read, and easy on the eyes. Because all text is graphically generated, true "what you see is what you get" word processing is available (with multiple fonts, sizes, and styles). Embedded drawings and proportional spacing are also possible. Some criticism has been made about the lack of a color-graphics capability. Frankly, I am unconvinced of its necessity. Most applications I have seen use color graphics as a substitute for detail, and the Mac can give you lots of detail. (An interesting footnote: the QuickDraw graphics routines in the Mac's ROM do provide for color, although Apple has not announced any intentions for supporting such.)

The Mac's display does create a problem. Computer graphics are memory-intensive: once you start drawing pictures, you start using up lots of memory. The video display itself consumes about 22K bytes (or about one-sixth) of the total RAM. Any off-screen manipulation (windows) or information (text fonts) chews up additional memory quickly.

THE KEYBOARD

Like the rest of the machine, the keyboard is significantly different from those found on

other systems (see photo 3). It's smaller than most and has only 58 keys. It is detached but the 3-foot coiled cord has lots of give to it so you don't have to wrestle the computer for the keyboard. The full printable ASCII (American National Standard Code for Information Interchange) set is available, and the layout of alphanumeric and punctuation keys is pretty standard. There are no function keys, no cursor keys, and no control key. Instead, you will find two Option keys and a Command key. The Option keys, located directly under either Shift key, are used to generate special text characters (Greek letters, math symbols, and the like). The Command key, whose symbol looks like a freeway cloverleaf, is an alternative to the mouse. For example, if I'm typing along and wish to underline some text, I can type Command-U instead of stopping and using the mouse to select Underline in the Style pull-down menu.

All in all, I like the keyboard. I'm a fast touch-typist and occasionally I overrun the two-key "rollover" (the number of keys you can press down simultaneously), but I never lose characters because of buffer overflow. The keyboard's layout is compact, so I can easily reach any key—well, almost any key. The Command key, located between the left Option key and the space bar, is in an awkward position. I often hit the Shift key or Option key instead.

I don't like function or cursor keys and the mouse renders them fairly useless, so their absence doesn't bother me at all. A separate numeric keypad is available for \$99 (it plugs in between the keyboard and the Mac). This keypad has cursor keys on it, but I wonder how many applications will recognize them.

THE MOUSE

The Macintosh has a standard, one-button, mechanical-tracking, optical-shaft-encoding

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mouse (again a departure from industry norms). The mouse has a 3½-foot cord, its own port in the back, and full support from the ROM routines and the operating system. In other words, almost every application on the Macintosh will use the mouse. (I say "almost" because someone is bound to come out with a program that ignores it altogether.)

Before buying my Macintosh, I used a mouse on an IBM PC and was not impressed. The Macintosh mouse impresses me. In some applications, such as MacPaint, I seldom touch the keyboard, except to hold the Shift, Option,

(continued)



Photo 1: The Apple Macintosh computer.



Photo 2: The Macintosh dot-matrix printer.

This is 9-point text, Geneva.
 This is 12-point text.
This is 14-point text.
This is 18-point text.
This is 9-point text, Geneva, bold.
This is 12-point text, bold.
This is 14-point text, bold.
This is 18-point text, bold.
This is 9-point text, New York, and this is bold.
This is 12-point text, New York, bold.
This is 14-point text, New York, bold.
This is 18-point text, bold.

Figure 1: A sample printout from the Macintosh using its printer and the MacWrite word-processing program. The printout was obtained using MacWrite's high-quality output mode, as opposed to the draft and ordinary quality modes. The output here is shown at 100 percent of actual size.

or Command key down with my left hand while moving the mouse with my right. I find using the mouse faster, easier, and less disruptive than using function and cursor keys. Function and cursor keys do not fall within the standard touch-typing layout because they vary in size, number, position, and function. To use them, I have to stop and think about what key I need, look down at the keyboard, find it, hit it, and look

up again. Often this process has to be repeated several times. With the mouse, I never take my eyes off the screen. I just reach to my right, grab the mouse, and do what I need to do.

Of course, the mouse isn't always a perfect solution. Some commands can be tedious to perform via the mouse and pull-down menu. For example, deleting text to the right of the cursor in MacWrite can only be done with the

mouse. This is a nuisance if you have only one or two characters to delete. I'd also like the mouse's cord to be a little longer and sometimes I have trouble finding enough surface area to work the mouse, but these are minor complaints. The mouse is an excellent feature of the Macintosh.

USER INTERFACE

Macintosh's user interface is far different from those of other personal computers. Strictly speaking, it is not all that new. The original concepts were pioneered at Xerox's Palo Alto Research Center (PARC) several years ago. Apple used them heavily in the original Lisa machine, released a year before the Mac. However, that Lisa sold for \$10,000, and the Xerox machines for much more. The people who most needed the interface were those who could least afford it: small business-people, students, etc. The Macintosh is still a bit expensive, but it's within the reach of far more people than any of its predecessors.

In creating the Macintosh's unique user interface, Apple has attempted to make the abstract seem concrete. Few things are as abstract as the data and programs stored and used on a computer. The Mac takes that abstraction and presents it as something familiar: a desktop cluttered with pencils, papers, manila folders, and even a wastebasket. Do you want to put a document in a folder? Pick it up with the mouse and put it in the folder. Do you want to throw something away? Pick it up and put it in the wastebasket. Abstractions take on real forms that we can understand and use without obscure commands or bizarre syntax.

Another important aspect of this user interface is the way in which the Macintosh makes commands available to the user. As I write this review with MacWrite, the top of my screen has an Apple symbol and six words (File, Edit, Search, Format, Font, and Style) written across the top. If I point at any of the items with the mouse and press the button, a menu of options appears on the screen. When I release the button, the menu disappears. All available commands appear in the menus. I haven't had to memorize or learn much; in fact, I opened my MacWrite manual only

(continued)

AT A GLANCE

Name

Macintosh

Manufacturer

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

Components

Size: 13.5 by 9.7 by 10.9 inches (main unit)
2.6 by 13.2 by 5.8 inches (keyboard)

Weight: 19.5 pounds

Processor: Motorola 68000 (7.8336 MHz)

Memory: 128K bytes of RAM; 64K bytes of ROM

Display: 9-inch built-in monitor; high-resolution bit-mapped display (512 by 342 pixels); adjustable

Keyboard: 58 keys, detached, standard layout, no function keys, software-mapped

Mouse: single button, mechanical tracking, optical shaft encoding

Mass storage: built-in single-sided 3½-inch Sony drive (400K bytes)

Sound generator: four-voice sound

Interfaces: two RS-422A serial ports (230.4 Kbps transfer rate); external-disk interface for second (optional) disk drive; mouse interface; synchronous serial keyboard bus

Operating System

Proprietary unnamed

Optional Hardware

Imagewriter dot-matrix printer:		\$595
Numeric keypad:		\$99
Carrying case:		\$99
Modem (300 bps): (300/1200 bps):		\$225 \$495
Security Accessory Kit:		\$49
Second floppy-disk drive:		\$495

Optional Software

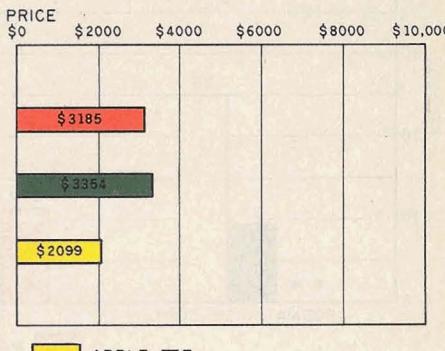
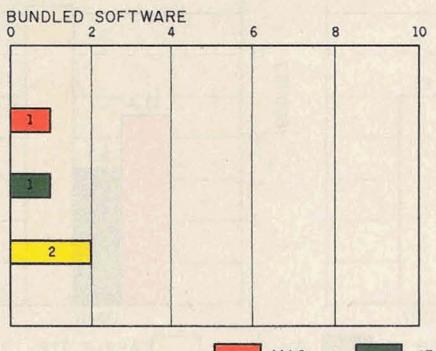
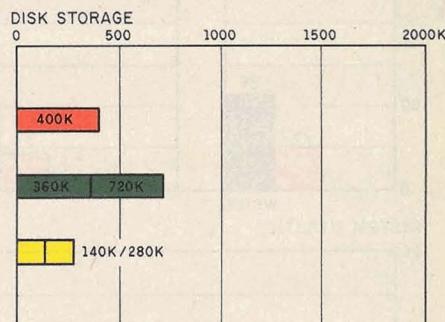
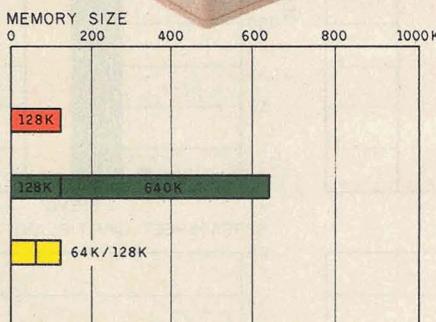
See text box

Documentation

160-page user's manual

Price

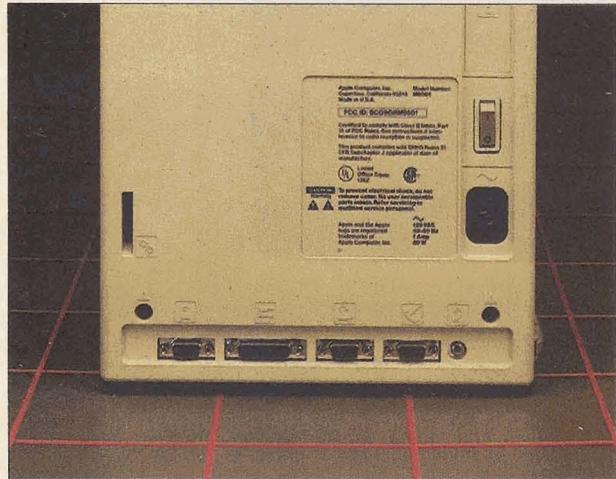
\$2495 (\$2990 with Imagewriter)



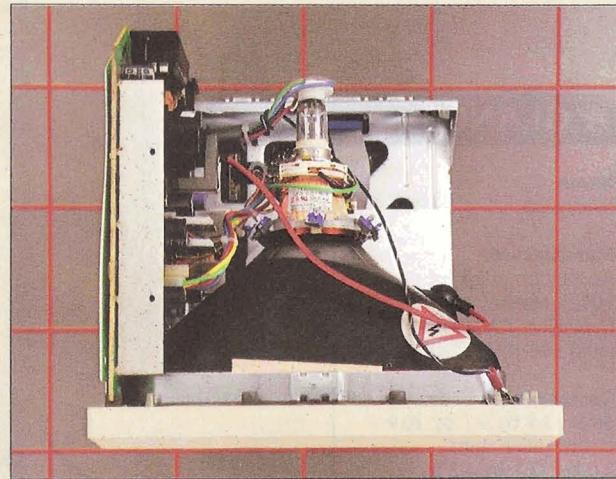
■ MAC ■ IBM PC ■ APPLE IIe

The Memory Size graph shows the standard and optional memory available for the computers under comparison. The Disk Storage graph shows the highest capacity of a single floppy-disk drive for each system. The Bundled Software graph shows the number of software packages included with each system. The Price graph shows the list price

of a system with two high-capacity floppy-disk drives, a monochrome monitor, graphics and color-display capability, a printer port and a serial port, 256K bytes of memory (64K bytes for 8-bit systems), the standard operating system for each system, and the standard BASIC interpreter for each system. The Mac's price includes 128K bytes of memory only.

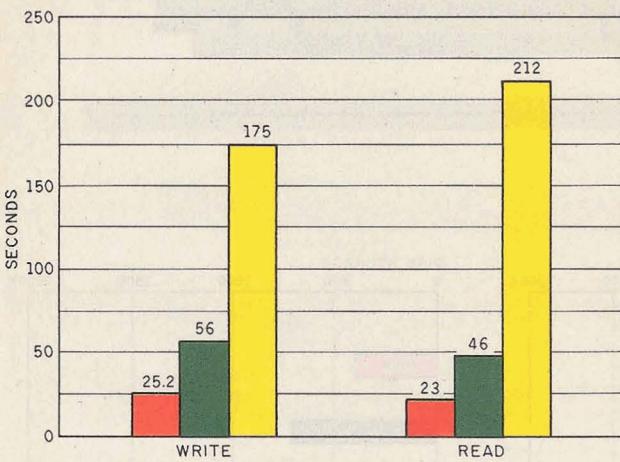


The rear of the Mac. Note the icon labels. The bottom row of connectors is for (from left) the mouse, second floppy disk, printer, modem, and speaker.

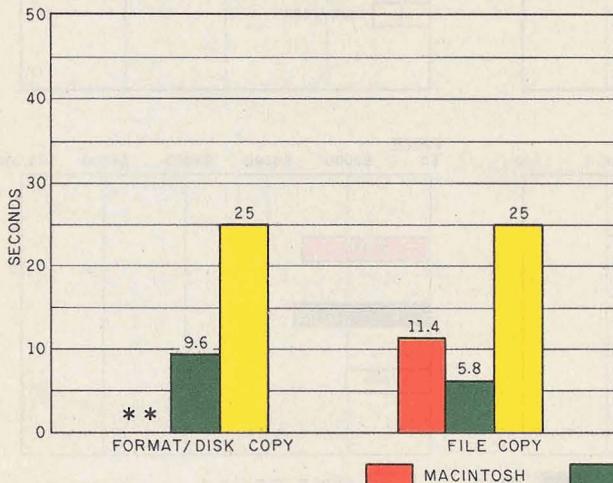


The top of the Mac with the cover removed. The disk drive and digital circuitry are below the cathode-ray tube; the analog circuitry is to its left.

DISK ACCESS IN BASIC



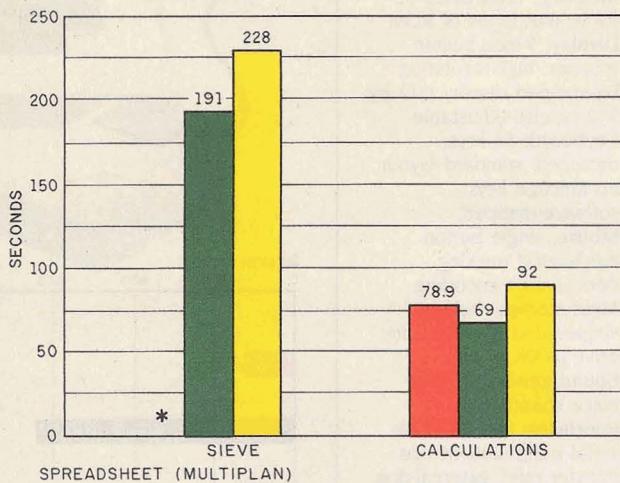
SYSTEM UTILITIES



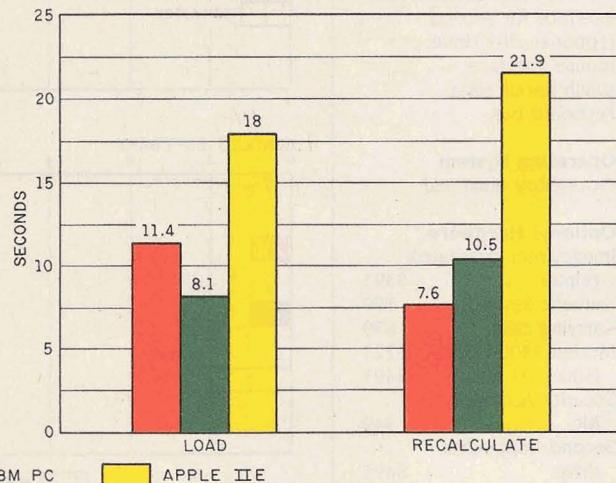
** MACINTOSH ■ IBM PC ■ APPLE IIE

The graph for Disk Access in BASIC shows how long it takes to write a 64K-byte sequential text file to a blank floppy disk and how long it takes to read this file. (For the program listings, see "The Chameleon Plus," by Rich Krajewski, June 1984, page 327.) The BASIC Performance graph shows how long it takes to run one iteration of the Sieve of Eratosthenes prime-number benchmark. In the same graph, the Calculations results show how long it takes to do 10,000 multiplication and division operations using single-precision numbers. The System Utilities graph shows how long it takes to transfer a 40K-byte

BASIC PERFORMANCE



SPREADSHEET (MULTIPLAN)



file using the system utilities. The Spreadsheet graph shows how long the computers take to load and recalculate a 25- by 25-cell spreadsheet where each cell equals 1.001 times the cell to its left. The spreadsheet program used was Microsoft Multiplan. The time for the format/disk copy test on the Macintosh reflects using the disk-copy utility on a single-drive system. Four disk-swaps are required for the complete disk copy, the time for which is included in the benchmark. *The Sieve benchmark couldn't be run on the Mac (see text for details). **The new Disk Copy program was not available at press time.

once or twice, briefly. The same is true at the "desktop" level. Any actions can be performed via the pull-down menus or by direct "physical" manipulation of the objects shown. The best feature of the Mac documentation is that I almost never have to refer to it.

My one complaint about the user interface is that it's slow. Sometimes running a program or opening a file seems to take longer than it should. File copying on a one-drive system is also tedious.

A special disk-copy utility is now available that lets you copy an entire disk in just four swaps—not too shabby when you realize that this utility uses nearly 80 percent of the total RAM just to hold the data. Unfortunately, this utility won't solve the problem of copying several files onto a disk that's already formatted and in use. There is a simple solution: more RAM.

MEMORY LIMITATIONS

The 68000 is a powerful microprocessor but it has a limited environment in the Macintosh. The Mac comes with 128K bytes of RAM: less than 1/100th of the 16-megabyte RAM the 68000 could use, and there's no way to expand it. True, Apple is planning to upgrade the Mac to 512K bytes sometime in the future, but that still leaves 97 percent of the

Apple is planning to upgrade the Mac to 512K bytes sometime in the future, but that still leaves 97 percent of the potential memory space unused and unusable.

potential memory space unused and unusable. The Mac has no provisions for expanding memory beyond replacing the 64K-bit chips it currently uses with 256K-bit chips as they become available. It has no expansion slots and no external bus. And remember, this is a graphics-intensive environment where memory often gets eaten up rather quickly.

So the question arises: why did the Macintosh design team so limit their machine? The most common reason I've come across is that the Macintosh team wanted to provide a standard environment for software developers and users (although the latter is less often cited). In other words, software developers know that a Mac will always have 128K bytes of RAM and users will never have to worry about software requiring more RAM than they have. The idea is sound, but it causes two problems. First, 128K bytes is *not* enough RAM for a standard, especially in the Macintosh environment, where graphics chew

away at your free space. Second, there will be no standard for software developers when the 512K-byte upgrade becomes available. Many software developers are ignoring (or unable to use) the 128K-byte machine and will release their packages for 512K-byte machines only. Unless Apple plans a free update to all Mac owners, the standard environment will no longer be standard.

Another argument I've heard to support the concept of such limited memory is that the expansion slots were dropped to avoid power and cooling problems and to keep the user out of the machine. Again, this is a good idea if you provide sufficient resources in the unexpandable model. I have no complaints with Apple's choice of two RS-422A ports, an external disk port, the mouse port, and audio output. External video would be nice, but it isn't critical. But there's just not enough memory.

Others argue that 128K bytes of RAM is enough because so much of the work is done for you in the 64K-byte ROM. The ROM toolbox (the optimized 68000 machine-language routines that handle all aspects of the user interface) is truly a marvelous thing, but it doesn't change the fact that large, complex programs need lots of memory, especially if the displays are all graphical. A supporting argument points to MacPaint and MacWrite, saying, "See, these work fine!" Yes, they do, but both have easily reached limits. Furthermore, these programs were developed over a long period of time, concurrently with the Macintosh. The authors of these programs knew a lot about optimizing code for the Mac. Software developers with less time and more ambitious designs will find the lack of RAM a serious roadblock.

I also have heard that the upgrade to 512K bytes will eliminate all such problems because there will be more than enough RAM for any application. Again, I disagree. You can never have enough RAM. I think it no accident that the



Photo 3: The Macintosh keyboard. Note the absence of a control key, but the presence instead of a 'cloverleaf' key just to the left of the space bar. This key performs several of the functions usually performed by a control key.

Apple says the 68000 is much better than the 8086/8088 chips used in the IBM PC and its compatibles, yet they can use more RAM than the Mac.

Commodore 64, with 64K bytes, has dominated the low-end market over machines that have (or had) 8K, 16K, or 24K bytes. Apple gave the IIc, which uses an 8-bit 6502 chip, 128K bytes of RAM. Why the company limited the 68000, a 32-bit chip, to the same initial amount of memory is beyond me. Even the fourfold upgrade is too limiting. Apple delights in stating how much better the 68000 is than the 8086/8088

chips used in the IBM PC and compatibles, yet most of those systems can use more RAM than the Mac. Where's the advantage?

Obviously, I think that 128K bytes is not enough RAM to make the Macintosh a truly powerful machine. My attempt to run the Sieve of Eratosthenes benchmark on the Mac provides one indication of its RAM limitations. Once BASIC was loaded into the Mac, there was too little space left in memory for the Sieve program. To fit the program into memory, I had to declare all variables integer. This will, of course, speed the execution time considerably. Thus, the speed of the Mac Sieve is not commensurable to the other two systems. (If you are curious, the modified benchmark took 96.4 seconds on the Mac.) The upgrade to 512K bytes will help considerably, but it's still an inexcusable limit. I am convinced that this limited RAM has held up the release of Mac software. As I write this, it has been

three months since the Macintosh was released, and all the Apple dealers in town have only three software packages for the Mac besides MacPaint and MacWrite, which are still bundled. Mac should have had at least double the initial and upgrade RAM, i.e., 256K bytes and 1 megabyte, respectively. It may be that Apple will release yet another upgrade when 1-megabit chips become available in mass quantities, or they may just release a new machine.

Although the RAM is a limitation on the Macintosh, the ROM is a tremendous strength. In what is undoubtedly one of the marvels of modern programming, the Macintosh design team crammed an unbelievable amount of power into the 64K bytes of ROM in the form of tightly written, highly optimized machine code. In doing so, the team provided standard user interfaces so that most application programs on the Mac will be used in similar forms. I tried

(continued)

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Altair 8080 5-User	6925	Virual 50		ProWriter	383
Teletype 808	1257	MONITORS		Epson RX-80FT	420
Teletype 808/20	4816	BMC BM-12A UW		Microprint	415
Sanyo 550	784	BMC Amber		Okidata 80 Par	245
Polo 80188	CALL	BMC Color		Okidata 92 Par	164
Zenith ZF-151-21	2072	Amdtek Color-I (1 Demo)		Tally Spirit	331
Eagle Proportional	CALL	Anadex 9500B			946
NEC PC 8201A	635				

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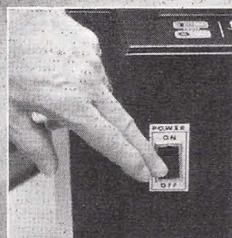
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A Second Opinion

BY J. EDWARD CHOR

The Macintosh is advertised as a 128K-byte machine. In reality, the Finder (Macintosh's operating system) and other systems software take about 40K bytes. Subtract from this another 40K to 70K bytes for any applications programs that may be in memory and the 128K-byte Macintosh becomes an 18K- to 38K-byte machine. For example, when Mac's Microsoft BASIC package is loaded on top of the resident software, there is only 13K bytes of space for programs and data left. Similarly, MacWrite, Macintosh's word-processing program, only allows documents with a maximum size of about 24K bytes. This problem seems to be an inherent limitation in the current design of the Macintosh because there is no way to expand the memory capacity of the machine. When 256K-bit memory chips become available the Macintosh will be upgraded to a 512K-byte machine, enough space for the most ambitious application programs. However, at the time of this writing these chips are only in the development stage. This means that they will not be commercially available before 1985.

DISK SWAPPING

Closely related to the memory limitations is the problem of "disk swapping." Because the basic Macintosh system has only one disk drive, transferring data from one disk to another requires that the Macintosh read from the input disk, eject the input disk, and prompt the user to insert the output disk. After sending the data to that disk, it is ejected and the user is told to reinsert the input disk. This cycle is repeated until the data transfer is complete. Initially, this shuffling of disks seemed to be tolerable. At least I thought it was until I attempted to back up a disk with 270K bytes of data on it. It took more than 50 disk swaps and 20 minutes to perform this simple operation. This works out to an effective transfer rate of about 5K bytes per swap. The process becomes even more hectic when the Mac has to consult systems software during the transfer. The user must then swap three disks in and out of the internal

drive. Unfortunately, this is precisely the kind of design flaw that will prevent the Macintosh from gaining widespread acceptance in a business environment. Disk backups are absolutely essential to business applications. Therefore, the need for a second drive is a hidden and unadvertised cost of owning the machine.

All things considered, the Desk Accessories (accessory programs that can be run at the same time as another program) are an excellent complement to the Finder. These accessories are available to the user at all times, regardless of the application program that may be resident in memory. This means, of course, that users will be able to cut and paste between diverse application programs. Although not as sophisticated as Lisa's information-passing capability, the Macintosh currently is the only machine in its price range that provides this feature as a system-resident function. However, sometimes the Finder does its job too well. If there are two or three disk icons present on the desktop, each with a copy of the System Folder, calling up a Desk Accessory such as the Alarm Clock will cause the Finder to request that the disk under which the system was initialized be inserted. The Finder then gets the data pertaining to the Desk Accessory from that disk's System Folder instead of using the System Folder of the disk that was in the internal drive. After the Finder gets that information, the user must then reinsert the disk he or she was originally working with to display the accessory. Although not a major inconvenience, this procedure does become somewhat aggravating when one wants to do a simple thing like set the Alarm Clock.

PROGRAMMER'S PERSPECTIVE

Nothing much has been said about Macintosh from the programmer's point of view. Unfortunately, the reason for this is that there is very little to say. The Macintosh is the only machine in recent history to be offered without a programming language. However, Apple has promised assembly language, BASIC, and Pascal for the Mac. As of April 1984 none

of these packages was being marketed. The only language currently available, Microsoft BASIC, is extremely disappointing. Programs written with it will essentially look like MBASIC programs written for the IBM PC. Even when Apple's language packages for the Macintosh are released, users should not expect to be able to produce application programs that utilize Macintosh features like the menu bar, dialogue boxes, and windows. Because any language that is run on a Macintosh will be treated like an application program, these routines will be inaccessible to programs created at a lower level than the application program that uses those features. The Macintosh applications that use those features are being done currently in one of two ways. They are either created on a Lisa and downloaded to the Mac, or two Macs are used in tandem (one for writing the program and the other for running it). Developing software in this fashion can be an expensive proposition.

Although Apple has indicated that programmers will be given assistance in developing application programs for Macintosh, in fact this assistance will be available only to a certain chosen few, i.e., established software houses or individuals who have a proven track record of commercial success. Of course, one can always purchase the technical manual for Macintosh, which presumably contains all of the information regarding the highly touted Macintosh toolbox, and attempt to develop Mac applications from scratch. It can be obtained from Apple for \$150. Regrettably, it is unlikely that a "cottage industry" will grow up around the Mac in the same way that one grew around the Apple II. But in spite of its shortcomings, the Macintosh is a significant advance in user-friendly computing.

J. Edward Chor (1307 West Addison St., Chicago, IL 60613) is an attorney. He received his B.A. in psychology from Eastern Illinois University and his J.D. from Southern Illinois University. His hobbies include reading, sports, and fiddling with machines.

Software for the Mac

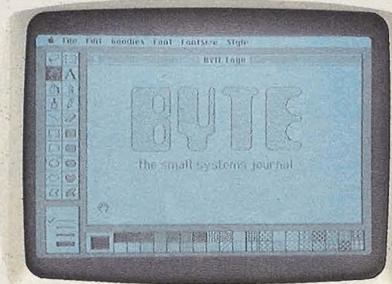
When I bought my Macintosh in mid-February, three software packages were available for it: MacWrite/MacPaint, which Apple developed and gave away with the system, and Microsoft Multiplan and Microsoft BASIC (Microsoft has been working with the Mac for two years.) By the end of April, the number of available packages had climbed to four: MacFORTH, from Creative Solutions Inc. (CSI) had hit the shelves. (CSI already had a commercially available 68000-based FORTH.)

By the time you read this, the trickle of Mac software should have grown modestly. The torrent probably won't hit until early 1985 when the 512K-byte, two-disk Macintosh emerges as the new standard and software firms have a year of development under their belts. The 512K-byte Mac will increase the flow of software in another way. With the extra RAM, individuals will be able to develop Mac software without having to buy a Lisa. Programs will be able to do fancier things because graphics capability increases as memory does. And the programs themselves will not have to be as tightly coded to fit into available memory; therefore, they will be developed more quickly. I think the result will be a flood of programs, both public-domain and entrepreneurial.

MACWRITE AND MACPAINT

Both MacWrite and MacPaint are great. Get them, use them, and have fun with them.

MacWrite gives you nine different fonts, six different point sizes, five different styles (mix and match), and superscript-



An example of MacPaint on the Macintosh.

ing and subscripting. The program has three types of spacing, four types of justification, adjustable margins, and two kinds of tabs. It also has headers, footers, rulers, and page breaks. And it has a screen that shows you what you're going to get and a printer that gives you what you saw. The result: the fanciest letter and report writer you ever saw. I don't think I'd use it to write a book, though. The amount of text you can edit is too limited and some things (such as pulling in or appending files) are awkward or impossible. Still, it's great fun.

MacPaint is also destined to be a classic. Admit it: you've always wanted to draw nice pictures but you haven't had the time to learn the necessary skills. Enter MacPaint (see the photo on this page). In seconds, you can create images that would take you hours by hand (if you could do them at all). Children and adults can learn to use it in an amazingly short time (a tribute to Bill Atkinson). My boss and I laid out a 16-page manual for a new software product in two days, complete with borders, boxes for illustrations, and

varying type sizes (MacPaint will generate text). We also designed the disk labels and drew up specs for some booth props we had built. However, you can only draw in a 3- by 5-inch window, which in turn moves around on an 8- by 10-inch area. The small drawing window makes large pictures tedious, especially if you're trying to put in text that is wider than the window. But this is a minor problem. MacPaint is a perfect example of what's amazing and fun about the Macintosh.

MacWrite/MacPaint is available from Apple Computer Inc. (20525 Mariani Ave., Cupertino, CA 95014) for \$195.

MULTIPLAN

Microsoft Multiplan is a Macintosh version of a standard spreadsheet. Not so standard are the crisp display, pull-down menus, and ease of cell manipulation via the mouse. The worksheet is limited to 63 columns and 255 rows, but these figures should increase once the 512K-byte machine becomes widely available.

I found Multiplan easy to use—easier, in fact, than any other spreadsheet I've used. But I do have a few complaints. The documentation assumes a fair amount of knowledge on the part of the user, a poor assumption considering the Macintosh's market. For example, this is the documentation for conditional expressions:

IF(logical-expression,value-if-true,value-if-false)

The IF function evaluates the logical expression, then returns the value-if-true if the expression is TRUE; or it returns the value-if-false if the expression is FALSE.

There are no examples and no explana-

some prerelease programs with no documentation and I was able to use them almost immediately. Try that under CP/M or MS-DOS. The ROM toolbox is a vital facet of the overall amazing nature of the Macintosh.

The Macintosh also lacks adequate mass storage. At first, it doesn't look bad: it consists of one single-sided 3½-inch built-in disk drive (made by Sony) holding 400K bytes. Having only one disk drive can be a nuisance, but it's acceptable if the drive holds enough

data and if you can copy it easily. However, the system files on a Macintosh disk take up over 200K bytes, or half the disk. Even with trimming, you only have about 220K bytes of usable space on a bootable disk. If any other company marketed a CP/M or MS-DOS system with a single disk drive with only 220K bytes of free space, no one would buy it. It takes a lot of time and disk swapping to copy files or to back up a disk. The Mac's only saving grace on this point is that it automatically ejects the

disk and prompts you for a new one.

The 128K-byte Macintosh with one single-sided drive is not a powerful machine. You can do useful work with it, and the user interface beats all others cold. But for the same price or less, I could go out and buy, for example, a Compaq with 256K bytes of RAM and two 360K-byte disk drives. And I could get lots of software for it—programs that can handle larger, more difficult tasks than the Mac currently can.

The upshot is this: a \$3000 Macintosh,

tion of what a "logical expression" is or how it resolves to true or false. The index refers us to the definitions of NOT or OR; the latter gives us a little more information and one complex example (demonstrating IF, OR, AND, and NOT). This will be confusing to novice users.

But consider getting Multiplan anyway. Not only does it work well, it can share its information with other Microsoft programs, such as BASIC, Word, Chart, and File. The program is available from Microsoft Corporation (10700 Northup Way, Bellevue, WA 98004) for \$195.

MICROSOFT BASIC

Microsoft BASIC is fairly standard. It does have lots of Mac-specific graphics calls. However, most of them are poorly documented: instead, the documentation refers you to the *QuickDraw Programmer's Guide*, which doesn't come with the system.

The BASIC itself runs in an environment with three windows: Command, Output, and List. All commands, typing, and editing take place in the Command window; program output and echoed commands show up in the Output window; and program text is seen in the List window. It all works nicely, although I find a few things annoying. The Command/Output window dichotomy can cause problems, especially when the Output window insists on writing text behind the Command window (and nowhere else). Also, the List window has a tendency to propagate itself, so that you end up with several List windows stacked behind each other.

Even with its shortcomings, Microsoft

BASIC is useful. Several public-domain programs for it have already shown up on computer bulletin boards, including a terminal-emulation program and a 68000 disassembler. The program is available for \$195 from Microsoft Corporation (10700 Northup Way, Bellevue, WA 98004).

MACFORTH

MacFORTH (Level I) lets you do amazing things on the Macintosh. You can create windows complete with close and size boxes and "attach" programs that will execute automatically when a given window is activated. You can build your own pull-down menus with check marks, inactive items, and command-key options. In fact, you could code your own application and have it "take over" the Mac, putting up its own menu bar and controlling all the windows.

The only catch to all of this is that you have to learn FORTH, a programming language unlike any other. FORTH isn't difficult to learn, but it can be a bit confusing to use because of its stack orientation and "reverse Polish notation" syntax. CSI's Going FORTH module helps a bit. Going FORTH is a clever program that sets up two side-by-side windows. One window steps you through an introduction to FORTH. The other is an active FORTH window, where you can try out the things you're learning. Also, each chapter in the printed documentation is a tutorial on a given subject (menus, windows, etc.) with lots of examples to key in and try out.

I think CSI has developed a solid FORTH implementation. (I programmed

in FORTH professionally for a year, but I am by no means an expert.) The window, menu, and graphics functions are well done and easy to use. For example, if you create a window called Easel, and a program to run within Easel called Sketch, the FORTH command EASEL ON.ACTIVATE SKETCH links Sketch to Easel. If you select the Easel window with the mouse, the Sketch program will automatically start executing.

All in all, CSI has done an excellent job. It has made FORTH relatively easy to learn. The documentation is easy to read and use, although the glossary can be cryptic to a FORTH neophyte. Best of all, CSI has unlocked a lot of the Mac's power. FORTH produces very compact code, which means that the Mac's limited RAM isn't so limited anymore.

CSI has three levels of MacFORTH. I reviewed Level I (\$149), which is designed as an introductory package. It does all the things I mentioned, but it doesn't support real (floating-point) numbers or all of the ROM toolbox routines. Level II (\$249), aimed at in-house developers, has real numbers and advanced graphics as well as provisions for inserting 68000 assembly routines. Level III (\$2500) is for software developers interested in marketing programs developed in MacFORTH. It includes technical support, a run-time package, and licenses for 250 copies. Additional licenses cost \$5 per copy.

If you want to make your Mac do things, get a copy of MacFORTH and have fun. MacFORTH is available from Creative Solutions Inc. (4801 Randolph Road, Rockville, MD 20852).

with 128K bytes of RAM, a 400K-byte disk drive, and an ImageWriter printer, is an amazing machine but not really a powerful one. A 512K-byte Mac with two 400K-byte disk drives is both amazing and powerful, but it is also expensive (\$3500, including printer and not counting any cost for the RAM upgrade). In the two-and-a-half months that I've owned my Mac, I've often wondered if I should have bought one so quickly. However, the arrival of MacFORTH (see the text box "Software for the Mac" on

this page) has done much to quell my reservations. I can now create my own windows, graphics, and pull-down menus, and the "fun quotient" of my Mac has made a quantum leap. Besides, I suspect that by the time this sees print, prices will have dropped and the software base will have expanded considerably.

CONCLUSION

You won't find another machine that's as easy to use or as much fun as the

Macintosh. In the right configuration, it can do as much as any microcomputer on the market. However, you should go for a 512K-byte system with two disk drives and a printer. Anything less and you'll find yourself frustrated by the machine's limits.

I have no doubt that I would have bought a Macintosh sooner or later, and I have no intention of getting rid of the one I own. The Mac's a gem—rough, slightly flawed, but a gem nonetheless. ■