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All about Your Personal Computer

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PRODUCTS TESTED AND COMPARED

all about Scanners
PRACTICAL BUYER’S GUIDE

Data Representation
5 FOR ACCURATE PRESENTATIONS

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CD ROM Drives
15 PRODUCTS TESTED AND COMPARED

QuickTime—Your First Time
HOW TO MAKE MOVIES
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4B7N4
John Sculley and Bill Gates shared a podium recently to announce Apple-Microsoft collaboration on database connectivity. Sculley said Apple will extend its Data Access Manager to support Microsoft’s Open Database Connectivity tools and will develop a Windows client for Apple’s Data Access Language, which Microsoft will market. Gates added that Microsoft will develop Mac products for Apple’s upcoming RISC-based computers.

**Quorum Back in Port:** Quorum Software Systems has dropped a suit filed against Apple to block Apple’s threat of a copyright infringement suit. Quorum’s products include tools to help developers port Macintosh software to Unix. Quorum says the agreement protects Quorum customers against litigation by Apple.

**Accelerated video boards** are now shipping from Radius (408/434-1010). The PrecisionColor 8Xj and the PrecisionColor 24Xk deliver 8-bit color for $599 and 24-bit color for $999, respectively. Radius also began shipping the PrecisionColor Display/20S, a version of its current 20-inch PrecisionColor Display/20 color monitor that now lets a Quadra run 24-bit color without an add-in graphics adapter board.

**StrataType,** from Strata (801/628-5218), is a tool for extruding text into three dimensions, adding bevels, and coloring the text with photorealistic solid shaders. The letters’ Bézier curves can be modified in a 2-D view, but not after they are extruded into 3-D. StrataType ($295) works with PostScript and TrueType fonts and can import Adobe Illustrator files.

**The QMS 860 Print System** is a 600-by-600-dpi printer that produces 11-by-17-inch output. It includes a RISC processor and its own multitasking operating system for controlling emulations, print queuing, and other complex functions. QMS (205/633-4300) expects to ship the printer in mid-August at a list price of around $4500.

**VideoSpigot Pro dropped in price,** and SuperMac (408/245-2202) added to it the capability to transfer QuickTime movies to videotape. The new suggested retail price for the real-time digital-video board is $1499, down from $1599.

**Synergy Software** (215/779-0522) is shipping new versions of VersaTerm and VersaTerm Pro that provide MacTCP support for Serial Line Internet Protocol, making it possible to access TCP networks via modem. VersaTerm 4.6 lists for $149, and VersaTerm Pro 3.6 lists for $295.

**Nikon Electronic Imaging** (516/249-2121) plans to market ImageAccess, an image-cataloging database. ImageAccess ($495) provides descriptive text fields that can be searched; can archive TIFF, PICT, EPS, and JPEG-compressed files; and, using a Nikon LS-3510AF scanner, can batch-scan slides and store a thumbnail of each image in the database.

**PowerBooks get some rays** with the SolarPower, a solar panel from Microtech International (800/626-4276). The $189 panel clamps onto the PowerBook and, according to Microtech, provides enough power to extend battery life significantly, depending on available sunlight. SolarPower is expected to ship in October.
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Printer's Ink with a C

BY JERRY BORRELL

THE SIGN ON THE WALL OF the building says Books, Espresso, Magazines. Printer's Inc. is a bookstore located on Castro Street in Mountain View, California. Don't ask me why I go there, since I live 35 miles away, in San Francisco. Perhaps it's because when I lived in Silicon Valley eight years ago and was considering the job as editor-in-chief of Macworld, I went there to find a copy of the magazine. Perhaps it's because Printer's Inc. is one of those increasingly rare (at least in California) bookstores where you can buy a cup of coffee and read the books. I didn't notice the shelves there during my most recent trip, but on my visit eight years ago Macworld fit in with the other non-mainstream magazines. In fact, there were four different issues sitting on the newsstand there in 1985. They somehow fit in with the atmosphere of the store, which invites you to sit and talk about anything from travel to philosophy to computers.

There aren't too many bookstores like that anymore. There used to be one on Chestnut Street in San Francisco. It had a little restaurant in the back and bookshelves up in the front. I would leave work at 8 or 9 p.m. and wander in for a late meal, and then over the course of dinner select a few books. I used to wonder whether the proprietors minded the crumbs in the books I looked at and didn't buy. But I also recall buying some extra books just to encourage them to maintain their policy. Another favorite place was the bookstore in Washington, D.C.'s Georgetown, on a street off Wisconsin Avenue, that I used to visit with my now-15-year-old son to buy Asterix and Obelix comic books. It's not there anymore. But the Harvard Bookstore on Newbury Street in Boston, where I lived for two years, still exists—a place to eat or buy a coffee and read books. There used to be a bookstore on Red Road in Miami, but that's gone now, moved to a shopping center. A lot of bookstores seem to have moved into shopping centers.

Now that I think about it, there are very few bookstores that I really enjoy anymore. Ones that really draw me in. Most bookstores today are more organized. Compact. Efficient. Some of the smaller chains are attractive, such as A Clean Well Lighted Place for Books in the San Francisco Bay Area. And City Lights, an independent local bookstore, still draws me in.

I don't know anything about the economics of selling books, but several things seem obvious in the stores I visit. Sales seem slow. Rents, and therefore the cost of doing business, must be high in modern shopping malls. The profit margin can't be much, especially given the trend toward book discounting. There are an enormous number of titles. And the range of titles or topics is amazing. I always admire the dedication that keeps bookstore shelves so full and well organized.

At the same time, it seems that people are reading less, with many watching television rather than reading. I wonder if the trend toward bookstore chains has been shaped by these factors. More important, I wonder, what will the trend become as even more information, like electronic magazines or books, is not distributed by bookstores? Several things will happen; one of them is likely to be the demise of the neighborhood bookstore.

Will Phone Jacks Replace Bookstores?

IN THE JUNE ISSUE I SUGGESTED THAT readers will have access to magazines like Macworld via phone lines before 1992 is over. Not just text versions or online services, but versions using full-blown graphics, video, and sound. And multilingual versions as well. In that scenario, a phone jack could begin to displace bookstores, or put enough additional economic pressure on this already stretched-thin distribution channel to cause even further changes.

It's not just the viability of a neighborhood bookstore, or the local Brentano's, Waldenbooks, or other bookstore-chain outlet that will be affected by the delivery of electronic magazines and books. College bookstores will change as well. My undergraduate experience was shaped in part by my college bookstores. I used to scan the shelves of those bookstores to determine if a class would have sufficiently interesting reading for me to enroll. I would browse in the aisles reading texts or looking at books I could not afford to buy.

The inevitable changes in book distribution will reach libraries as well. I'm fearful of what may happen to libraries because I have a certain reverence for them. Libraries have worked so hard over the last 20 years to become more than a place for books, that they now successfully fulfill a multipurpose role of a community resource, a haven for children, a meeting place, a place to access computers for those normally without access, and much more. But without books, libraries will lose their central purpose. And just as major cities experienced the flight of the middle classes, so too will libraries experience the flight of those seeking information as the information they want becomes available in the home via phone lines. And as the people who vote to fund libraries see them as less useful for the needs of their children, they will be less likely to support them.

I recognize that's a very pessimistic conclusion about what is likely to happen. But it's well grounded. There are fewer bookstores today that I can treat like a second home. Libraries, at least in California, have been reducing hours, staff, and collections for a decade. And there are, of course, many citizens who have never had access to the kinds of bookstores and libraries I'm even talking about. How often do you find even Waldenbooks bookstores and multimedia-rich public libraries in ghettos?

Changes in Information Consumption

IT'S BEEN PUBLICIZED FOR A while that the average American household consumes six hours of television per day. There are fewer newspapers in the United States now than at the turn of the last century. Our information sources have changed. Companies such as

What happens to our society when books and magazines are electronic?
Whittle Communications want to change information distribution through advertising—by offering schools, for example, information along with paid advertising. There’s a trend in newspapers, such as USA Today, toward replacing articles with graphics. A trend for all magazines to make articles shorter. A trend in broadcasting toward airing stories in image and sound bites in place of substantive reporting. For me, there is little question that our consumption of information is changing. Given such an environment, I wonder, as content development begins for electronic magazines, who will be the first to succeed—National Geographic or “Entertainment Tonight.” Those into the market first will define what people come to expect, and I fear that something like “Entertainment Tonight” or other, commercial-like content is just as likely to be the outcome of electronic publishing as is a multimedia version of “Nature” narrated by George Page.

COMMENTARY

To Go Forward, You Must Backup

“The high-end backup standard against which all others are judged.”
—MacWEEK, Dec. 1990

“If you are looking for a fast backup system that can help you effectively manage the backup process, we recommend Retrospect Remote.”
—MacUser, Aug. 1991

“Because of its profusion of features, Retrospect Remote is the cream of the network-backup crop.”
—Macworld, Nov. 1991

The Craft of Publishing

As those of us with knowledge and skills in traditional publishing begin to explore using video to supplement our stories, we have precious few role models. But I think we can actually improve on the original printed version of a story. Take Macworld’s story “How to Keep Your Mac Current” (May, 1992), for example; adding video to that article could show you how to open the Macintosh to put in SIMMs—unlike text, which can only describe the process. And with sound to supplement the video, viewers can hear the sharp snap that a SIMM module should make when it is placed properly onto the Mac’s system board.

As print editors, our video production skills are minimal, but so is the support of QuickTime for full-motion video. The limitations of the Macintosh mask our limitations in using video as we explore this medium. I’d like to think that we are going to bring the patience and dedication of monks working on illuminated manuscripts to any new electronic magazines, but time is money. The pressure to publish and succeed will compete with the desire to produce content ideally suited to new technologies.

Finding Information

The change in information distribution brings other troublesome issues to the fore, including the issue of choice and the issue of access.

The concept of choice: Cable TV really elevated this issue, by offering viewers a wide selection of programming. Another aspect of choice that cable brought to the public is the ability to choose to view programs without advertising. Home Box Office legitimized the concept of advertising-free programming. I would like to see the HBO model for electronic magazines. I believe some people will pay a premium to avoid advertising. Particularly if they have the ability to watch advertising if they want—the electronic magazine equivalent of the shopping channel is being pursued by most people discussing electronic magazines. For those of you who want this, never fear. Electronic magazines will offer readers even more choices, and more flexible choices. They’ll raise the cable-initiated concept of choice to a much higher level. Not only will you pick magazine articles based on your interest, but also you’ll be able to pick the advertising that you want based on what you desire to purchase.

The concept of access: One evening while I was busy pondering what would happen to people without the economic ability to access electronic magazines and continues
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books, I began to remember what access to books and magazines is like today. I remembered, in particular, a report I wrote while working in the Library of Congress on the notable lack of correspondence between the entries in the card catalog and the books actually on the shelf in the library.

I loved the stacks, the seemingly endless miles of shelves housing the millions of volumes in the library. They were my downfall. I lost months of evenings perusing subjects that I shall never have time to go back to. Still, I learned a great deal about the problems faced by our nation's library of record. That many books are missing—stolen, lost, misfiled. Just plain gone. I stood in the gallery of the main reading room of the Library of Congress more than once as some crestfallen researcher learned that a request for books could not be filled because there was no book on the shelf.

That reminded me of the times that I have gone to a bookstore, as I did recently looking for material on ancient Sumer (what is today southern Iraq), only to realize that despite all those gleaming shelves of beautifully crafted books, there was nothing on the topic I wanted. There was a short passage in a history of the Near East. A few pictures of southern Iraq in a coffee-table book. A definition of Sumer in an unabridged dictionary. I thought about the many times I have combed the shelves of bookstores and not found what I wanted.

Electronic books and magazines will change that. No more missing. No more checking out books by someone before me. Or an empty magazine slot on a rack. I'll have the ability through keyword searches to electronically retrieve all of the materials I mentioned above: the definition, the pictures, the historical passage. In fact, I'll find materials that would have been inaccessible to me on a bookshelf. I'll pull material from such a wealth of sources that even where there is no book on a particular topic, I'll be able to pull together so much that I may have the information I need. A kind of self-created, if unedited, book.

In that light, access to information will improve dramatically with electronic books and magazines. And I won't have to drive all over the Bay Area looking for a book on my topic.

What's It All Mean?

As electronic books and magazines accumulate in data banks across the nation, information consumption will change again.

Some people will simply never see the books and magazines that we are creating—a situation much worse than not seeing HBO or MTV on a cable channel. But I suspect that people who can't watch "Yo! MTV Raps" now are unlikely to have access to Macworld Interactive either. People who are finding their public library doors closed are also unlikely to be able to hook up their computers to phone jacks and download a multimedia history of the Civil War for their children. Libraries will go on trying to provide the public with access to books and magazines, but the truth is that some books will simply never appear in print. Most new electronic magazines and books will not even be suitable for print publications.

Saddest of all, there will be even less likelihood that we'll be able to sit in a quiet bookstore over coffee and tell each other what is happening. In the 1890s American society was connected by new technologies. The technology of the 1990s is likely to make American society less connected.
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Best Hard Drive!
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MacWeek, February 1991
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<td>Optional PocketDock Cable</td>
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<tr>
<td>Extra T-Connector</td>
<td>$59</td>
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<tr>
<td>128MB 3½&quot; Optical</td>
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La Cie Tape Drives

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<td>1.3-2.0GB DAT Drive</td>
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Protest Defective Displays

I read the Conspicuous Consumer column (July 1992) and immediately got hot. The PowerBook 170's voided-pixel problem is much more severe than the article indicates. Having personally bought more than three dozen PowerBook 170s since December 1991, I can tell you that only three had no voided (white) pixels. All the others had from one to five voided pixels, most in the center of the display.

My experience is that the vast majority of PowerBook 170 owners do not even recognize the existence or severity of the voided pixel problem, and if they did, they would be raising as much hell about having been sold a defective display as the people you referred to in your column.

My advice to PowerBook 170 buyers with voided pixels is to do what I have done: return the units for a refund or exchange, protest credit card charges, stop payment on checks, raise hell with Apple corporate headquarters, and alert potential buyers to the problem so they can check the displays before they pay. If all else fails, go to court. You'll win a refund or a replacement plus reasonable attorney's fees and court costs.

Robert Duttorre
Maitland, Florida

Memory Hogs

It's too bad Steven Levy singled out Microsoft for creating a monster out of what was once a fast, full-featured word processor (The Iconoclast, July 1992). He could also have pointed out how Aldus took a perfectly good piece of presentation software and turned it into an unwieldy, unforgiving beast called Persuasion 2.1. I am stunned by how miserable this new version can make my workday. But there's no going back—2.1 documents can't be saved in 2.0 format, and everyone else in our firm has upgraded.

I think we are beginning to see the limits to the usefulness of marketing input in software design. For years we have been told that Microsoft, Aldus, and other companies with similar reputations have listened to the customers and added new features galore at their behest. Now we have these omnibus programs that are inimical to the practical people who made them popular in the first place, since one of the most practical features of any software is efficiency. The problem is, it's easy to persuade companies to add to their next version; how are you going to get them to subtract?

Aaron Barnhart
Evanston, Illinois

Being a part-time user of Microsoft Word 5.0, I read with amusement Steven Levy's "Livin' Large." I say I'm a part-time user because even with my IIvx, 20MB of RAM, and a 210MB hard drive, I find Word 5.0 to be a sluggish hog—so much so that I use it only out of necessity. Annoying traits, such as overzealous screen-updating (every time a letter is typed) and torpid scrolling, make Word such an inefficient sloth, I'd rather use the story editor in Aldus PageMaker to input new text.

Andy Hong
Cambridge, Massachusetts

Steven Levy is among the annoying group of Mac whiners that has me fed up. Rather than marvel at the products companies such as Apple and Microsoft continue to develop and improve, Levy only seeks to complain about and amplify the trivial.

Get a life. I also have a Mac IIcx. Even with five applications on the original 40MB hard drive, my Word 5.0 always works perfectly. The only space problem was the amount of paper and ink wasted on your long-winded commentary.

Alan Trudell
Anaheim Hills, California

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CORRECTIONS
PLF's Infinity Floptical 21MB should have received a 3-star rating:

Infinity Floptical 21MB

MW

(Reviews, September 1992). The Floptical 5020FL from Liberty Systems, which should have received a 1-star rating, is no longer available. The slow performance of the Liberty Floptical 5020FL was due to the power supply and not FWB's software.

Tempo II macro software and an RJ-11 cable are no longer included with KeyTronic's MacPro Plus keyboard ("Input Alternatives," June 1992).


MacLand offers toll-free technical support but no extended-warranty plans ("Low-Capacity Drives," August 1992). It also offers a 105MB Quantum-based drive.

The U.S. version of Arbition's Tech 2-D is called AEC Draw; Symtron will be replaced with rendering technology licensed from Ray Dream; Uni's U.S. office is at 617/731-1765 (News, August 1992).

The RasterOps QuickPak board will begin shipping in late August or early September, and its price has not yet been set (News, August 1992).

La Cie offers a one-month money-back guarantee ("Low-Capacity Hard Drives," August 1992). Its 105MB drive uses a Quantum mechanism. Dealer sales are available only outside the United States.


Delta Tao Software's number is 408/730-9336 (Reviews, August 1992).

Tracel's number is 703/742-9500 (New Products, August 1992).

In Editors' Choice ("The Bigger Picture," September 1992), the E-Machines 8-bit video board that sells for $449 should have been the DoubleColor SX. The Futura MX board named is a $999 24-bit board.

EasyShare Mac Menu is available from Learning Performance Corporation at 800/926-3279. (New Products, August 1992). Prices range from $99.95 to $499.5 for 1 to 100 users.

CONTINUES
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Letters

Levy might want to send a signal to the wretchedly excessive software hogs by using WriteNow 3.0. It is a fraction of the price of Word 5.0; it's fast, even on a Mac Plus; and it runs in a default memory allocation of 490K. No, I do not work at DVMaker, nor am I in any way associated with them. But I do believe if you don't like the software you are using, vote with your feet and support the developers who are doing the things you like.

Robert Stevens
Sunset Beach, California

Those Reviewed Talk Back

In the article "Rendering: Making Realistic 3-D Graphics" (June 1992), David Poole does not include Infini-D in the list of products that excel at lighting, yet Infini-D offers the same features that he credits the other programs for—visual feedback and flexible control of parameters.

Poole also says that ElectricImage Animation System 1.03 has advanced capabilities for creating compound surfaces. However, ElectricImage allows you to use only two texture maps to create a compound surface, while Infini-D supports an unlimited number of texture maps and mapping methods.

Poole states that "you may end up buying Infini-D for its effects, and another product for its overall quality." I would agree with anyone who says that Infini-D's antialiasing quality may not be quite what they need for broadcast video. However, I strongly disagree that Infini-D is not good enough for print work.

Finally, there seems to be a bias against midrange products under $1000. Yet, the output from Infini-D and StrataVision 3D has easily held its own against expensive products. ElectricImage is fast, but how many readers can afford a $7500 product?

Andrei Herasimchuk
Marketing Director, Specular International
Amherst, Massachusetts

We erred in not including Infini-D in the list of programs that excel at lighting, and we incorrectly stated that you can't create procedural textures with Phong shading. We were unclear about the use of compound surfaces in ElectricImage—the use of the alpha channel with textures gives ElectricImage advanced capabilities. Similarly, we were unclear in comparing ElectricImage's bump map abilities to those of Infini-D—Infini-D allows an unlimited number of bump maps; ElectricImage allows only two. But our reviewer felt that ElectricImage produces more pronounced, higher-quality bump maps.—Ed.

Hank you for your recent review of Workspace (Reviews, July 1992). I believe that the negative aspects of your review arise from a misunderstanding of the program rather than from any design or programming defects.

In contrast to your assertions, Workspace indeed recognizes more than 23 applications. Workspace automatically loads 23 applications into the binders as a courtesy to the new user. All other applications are listed in the Binder Setup dialog box, ready for the user to move into binders at the click of a button.

Also in contrast to your review, the Workspace user need not navigate through layers of folders or wish for a Find function to assist the process. Everything needed for productive work—both applications and documents—is immediately available to the user from within Workspace.

Steven Paul Snyder
Workspace Product Manager, Ark Interface
Seattle, Washington

While it is true that loading applications into Workspace is not as difficult as my review made it seem, the lack of a fluid Find function is a significant shortcoming when it comes to adding existing documents to projects. And clicking on tools to launch applications continues.

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Letters

ions adds little to what is already achievable in the Finder using System 7 aliases or other utilities. Although I found the interface appealing, Worksheet simply didn’t add enough functionality to warrant a higher rating.—Franklin N. Tessler

The reviewer’s testing of VersionMaster 1.0.7 (Reviews, May 1992) on a stand-alone Mac demonstrated a lack of understanding of the purpose of the product. VersionMaster is a groupware product designed primarily to track document-version control in a Mac workgroup. The reviewer seems only to have considered the product for his own needs.

Jerry Shields
President, Astar Technologies
Littleton, Massachusetts

The reviewer tested the software on a stand-alone Macintosh in addition to tracking different versions of a document on the Macworld network.—Ed.

OCR Disparities

What a difference a month makes! In your June 1992 issue you gave a glowing review of WordScan and WordScan Plus (Reviews). The reviewer concluded, “If Calera were to knock $300 off the list price of WordScan Plus, I would easily recommend it over any other OCR product costing less than $1000.” Calera must have read the review, because they proceeded to significantly reduce the price of both products. I purchased WordScan.

Imagine my surprise at what a dog this product became in just one month. That’s when, in your July issue, Macworld Lab tested all the major OCR players (“From Page to Pixel”). WordScan wasn’t at the top, it was barely in the middle. The program was considered awkward and confusing to use.

I understand that different people have different opinions—Siskel and Ebert disagree. However, you should then present your reviews and Macworld Lab exposes as just one person’s opinion. At the very least be consistent. A product can’t be the best in the market and mediocre at the same time.

David Weisbord
Gresham, Oregon

Macworld believes the feature is an accurate evaluation of the OCR packages that were shipping at the time it was written. The review, written a few months earlier, based its comparative evaluation on WordScan 1.0 versus earlier versions of both AccuText and OmniPage. OmniPage Professional, the Editors’ Choice overall in the feature, wasn’t shipping when the WordScan review was written.

The review gave the product three stars, which means that there was room for improvement, which is essentially what the author of the feature thought as well.—Ed.

Fearing Obsolescence

I was an inch away from buying a Quadra 700 when I read your article introducing the Quadra 950 (“The Quadra 950,” July 1992). According to the article, the 950 is faster because of recent technological advances in the making of certain chips, including the Motorola 68040. I also noticed that the price of the Quadra 700 dropped considerably in the past month. Since the 700 contains basically the same components as the 900, does this mean we should expect the Quadra 750 to be released soon? I would hate to be put in the same situation as the owners of the now obsolete Quadra 900.

Bryan Taylor
Dallas, Texas

The continuing advancement of technology guarantees that almost any computer you buy now will be worth less and have a more powerful and less expensive counterpart a year from now. However, as owners of the Mac Plus, Mac II, and other older...
Disadvantages of BetterWriters

It was with particular interest that I read your review of GDT Softworks' BetterWriters 1.0.1 (Reviews, July 1992). Seeking to improve the graphics output from my DeskWriter last January, I ordered this package. I abandoned it soon thereafter. It is true that the GDT driver provided somewhat better rendering of graphics under some circumstances. It used halftones to render gradient fills, for instance. However, even there the driver cannot render a dual gradient-fill from Canvas 3.0, nor would the gradient fill survive being passed into a word processing document.

The GDT driver had a marked disadvantage rendering text. My reports from Micrograde 2.0.8 in 9-point TrueType Monaco font printed using this driver have the letters in each word bunched up, with double spaces between the words.

Recently, Hewlett-Packard released version 3.1 of its DeskWriter driver. While not perfect, it prints dual gradient-fills and rotated text from any application.

It maps colors onto a gray-scale image. It allows background printing. Furthermore, this driver has a built-in preview. And it is available at no cost.

Matthew Ware
Greenboro, North Carolina

FreeHand Accord

In response to Deke McClelland's review of Aldus FreeHand 3.1 in the June 1992 issue (Reviews): If Aldus FreeHand is so weak, why is the lion's share of the work that is used and featured in the major Macintosh and computer graphics publications executed with it? The answer is in its intuitive approach to creating color graphics optimized for PostScript output. Graphic artists are willing to work with text dialog boxes in exchange for color, style, and layer palettes and direct-from-file color separations.

Given the choice, anyone who has tried to work with Deneba Canvas's QuickDraw-PostScript hybrid approach to generating unpredictable output, and who works with timely production in mind, quickly turns to Adobe Illustrator or Aldus FreeHand. Anyone who has battled Illustrator's approach of direct selection/object selection, dithered Pantone color, limited page size, limited import, and a single layer will choose FreeHand.

McClelland also states, "The fact that FreeHand can now open and edit some of its own EPS files qualifies as a step in the right direction." FreeHand cannot open its own EPS files. It can, through hot links and System 7 devices, open the file that exported the EPS file. EPS is, by design, an uneditable file format that allows an artist to supply a usable, printable, viewable file to clients and that allows programs to import the finished output of other programs.

B. Ware
Cleburne, Texas

First, EPS is not uneditable by design. Since its debut in March 1987, 11 months before FreeHand 1.0 shipped, Illustrator has provided a fully editable EPS format. Both FreeHand and Canvas can directly open and edit EPS documents saved in the Illustrator 1.1 format. With EPS Exchange, FreeHand can open and edit EPS documents saved in the Illustrator 88 and 3.0 formats as well.

Second, try this experiment. Check to make sure your FreeHand Filters file is in the same folder as the FreeHand application. Create a new document in FreeHand. Draw something but keep it simple, and whatever you draw, do not add text, since FreeHand cannot interpret an EPS document with text.

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in it. Export your document as a Macintosh EPS file. Close the document and do not save changes in the FreeHand file. If you want, quit FreeHand, restart your machine, and clear every possible means of recall to the original path. Then restart FreeHand and open your EPS file directly using the Open command.—Deke McClelland

Mum Mail-Order Company

I AM CURRENTLY INVOLVED IN A DISPUTE with a mail-order house, MacCenter of Austin, Texas, that I found through Macworld. The simple story is that they not only refuse to repair a Seagate hard drive while it is still under warranty, but they refuse to even discuss the issue or return the hard drive to me. I tried to work through your Conspicuous Consumer complaint system, but MacCenter has not responded to your letter. I filed a complaint with the Austin Better Business Bureau, but MacCenter has also refused to respond to them. It has been over four months since I sent the drive to MacCenter, and things appear grim.

Michael Maciag
Orange, California

Since January 1991 we have received 16 complaints about MacCenter; Macworld has no record of any direct responses from MacCenter about the complaints, though Mr. Maciag reports that he did get his drive back after continued effort. For information on how to protect yourself when ordering by mail and specific facts on 38 mail-order companies, see Conspicuous Consumer, November 1991.—Ed.

Readers Respond to Readers

IN HER RESPONSE TO ONE OF STEVEN LEVY'S columns, Julia Lipton Skalka refers to "astrology and other self-help information" (Letters, July 1992). Science is information, astrology is fiction. Those who seriously use a horoscope to guide their lives are really in need of help, self- or otherwise.

Kristian Trueben
Orlando, Florida

AGREE WITH GEORGE FORCE (Letters, May 1992) that the McClelland book on Canvas 3.0 is a dud, but that is where Mr. Force and I part company. Canvas 3.0 does contain a few minor bugs, but what piece of software doesn't these days? And how could unlimited, 800-number tech support be considered lousy? This guy is unbelievable when he says the documentation is sparse: with a 164-page tutorial section and another 680-plus pages of technical details and examples, what does Force want? A 20-minute videotape on each command?

Gary Van Aken
Littleton, Colorado

Looking for an Index

AS A NEW USER, I PARTICULARLY enjoy the equipment and software critiques. I presume there must be some index. I am sure I can find back issues of Macworld at our local library. Can you send me such an index, if it exists?

Ronald Nilson
Vancouver, Washington


Mice or Mouses?

IN YOUR "INPUT ALTERNATIVES" ARTICLE (June 1992), you used the plural of mouse, as in a computer mouse, as mice continues.
The new PSI PowerModem™ III is the fastest fax and the only 14,400 bps fax and data modem you can buy for your Macintosh® PowerBook™. For more information, call us at 800.622.1722 or 408.559.8544. **PSI POWERMODEMS. WE GIVE YOU THE WORLD™.**

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several times. I had always thought that the plural of mouse was mouses in the computer word form.

Matthew Haskett
Modesto, California

Webster’s Ninth New Collegiate Dictionary (Merriam-Webster, 1986) shows a definition for the computer mouse but does not show any plurals for it other than mice. A panel of professional copy editors, when queried, agreed that the plural for a mouse, of any kind, is mice.—Ed.

File-Cataloging Shareware

I recently got a disk from you labeled the “Best of Educorp.” There was a program on there called FileTree, which worked for me once, then no more. My letter to the author, Jody Kravitz, was returned by post office with the address unknown.

I am surprised there are not more programs like FileTree. I'll bet there are thousands of disk hoarders out there who could use a program like that. Do you know where I can find a working version of FileTree or any program that will list the contents of my disks?

David Bowen
Canyon City, Colorado

FileTree is available on America Online but has not been updated since 1989, and we have no current address for Jody Kravitz. Another disk-cataloging program, DiscKeeper, is available for $20 from J. Geagan, 7H Laurel Hill Rd., Greenbelt, MD 20770.—Ed.

The Computerized TV

A MAC CLASSIC II USER, I AM starting to get a little annoyed with having the small 9-inch black-and-white monitor. I use PageMaker and have problems doing page layouts because of the small size. I was wondering if there is any reasonably priced product on the market that would let me use a TV as a monitor. I would like to use a TV because I have one that I could use, and I can't afford the large monitors that I would like to have.

Mike Hutchison
Saint Louis, Missouri

You can add a larger computer monitor to your Macintosh Classic II, and several companies have products that allow you to watch television on your computer monitor, but we know of no company that makes a product that allows the use of a television monitor as a Macintosh screen. Moreover, the quality of a television would be too poor for effective work with PageMaker; see “Black-and-White Monitors,” Macworld, July 1992, for an overview of low-cost screens.—Ed.

Portable, Not PowerBook

I have noticed some very low prices for the Macintosh Portable. I was wondering whether you had an old magazine issue with a large article about the Macintosh Portable, similar to your article on the Macintosh PowerBook series that was in the December 1991 issue.

Curt Harris
Lake Bluff, Illinois

We ran a feature article on the Macintosh Portable in our November 1989 issue. For back issues, write to Back Issues of Macworld, c/o Snyder Newell, P.O. Box 7046, San Francisco, CA 94120-9727; the cost is $6 per issue, $20 overseas.—Ed.
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Behind Macworld's graphics

Art Beat

BY CATHY ABES

Artist: Louis Fishauf is creative director and one of the founding partners of Toronto-based Reactor Art & Design. He has been a Macintosh user since 1987, when he received a Mac Plus as partial payment for an Apple ad he produced.

Hardware: Mac Ilfx with 32MB of RAM, a 400MB internal hard drive, and a RasterOps ColorBoard 264; 13-inch Apple-Color High-Resolution RGB Monitor; two SyQuest removable-cartridge drives; Wacom graphics tablet; Sharp JX300 color scanner.

Software: Adobe Illustrator 3.2; Adobe Photoshop 2.0.1.

How It Was Done: For the illustration that opens our feature this month on QuickTime, Fishauf used a combination of scanned photos and created images. The 300-dpi scans include photos of a Greek bas relief, a camcorder, and a box of popcorn, as well as three photos of a horse and rider from the Eadweard Muybridge stop-motion photographic studies done around the turn of the century; the image behind the funnel and the triangle was of a VideoSpigot board, which Fishauf scanned in directly.

In Illustrator he created an initial page with crop marks containing the free-form background, the computer, and the tabletop. He selected the computer and the tabletop, and turned them into guides (using the Make Guide command under the Arrange menu) to hide them. Now only the background was visible in the Illustrator file, which Fishauf then saved. After opening the Illustrator file in Photoshop, in the resulting EPS Input Options dialog box he changed the default resolution to 200 dpi and set the mode to RGB—an RGB file is three-quarters the size of a CMYK file. In Photoshop, he pasted the free-form background into an alpha channel, where he inverted it to white on black (to mask out everything but the kidney shape). Then he used the Gaussian Blur filter (set at about 10 pixels) to soften the edges.

Fishauf applied four different background textures to the free-form shape to represent the four-step transition from real life to film to video to digital technology. Beginning with a new grayscale Photoshop file, he combined the Add Noise and Emboss filters to create the uppermost, grainy texture. For the second texture, he opened up a black-and-white pattern file and, using the lasso tool, he made a 20-pixel feathered selection and pasted the selection over the first texture. Using the Paste Controls command he set the opacity to 30 percent to make the grainy texture underneath show through, and chose the Darken Only option to keep the darker areas of the texture visible. Using the lasso tool again, with the same feather setting, he selected the lower portion of the background, where he wanted to place the third texture; he pixelated the second, granular, texture with a Mosaic filter (set to 15 pixels per square) in that selected area. Finally, for the fourth texture, around the lower edge of the free-form shape, he applied the DCI Wind filter (continues)

The illustration that opens our QuickTime feature on page 170.

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The Illustrator file that contained the shapes of the free-form background, the Macintosh, and the desktop (left). The Illustrator file opened within Photoshop at 200-pixels-per-inch resolution (center). Only the free-form background appears because the other objects were converted to invisible guides in Illustrator. The background shape in the alpha channel (right) after the artist blurred the edge with the Gaussian Blur filter in Photoshop.

The original texture Fishauf scanned in for the free-form background.

third-party filter that's not part of Photoshop) to simulate electronic static.

To convert the gray-scale file to RGB color, he used Adjust Hue/Saturation (Image menu). Then he copied the colorized textures and chose Load Selection (under Select menu) to bring the alpha channel into the main (empty) file and define the free-form background area, into which he would paste the textures.

Next, Fishauf went back to his Illustrator file and used the Release All Guides (Arrange menu). The next image he wanted to bring into his Photoshop file was the desktop, so he made everything else a guide and resaved the file. Then in Photoshop he placed the desktop as a floating selection. Because Fishauf had used the Place command, Photoshop used the crop marks from the original Illustrator file to precisely position the desktop shape at the bottom of the textured background. He then opened a wood-grain texture and used Color Balance and Contrast/Brightness to lighten the texture and bring out the grain pattern. After copying and pasting the texture into the floating selection, he again went back to the Illustrator file, released all guides again, selected the two rectangular shapes of the computer, made everything else a guide, and painted the rectangles with a white fill and no stroke, then resaved the Illustrator file. After placing the rectangles in the Photoshop file, he used Paste Controls to set the opacity to 80 percent so the wood continues

The middle horse-and-rider photo and the black-and-white pattern Fishauf used to create the vertical scan-line effect (top). An alpha channel was created and the selected area was filled with the vertical-line pattern (center). After loading the selection from the alpha channel, he used the Brightness slider to create the scan-line effect (bottom).

The funnel, the triangle, and the type objects created in Illustrator (top left). First the triangle and then the funnel were placed in the Photoshop file over the scanned image of the VideoSpigot board (top right). After colorizing the triangle and applying the halo effect to the funnel, he placed the type (bottom left). While the type was still a floating selection, the excess was trimmed away and the type was filled with a black-to-white blend (bottom right).
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Circle 237 on reader service card
The horse-and-rider photos originated as gray-scale scans that he assembled in a Photoshop file. Then he converted the gray-scale file to RGB, using Hue/Saturation to give it a sepia tone. Fishauf used the Blend tool to produce the top-to-bottom color transition between the three photos. In the Blend Tool Options dialog box, he set Mode to Color Only and Color Space to HSB-CCW to blend all the colors in the spectrum between his background color (blue) and his foreground color (red) in a counter-clockwise direction.

To reinforce the theme of transition from natural to digital images, Fishauf treated each of the horse-and-rider photos in a slightly different way. For the top photo, he pasted in a sky blue background with fluffy white clouds at 50 percent opacity. For the middle one, he devised a pattern consisting of one row of white pixels and four rows of black pixels, selected that, and chose Define Pattern (under Edit) to create vertical white lines on a black background. Then he created an alpha channel of that shape, filled it with the pattern, and loaded the selection into the RGB file to select only the white areas of the pattern—every fifth row of pixels; setting the Brightness control to 60 brightened those white rows to create the vertical scan-line effect. On the bottom picture Fishauf used the Mosaic filter to create a bitmapped look. After pasting the three-photo sequence into the main illustration as a floating selection, he used the Perspective command to squeeze it at the bottom.

Next Fishauf selected and copied a square portion of the scanned Video-Spigot board, then distorted it in Photoshop. After creating the funnel and the triangle in Illustrator, he placed the triangle in Photoshop and filled it with a blue-to-orange blend. Then, once he’d placed the funnel as a floating selection, he copied it to the Clipboard, feathered the selection by 6 pixels, and made the current background color light blue. Next he deleted the selection, replacing its black edge with a soft blue halo, and pasted the original black-edged funnel over the halo. After placing the type over the funnel, he eliminated the areas outside the triangle using the lasso tool with a feathered edge and the % key (to subtract from a selection rather than add to it). While the floating type was still selected, he filled it with a black-to-white blend.

To create the rough edge around the Greek head, Fishauf converted the original gray-scale to RGB and gave it a blue tone. After selecting the rectangular area with the marquee and saving it to a new alpha channel, he used the Spatter filter (from Aldus’s Gallery Effects) to roughen the edge of the rectangle. He loaded the selection into the gray-scale file. Then he copied and pasted it into the main illustration, where he colorized it and rotated it at an angle. The scissors and clap board were created in Illustrator and pasted in at 70 percent opacity.

To compensate for the difference between the illustration’s screen and printed versions, Fishauf used a home-brewed method of color correction. First he created a file that contained four miniature copies of the illustration (resampled down to 100 dpi). Experimenting with contrast/brightness settings, he saved a different batch of settings for each copy. He had a high-resolution ink-jet color proof made to see which of the settings worked best, then used those settings on the final file. From experience, he’s learned that boosting brightness between 15 and 20 percent and contrast between 5 and 10 percent usually gives good results.

The illustration (excluding research and preparation) took roughly 20 hours to create, and the final RGB file size was 10.5MB.

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VOICEOVER: Are you ready, America? Have you upgraded your hard drives? Expanded your memories? Have you installed QuickTime, Apple Computer's amazing system extension for running often-postage-stamp-size video clips on your own computer screen? If so, you're ready for "Queak Previews," where your two favorite critics introduce you to all the hot clips and then make often indefensible pronouncements about them! Here they are... Geeeeene and Roger!

ROGER: We've got to lose that announcer.

GENE: You've got to lose some weight. Or do you have a few loaves of bread stuffed under that sweater?

ROGER: Obviously, the last 20 hours of decompressing QuickTime files has gotten to Gene. Believe me, we had a hell of a time getting these things onto our system. They came on CD ROM, SyQuest cartridges, bundles of high-density floppy disks, and high-capacity hard drives—but we finally have everything ready for our old reliable MoviePlayer. And may I say that multimedia has never been better?

GENE: You may, but we're running late already. So here's the first clip, which appeared on the ever-popular Apple Computer QuickTime Developer's Disk. It's called Engineers in the Shower.

Gene and Roger turn toward a wall-sized monitor in the front of the room, displaying the Mac desktop. A small portion of the screen shows the clip.

LOCATION: A communal bathroom with three shower stalls, side by side. Several males, approximately in their late twenties, wearing T-shirts and baggy jeans, are frantically running into the showers, fully clothed. (The water is off.) Then they immediately run out of the stalls, slamming the flimsy frosted-glass shower doors. The sounds are a jangly, metallic clatter of doors slamming, the feverish patter of sneakers on bathroom tile, and the heavy breathing of people unaccustomed to physical exertion. Finally one leans to the camera and says, "These are trained professionals—don't try this at home." Soon thereafter, as they breathlessly scuttle out of the room, we hear a giggly voice asking, "Are we recording?"

ROGER: Gene, this is just another one of those teen-oriented QuickTime clips, where a bunch of adolescents turn on a video camera, act like morons, and think it'll be considered clever when everything is digitized and stuck on a Macintosh. Where are the new ideas? Is this the golden age of media? To me, this is a big thumbs-down.

GENE: Once again, Roger, you miss the point. I find Engineers in the Shower to be a hard-hitting yet poignant expose of the working conditions at one of the country's most admired computer companies. Working 90 hours a week trying to create a new era in computer media has obviously driven these young wage-slaves to the point of insanity. They're scrambling like rats in a cage! The amazing thing is how their employer slyly placates them—by allowing them to tape their own mental breakdowns with a cheap camcorder, and then actually including the clip in a CD ROM distributed by the company! Besides, I think it's fun, especially since the choppy images give it a fast-forward, Mack Sennett feeling.

ROGER: Gene, don't you know that almost every QuickTime clip is choppy like that? Unless you run them on a Quadra 950?

GENE: Well, to me it's still a thumbs-up. Now, our next clip is bound to be controversial. In the spirit of Oliver Stone's JFK, comes 11/23/63 Extra! It's a HyperCard stack that professes to prove, beyond all doubt, that the Kennedy assassination was a conspiracy. And the linchpin of all this is the Zapruder tape, which is included as a QuickTime clip.

They turn to the monitor. The familiar, if unusually blurry, image of the presidential limo that day in Dallas, after the first shot. Kennedy's head is bowed, and Jackie, in pink suit and pillbox hat, is cradling him. Suddenly part of his head seems to explode, and he is violently thrown backward.

ROGER: Now, that was only part of the Zapruder film, but the clip's creator promises to digitize the entire thing later on. What makes this unusual is that the viewer can play with the film with a utility called QuickTime Detective, which supposedly helps you prove the original film has somehow been tampered with.

GENE: I vote for a thumbs-down. How do we know that the QuickTime clip hasn't been tampered with?

ROGER: Good point. Using QuickTime and a program like Adobe Premiere, one can manipulate images all sorts of ways, altering reality. Just because you see something on a video doesn't mean it happened. What if this guy is part of the conspiracy, and he painstakingly flipped the digits to make it look like John Connally shot the president? Still, this is a good example of how QuickTime clips can vividly portray historical moments. Thumbs-up.

GENE: I'm glad you mentioned Premiere, because Adobe includes a CD ROM loaded with QuickTime clips. Here's an example, called Evening.

First we see a pearl necklace, then an empty dress of the short black variety. The dress is suddenly filled with a woman, a model who is sort of a low-rent Annette Bening. We get a brief glimpse of someone else, but mostly this is a one-woman show, a montage of views of the woman in her skimpy dress. The most dramatic shot is an upward pan—to hair—that follows her curves. There are lots of fades, double exposures, zooms, and the like. The sound track is a deep Hammond organ, playing moody R & B.

GENE: Sort of an MTV clip. I give it a thumbs-down.

ROGER: Try VH-1. But I like it anyway. Thumbs-up.

All Thumbs

BY STEVEN LEVY

MACWORLD October 1992 67
GENE: Funny, though. Did you ever notice how much QuickTime clips are engineered to the low attention spans of MTV viewers? Since it's extremely difficult to accommodate clips longer than 20 seconds or so, the creators wind up stuffing in all sorts of special effects, quick cuts, and gimmicks.

ROGER: Yeah, a lot of stunts with text, too. I think artist Jenny Holzer is the patron saint of QuickTime artistry.

GENE: And also, as we see in *Evening*, a focus on sex. Is it inevitable that the cutting edge of every visual media winds up as lurid exploitation of the female body?

ROGER: Is this a politically correct diatribe? Have you been reading *Backlash*?

GENE: Wake up and smell the coffee, Roger. You won't believe how quickly sleaze has oozed into the world of QuickTime clips. Let me show you this Quick-Time 4th Dimension database that a fellow named Craig Hosoda entered into the Macworld QuickTime Festival.

ROGER: Craig Hosoda? Isn't that the guy who wrote that book *The Bare Facts Video Guide*, that identifies and rates the nude film appearances of every actor and actress in Hollywood? That's a great book!

GENE: You would think so, Roger. Here's his database.

The 4D interface comes on the screen. Roger, working a keyboard, begins typing in the name of Jodie Foster. A record exists that lists her movies and shows a picture of her. Roger points-and-clicks at the picture, which is from the film *Backtrack*. It shows Foster exiting a shower. She is dressed appropriately for the scene.

ROGER: A big thumbs-up. Just imagine what the perverts who swap porno TIFF files on the networks will do with this technology!

GENE: Don't imagine, it's happening already. My thumb goes down. Now for a final word, from Apple's QuickClips CD ROM disc. It's a little piece called *Seul*.

A black screen fades into a tight head shot of Apple chairman John Sculley, seated in a busy office, wearing a dark suit and a green tie. Somewhat tentatively, he makes the following prediction, presumably about QuickTime: "I believe that it is an important enough new technology that it's going to create not just a series of businesses, it's probably going to create an entire industry. If you go out 15 years from now, people probably won't talk about the computer industry as they do today, uh, they'll probably talk, um, about, uh, the tools industry, which will include interactive multimedia... They may talk about the information management industry, um, but we'll probably have a different nomenclature 15 years from now..."

ROGER: It kind of reminds me of one of the witnesses in that Warren Beatty movie *Reds*. Or one of the speakers in *The Sorrow and the Pity*. Searing stuff. I give it a thumbs-up.

GENE: It's thumbs-down for me. Roger, don't you get it? You're looking at the presentation but not following the content. Try to comprehend what the man is saying. Do you really believe that QuickTime is going to change the industry so much so that it will explode the computer industry into an array of other industries?

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ROGER: Who knows what the computer industry will be in 15 years? But I do know one thing—QuickTime does teach us that integrating video technology into computer media is much, much harder than anyone suspected. I think Apple has done a great service by making it possible to use QuickTime clips, and one day in the not-too-distant future we will all have powerful enough computers, video add-in boards, and enough storage space to make use of it without going through the terrible contortions we suffer with now. And, ideally, all that horsepower will be affordable. On the other hand, if you want to make a statement as Sculley does, I still think that the way to do it is to write it down and edit it. To be honest with you, I had to watch that clip four times before I really understood what he was saying. The first three times I saw it, all I noticed was that somewhere in the background a guy in a yellow shirt was walking across the office.

GENE: Roger, you actually seem to be making sense here. Let's wrap up the show while we're still ahead.

ROGER: Can't we watch that Jodie Foster clip one more time?

GENE: Only if she grants Craig Hosoda permission to exploit her image in that manner.

ROGER: Get permission for stuff you picked up from a VCR movie to use in a QuickTime clip? Dream on.

GENE: Wrong again, Roger. It's only a matter of time before the Multimedia Police elbow into the game and put the hammer down on all the fun. It'll be thumbs-down on piracy.

ROGER: Maybe by then our computer will be powerful enough to run QuickTime clips big enough to fill the screen, and they won't be choppy!

VOICEOVER: You can bet on it, Gene and Roger! In the future Multimedia will be Nirvana on Earth! We'll have new nomenclatures! And a document, be it a spreadsheet or a press release, won't be a document without at least one QuickTime clip!

GENE and ROGER (in unison): We've got to lose that announcer!

Fade to black.

STEVEN LEVY'S most recent book is Artificial Life (Pantheon, 1992).
STATISTICA/Mac™ is a complete statistical data analysis system with hundreds of presentation-quality graphs integrated with all procedures. It offers in-depth, comprehensive implementations of: Exploratory techniques: Descriptive statistics; frequency tables; large selection of nonparametric tests; Stepwise multiple regression methods with extended diagnostics; General nonlinear estimation (with predefined or user-specified models); Logistic/Probit analysis; General implementation of ANOVA/MANOVA/ANCOVA (designs of practically unlimited complexity); repeated, nested, incomplete, random, changing covariates, contrast analyses, post-hoc tests, custom designs); Discriminant function analysis statistics; Canonical analysis statistics; Time series modeling techniques with forecasting; Factor analysis with rotations; Cluster analysis (including hierarchical and k-analyses); General survival/failure time analysis (including life tables, groups comparisons, and regression models); Distribution fitting (a large selection of continuous and discrete distributions); Curve and surface fitting and smoothing (including spline, LOWESS, NEX, and cox); and much more. Manual with comprehensive introductions to each method and step-by-step examples (Quick Start booklet explains all major conventions); balloon help. Extensive data management facilities: a super-fast spreadsheet of unlimited capacity with formulas (and Publish and Subscribe; merge/split files; “double identity” of values (numeric/text); BASIC-like data transformations programming language; Import/Export data and graphs from/to fixed, MacSS, CSS and other formats. Graphs with integrated with all procedures (e.g., click on a correlation coefficient to produce the corresponding scatterplot and other graphs; click on a variable in the descriptive statistics table to produce a histogram and other graphs; click on an interaction effect in the ANOVA table to see a plot of interaction). Large selection of 2-dimensional graphs: Histograms (including multiple, clustered breakdowns, overlaid functions), Scatterplots (including multiple, weighted frequency, smoothed, function filling), Multiple line and Range plots, Trend plots, Standard deviation plots, Data sequence diagrams, Contour plots, Bar- and whisker plots, Column plots, Box graphs, Double pie charts, Scrollable dendrograms, Two-way joining, Correlation fitting, Curve fitting, Distribution comparison plots, Range plots, Probit plots, Randomization plots, Factor score plots, Censored outlier and residual diagrams, ANOVA interaction plots, Multivariate (multiple) matrix plots, exploratory Drafgraph with histograms, and many other specialized plots. Large selection of 3-dimensional graphs: 3D surface plots (with data smoothing procedures, color or gray-scale shading, and projected contours); 3D scatterplots, 3D block scatterplots, 3D axis (space) plots, 3D spectral plots with adjustable planes, 3D line/ribbon plots, 3D sequence block plots, 3D histograms, 3D surface-smoothed frequency plots, and 3D range plots (flying boxes). All 3D plots displayed in true perspective, feature interactive real-time rotation facilities (including continuous rotation). Extensive graph customization options: all structural aspects of graphs (axes, scaling, patterns, colors, sizes, styles, regions, perspective, rotation, fitted functions, etc.); MacDraw-style tools with specialized “objects”; hi-res graph and artwork embedding; page layout/review; dynamic rulers; Publish and Subscribe graph links. All output displayed in ScrollSheets™ (dynamically scrollable tables: all numbers can be instantly converted into a variety of on-screen customizable, presentation-quality graphs). All ScrollSheets can be saved into data files and used for input, or exported to flexible facilities to perform analyses on specific subsets of data. Extensive large-analysis designs; Unlimited size of files. Extended precision. Unmatched speed (e.g., on a Mac IIi, arbitrary rotation of a surface with 1,000 points takes second; correlation matrix 50x50 with 100 cases—less than 2 seconds; transposing a 5,000 data points file—less than 2 seconds). Full support for System 7 (“savy”) incl. “Publish and Subscribe.” Apple events, balloon help, “drag and drop,” 32-bit, Quadra cache, etc. Price: $955.

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EHMAN INC., A MACINTOSH peripherals company founded in 1985, hit on a winning strategy near the end of 1988 by introducing Mac owners to inexpensive hard drives. The Evanston, Wyoming, upstart became one of the fastest-growing businesses in the United States. Sales under the Ehman and Cutting Edge labels boomed to $30-plus million in 1990. But despite the record numbers, Ehman Inc. didn't make a dime that year—it actually lost an estimated $300,000.

The company's financial struggle ended in April 1992 when founder Michael Ehman shut the office. The company, which has not filed for bankruptcy, has an estimated $4 million in debts (see Conspicuous Consumer, August 1992). A new company, called Bridgette, is now selling Ehman-labeled drives and monitors under Michael Ehman's direction from the San Diego suburb El Cajon.

How Michael Ehman made the transition from managing Ehman Inc. last year to managing Bridgette this year is a matter of intense interest in Wyoming. The state guaranteed a $500,000 private bank loan to Ehman Inc. and also made a direct loan of $50,000 to the company. Both loans were secured by Ehman Inc. inventory, and both loans are in default. The state of Wyoming will have to pay an Evanston bank the considerable difference between the value of the remaining inventory and $500,000, and probably take a complete loss on the other $50,000.

According to internal corporate documents and interviews with key sources, Ehman may have caused his company to violate the terms of his company's state-guaranteed loan by transferring inventory and business equipment from the old, failing enterprise to a new one unencumbered by debt. Ehman denies that he did anything wrong in moving from Ehman Inc. to Bridgette, a company he is working for as an unpaid consultant. A family member, he said, owns Bridgette.

Profile of an Entrepreneur
WHEN I ASKED MICHAEL EHMAN WHY his old company unraveled, he invoked bad sales forecasts, accounting problems, and a lack of controls. He said Ehman Inc. didn't have access to seasoned executives and alluded to a power struggle with former company officials. He also mentioned a shortage of skilled workers, and his own lack of management skills. But when I asked former employees and associates of the executive why the company unraveled, they pointed to Michael Ehman.

Michael Ehman is a bright, talented salesperson who got in over his head, according to sources. Several large Ehman Inc. creditors said Ehman is an honest, stand-up guy. Former employees I spoke to admired his drive and commitment but said he is a lousy manager who is more comfortable with hardware than humans and who changes plans as often as he changes clothing.

Rapid growth has damaged many companies, including those with more-experienced managers. In fairness to Ehman, it shouldn't be surprising that he ran into problems with the company. Ehman was an entrepreneur, not a manager, and worked as a petroleum engineer before starting a Macintosh business out of his home.

But as Chrysler head Lee Iacocca is fond of saying, you need to lead, follow, or get out of the way. According to interviews with former employees and sources close to the company, Michael Ehman couldn't do any of those things well. He tried to lead, but couldn't stay focused on a single plan of action, pushing the company first in one direction, then another.

In February 1991, for example, Ehman founded Sterling Solutions, an off-brand hard drive company in Salt Lake City. Sterling had only two employees and sold drives made by Ehman Inc. Sterling was supposed to steal sales from other no-name companies and increase the overall sales volume. Instead, it flopped, and closed its doors after a few months.

Ehman couldn't follow, either, or get out of the way. Time and time again he hired people to save Ehman Inc., gave them responsibility, grew disillusioned with their work, felt betrayed, and then denounced them. Sometimes he had good reason to feel betrayed, but not always, sources said. "I picked the wrong people," said Michael Ehman. "I continually staffed the company with people who were not ready for the job from an experience and ability standpoint. I had some real talented people, but they didn't have the background yet . . . That was my biggest shortcoming—I didn't build a good team."

According to former employees, and Michael Ehman himself, the company had few controls to speak of. Tales abound of confusion, misinformation, and waste. Of customers who paid for one monitor but received two. Of accounting failures, inventory problems, and tracking issues. "We had a sale at one point where we were actually losing money on the product, which we didn't know, because of incorrect cost estimations," said Peri Vastardis, a former salesperson for Ehman Inc. "Every unit we sold—and we sold 400 to 500 of these things—we were losing money on."

Associates paint the picture of a chaotic company generally without consistent plans, controls, or profits. And they describe a man in charge who resisted paying suppliers and often acted impulsively. "Michael Ehman is his own worst enemy," said Dave Watson, a former associate.

Bridgette's Birth
EHMAN INC. HAD A HISTORY of financial ups and downs even before it began selling hard drives, but its most serious troubles began in early 1991, when the company lost a $1.1 million credit line provided by a financial services company. Several months later the state of Wyoming stepped in with the $500,000 loan guarantee for operating costs, but the loan was too little, too late, according to Michael Ehman. Although company officials were optimistic about Ehman Inc. in October 1991 (see Conspicuous Consumer, February 1992), their enthusiasm soon faded. By December...
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1991, sales had dropped so dramatically that, Ehman said, he began trying to sell the company.

The next month, in January 1992, Ehman continued looking for capital that required Wyoming Software to repay the loan, and a consulting agreement that needed Wyomning Software to pay Bridgette $2000 per month for consulting services, whether or not consulting actually took place.

The $35,000 went to one of Ehman Inc.'s creditors. Display Technologies of Elgin, Illinois, built monitors for Ehman Inc., invoiced the company, and then held the monitors for Ehman Inc. until they were shipped to customers at Ehman's request. By March, Ehman Inc. owed the supplier a considerable amount, and Display Technologies was threatening to stop...
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What about Business Sense?

Recently readers have written with questions about Business Sense. Some users may be wondering what has happened to the product, which company is publishing it now, and what an accounting program has to do with Ehman Inc. Here's an update.

Business Sense began life as an accounting package called Turbo Maccountant, which Macro-world reviewed in October 1986. Digital Etc., the small company that developed it, sold the rights to Monogram Software, which marketed the product as Business Sense in 1987. A few years later, Digital Etc. reacquired the rights to the program and then licensed them to a new company in June 1990. That company was called Inman Software and was started by Michael Ehman and two consultants to Ehman Inc.

According to interviews and legal documents, the Inman partnership dissolved in April 1991 after the two other principles lost a power struggle with Michael Ehman over the course of Ehman Inc. He became sole owner of Inman, which shut down. A new company, which used the same employees, emerged in August 1991. It was called Wyoming Software Corporation. As Michael Ehman explained it to me at the time, “Some California investors bought licensing rights to Business Sense... I do not have an equity position in Wyoming Software, although I have been retained as a consultant.” According to interviews and company documents, Ehman managed the company as president. The California investors were apparently one person, Ehman’s mother.

Ted Wood, a former Ehman Inc. employee who started working at Wyoming Software, badly wanted the rights to Business Sense for himself. So he negotiated an agreement with Michael Ehman in September 1991 to buy the outstanding shares of Wyoming Software Corporation from Ehman’s mother. Wood claimed he made monthly payments faithfully. But he was unable to make two balloon payments. On January 30, 1992, Ehman regained control of the company when he went to the Wyoming Software office in Evanston, Wyoming, with a sheriff and had the locks changed, at least nominally on behalf of his mother.

According to former executive Jim Acton, Wyoming Software wanted to broaden its user base, so the company made an upgrade deal with Software Toolworks, which publishes Dollars & Sense. Wyoming Software paid Software Toolworks for the right to notify Dollars & Sense users of a recent upgrade and sell them the upgrade plus a free copy of Business Sense 1.5.

The mail-in in early February 1992 was fairly successful in terms of responses, but there was a hitch. Digital Etc. indirectly halted shipment of the completed Business Sense version 1.5 because of allegations involving unpaid royalties. As a result, Wyoming Software was forced to send users Business Sense 1.4.1, which had fewer features than the version they paid for. (Version 1.5 solved a low-level printing problem and, for the first time, allowed data to be imported into the program, according to Acton.) The company did promise users who bought the Dollars & Sense upgrade package a free upgrade to Business Sense 1.5; it’s not clear whether everyone who requested the upgrade got one.

The dispute between Wyoming Software and Digital Etc. was resolved when the principals signed legal documents in April 1992 that amounted to a peace treaty between them. At the same time, Michael Ehman left the company in the hands of Jim Acton. There are differing accounts of what happened next. Acton said he resigned from the company in April. Ehman said Acton agreed to take over Wyoming Software and didn’t follow through on the deal.

In any case, Wyoming Software was essentially dissolved. On May 7, 1992, Jim Acton sent a letter to Michael Ehman about the company that read in part, “I am returning your proposal unsigned. What little was left has been either repossessed by unpaid vendors, used to pay payroll, returned to Ehman headquarters, or blown off.”

Jim Acton and Ted Wood have licensed the marketing rights to Business Sense from Digital Etc. and started a new company, called Business Sense Inc. (307/877-2231 or 800/377-4954), to distribute it. Acton is in charge of technical support and oversees the small Keeneberm, Wyoming, office, while Wood manages sales from West Jordan, Utah. Version 1.6 of Business Sense is cut and includes a new check-reconciliation function and improved import and export features, according to Acton. The company is working to resolve any consumer problems that may have arisen in the transition from Wyoming Software to Business Sense Inc., Wood said.

releasing products if payment wasn’t forthcoming, according to Ollar. So at Michael Ehman’s request, Ollar sent Display Technologies a payment of some $40,000 shortly after the $35,000 check from Wyoming Software was deposited into the Ehman Inc. bank account.

A few days later, around March 16, Ehman Inc. instructed Display Technologies to ship 264 monitors and 264 graphics boards from Ehman Inc. inventory to a customer in California. The order, which covered about half of Ehman’s total inventory, was unusual because the monitors were being sold for less than $200 per unit.
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what they cost Ehman Inc., according to Ollar. Display Technologies didn’t have any graphics boards but shipped 264 cartons of monitors to San Clemente, California—Bridgette’s future home—on March 30. It was a neat trick—$35,000 from Wyoming Software mingled with $5000 from Ehman Inc. and then arrived at Display Technologies as partial payment on the existing Ehman Inc. inventory. Shortly afterward, Ehman instructed that part of that inventory—worth about $150,000 if sold at retail prices—be shipped to his new company, Bridgette.

The problem with the transfer, according to sources, is that by March 16 Michael Ehman was working to leave Wyoming so he could open Bridgette in California. Ehman Inc. would soon close its doors. And in that case, all of Ehman Inc.’s inventory belonged to the private Evanston bank that had loaned Ehman $500,000 and to the state, which had guaranteed the unpaid loan.

Ehman denies that any transfer of assets took place between Ehman and Bridgette, and he denies that the state of Wyoming had any legal claim on the monitors at all. In fact, he said, Wyoming is in better shape now as a result of the monitor purchase by Bridgette because Bridgette must repay Ehman—and thus, the state—for the purchase. (That logic ignores the money Display Technologies lost on the deal by never receiving full payment for the monitors, assuming the state didn’t actually have rights to Ehman’s inventory. And if the state did have rights to the inventory, as sources claim, that argument overlooks the below-cost sales terms that the state of Wyoming might have been able to better if it retained the inventory itself.)

John Cox remembers the monitors well—he called them “Bridgette’s funding source.” No profits could be expected from hard drive sales, because Questronex had agreed to supply products to Bridgette only if all the profits from drives went toward the debt Ehman Inc. had run up with that company. So selling monitors may have been the only way Bridgette could have been funded, although Ehman denies that was the case.

Another theory, suggested by a source close to the company, is that Ehman was trying to protect a family member’s investment of close to $20,000 in Bridgette. The funds, which were intended for Bridgette—a company that didn’t exist at the time—were deposited in Ehman Inc.’s bank account in January and went to pay for advertising. That made the family member an unsecured Ehman Inc. creditor, according to the source. But as Michael Ehman explained it to me, Bridgette actually funded Ehman Inc. by providing the company with needed funds, and it was only reasonable for the investor to protect his investment by buying discounted inventory in return. (Inventory that was worth, remember, about $150,000 if sold at retail prices.)

The Comeback Kid?

LATE LAST SPRING, MICHAEL EHMAN sent overdue commissions to some former Ehman sales people and repaid some local businesses that had been burned when Ehman Inc. closed its doors. Questronex is no longer building hard drives for Bridgette, which moved to El Cajon, California, where it continues to sell products via Ehman Inc.’s former 800 line. In June, Bridgette employees worked to repair and return drives under warranty to Ehman customers, said former Bridgette consultant Randy Carter. And in the last week of July, Bridgette ran an ad in MacWorld for an inexpensive two-page monochrome monitor and 120MB hard drive.

According to Ehman, Bridgette is spending $5000 a month on telephone bills to support old Ehman Inc. customers. And at press time MacWorld has received about five complaints from Ehman and Bridgette customers, far fewer than the number we received from Jasmine customers when that company closed. Ehman said he should be judged on his actions the past several months and reiterated his concern for his customers. Will Michael Ehman be the comeback kid? Let me know what you think.

Research assistance by CAROLYN BICKFORD.

Send nominees for sainthood to Service Heroes, Macworld, 501 Second St., San Francisco, CA 94107, or via AppleLink (Macworld1) or America Online (Branscum). Conversely, drop Conspicuous Consumer a line if a company is ignoring you.
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SKU# Formatted Drive Type Drive Mechanism Access Time Throughput MB/Sec ZONE PRICE Cost/MB
04880 52 3.5" LPS Quantum 17 2.0-4.0 $358 $6
04881 105 3.5" LPS Quantum 17 2.0-4.0 498 5
04882 240 3.5 Quantum 16 5.0-10.0 $848 4
05367 330 3.5 Quantum 12 4.0-5.0 1318 2.2
05366 520 3.5 Quantum 12 4.0-5.0 1538 4.3
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### Updates

**OCTOBER 1992**

This section lists the latest versions of selected Mac applications that were shipping by the time we went to press.

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>V.</th>
<th>REQ.</th>
<th>*</th>
<th>S</th>
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<tbody>
<tr>
<td><strong>4TH DIMENSION</strong></td>
<td>2.2</td>
<td>1MB/60</td>
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<td><strong>A4</strong></td>
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<tr>
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<tr>
<td><strong>ADOBE PHOTOSHOP</strong></td>
<td>2.0</td>
<td>1MB/60.2</td>
<td></td>
<td>$199</td>
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<tr>
<td><strong>ADOBE TYPE MANAGER</strong></td>
<td>2.0</td>
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V. = version #, Req. = min. RAM and system software required. * = last time (in the past year) this or an earlier version was reviewed. $ = cost of update to registered owners. NA = first version, not applicable. * = contact your dealer for update policy. Blue = new version. Yellow = reviewed product.

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| FREEDOM OF PRESS PROFESSIONAL | 1.0 | 1MB/6.0 | 3/92 | # |
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| MACBRAF | 2.1 | 1MB/6.0 | FREE |
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resolution, 24-bit color. It also supports digital video recording through Apple's QuickTime software, and video playback at 30 frames per second, video-in-a-window. And if that weren't enough, VideoVision is compatible with NTSC, PAL and SECAM, and lets you easily convert from one standard to another. If you'd like to know how to do all this and receive a free videotape demonstration, call 1-800-227-2798. Or for immediate faxed information, dial 1-800-966-7360. We'll take all your unnecessary wiring and turn it outside in.
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Lab Notes

Pushing Scanners to the Limit

BY MARK HURLOW

As we discovered during our lab testing of slide scanners for this month's feature "Seeing Through Slide Scanners," fine-tuning a scanner to produce the best output in the least amount of time can be a tricky endeavor. For most of our testing, we focused mainly on three areas: speed, scanning resolution versus output resolution, and gamma correction.

Using a Mac Iic with 8MB of RAM and Adobe Photoshop 2.0, we began by testing scanners that enable you to scan images at different speeds (including the Tamarack/Artix Technologies ArtiScan 600S, the MicroTek ScanMaker 1850S, and the XRS OmniMedia 6ex) to find the fastest setting that could produce a high-quality image. While scanning in the slowest mode usually produces a far better image, it may take considerably longer. For example, at the fastest velocity setting (1), the ArtiScan was able to scan a test slide in 36 seconds, but at the lowest velocity setting (15), the ArtiScan took more than twice that time—85 seconds—to scan the same image. The downside was that the images scanned in 36 seconds suffered severe streaking and flaring. However, the ScanMaker and XRS's OmniMedia showed virtually no difference in quality or speed between the fastest and slowest scan speeds.

By changing a scanner's velocity setting, you actually adjust the speed of the scanning mechanism. However, if the Mac can't receive the data as quickly as the scanner can send it, the scanner must halt and wait for the computer to digest the information before starting again, thus negating the advantage of a higher speed setting. This sudden stopping and starting is what sometimes causes streaked images.

Prescanning Wisely

Our next test focused on how quickly each scanner can perform a prescan, which you use to select the part of the image you want to scan and to adjust scan settings. To minimize the prescan time, we limited the prescan to an area just big enough to cover the slide and its mount (about 3 inches). Another way to save time during the prescan phase, if you're using a flatbed scanner with a transparency adapter, is to build a frame from stiff black cardboard; this makes it easier to scan a small area consistently and also helps block unwanted ambient light that might cause loss of color or contrast.

As we expected, prescanning in color mode takes a lot longer than prescanning in black-and-white mode or grayscale—especially with scanners using a three-pass scheme (a grayscale scan requires only one pass, whereas most color slide scanners require one pass for each primary color). For example, the ScanMaker took 112 seconds to complete a color prescan, about three times as long as a grayscale prescan (40 seconds)—and we found no difference in quality between the two.

Scanning Time-Savers

Judiciously cropping the prescanned image before doing the final scan can also save a tremendous amount of time. For example, scanning an entire slide, including the mount (40mm by 40mm), on a Leaf Systems LeafScan 35 took 368 seconds, 55 percent more time than the 237 seconds required for the cropped image minus the mount (36mm by 24mm). The reason is obvious: scanning a full-size slide at 1000-dpi resolution...
LAB NOTES

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tion requires 7.1MB of memory, compared with only 3.8MB for a 36mm-by-24mm slide. Generally, the amount of RAM should be equal to three times the image size plus 4MB for running Photoshop. And don't depend on virtual memory. Physical RAM provides much faster performance, especially when the maximum amount of memory is allocated to Photoshop.

Surprisingly, we found that hue intensity can affect scanning speed; that is, some scanners can scan a brighter image faster than a darker image. A test trial on the Barnesyscan CIS 3515 showed that a low-density (light) image can be scanned as much as 80 percent faster than a high-density (dark) image. Why? When a scanner makes an automatic exposure on a prescan image, it calculates the exposure time for each color. Because rich saturations and high-density colors take longer to expose, they slow the scanning process.

The scanners with a top-to-bottom orientation—the LeafScan 35, the Nikon LS-3510AF, and the ScanMaker 1850S—performed much faster when we rotated the slides 90 degrees. For example, by rotating a slide on the Nikon scanner, we were able to complete the test scan in 174 seconds. The same image took 250 seconds to scan in normal orientation—more than 40 percent longer. When the Nikon performs a scan, it sends the Mac data in columns. Since Photoshop (and scanning software) reads data from left to right, data from a scan must be assembled and sorted into rows, a time-consuming operation, especially at high resolutions. However, if you set the scan orientation to Tall rather than Wide and then rotate the slide 90 degrees before scanning it, the Mac reads the data in rows rather than columns. Once the data is gathered, the scanning software simply rotates it back to the original position.

The Right Resolution

ONE OF THE MOST IMPORTANT FACTORS in choosing a scanner is its resolution. We considered testing each scanner's maximum resolution, which ranged from 300 dpi to 1200 dpi for flatbeds and from 1000 dpi to 4000 dpi for slide scanners. However, we soon realized that scanning at the highest resolutions would be likely to produce more detail than we needed, and would eat up more time as well as disk space. To standardize our tests and provide fairer comparisons between scanners, we decided to use one resolution for slide scanners (1000 dpi) and two (600 dpi and 300 dpi) for flatbeds. Unless your final output will be larger than 5 by 7 inches, a lower resolution will probably suffice anyway. And a 3000-dpi scan won't give you any better output than a 1000-dpi scan if you plan to use a low-resolution (85-lines-per-inch) printer.

Gamma Correction

PERHAPS THE TRICKIEST ISSUE AND the hardest to understand is gamma setting. Before you can understand gamma correction, you need to know how data is obtained and interpreted by scanners.

A scanner contains CCDs (charge-coupled devices) that read data in a linear fashion. For example, if one color in a scanned image is twice as bright as another color, the CCDs read the brighter color's pixel value as double that of the darker one. A human eye, with its nonlinear response to light, sees much less intensity difference between the two. To counteract this disparity—and get realistic-looking scans—you must apply an output gamma correction curve to the scanned data, adjusting its brightness and contrast to more closely parallel the human eye's perception of the image.

There are two types of gamma correction: output gamma mapping, which affects the scanned image itself; and monitor gamma correction, which corrects the appearance of the image on screen, so that the screen image more closely approximates the final output. But because it's easy to confuse monitor gamma correction with image gamma correction, you may think you've altered the real image when only the screen version has changed.

The LeafScan 35 and the ScanMaker 1850S let you customize your own gamma curve with a freehand tool. Where the gamma curve is adjusted upward, the pixels are brightened; where it's adjusted downward, they're darkened.

Without gamma correction, the image will lack shadow detail but be rich in highlight detail. We found that, depending on the intensity of the image, a gamma setting of 1.4 (the typical default setting) to 1.8 usually yields good results.

By experimenting with the output gamma setting in conjunction with brightness and contrast settings, we changed the brightness and contrast to produce screen images that retained all shadow and highlight details. Then we sent each scanned image to an output bureau for color balancing plus hue and saturation correction to match the original slide. We checked the output for good color matching, and for maximum highlight and shadow detail.

By the time we were through, we had coaxed some excellent output from most of the scanners. But be prepared to invest some time and effort experimenting with speed settings, resolutions, and gamma corrections—as we did—before you get the results you want.
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Display typefaces — designed to attract attention to whatever you have to say. Take advantage of FontBank's staggering array of quality fonts at down-to-earth prices. 263 display typefaces and 100 EPS borders for just $99.95!

You'll create attention grabbing documents and eye stabbing graphic elements for any graphics program and desktop publishers. With such a wide variety of faces available to you, creating incredible headlines is fact, fun and amazingly professional. The headline is the face of good advertisements. Wimpy headlines are usually ignored, while bold headlines attract the reader, and if your message is important, the casual reader becomes curious — and persuaded. Remember, though, that headlines must be legible. If you'd like to know more about working with display faces and creating winning headlines, call TigerSoftware and ask for a free copy of a 24-page book that we've prepared entitled "A Short Course On Working With Type." It has been prepared by the typographers at Tiger and we'd be happy to get one in the mail to you.

FontBank has assembled a vast array of looks and feels in their type library. 250 different faces, each with its own distinct character. Some you may never have seen before. Combining FontBank's 250 faces with the capabilities of these programs offers the opportunity for an unlimited number of special effects. And FontBank display faces are compatible with all major page layout applications like QuarkXPress, PageMaker, Illustrator, FreeHand and ATM.

Regardless of what the design assignment, from flyers, posters, ads, coupons and greeting cards, to presentations, notices, manuals and packaging, FontBank display typefaces give you the typographic tools you need to look your creative best. And, when converted to editable outlines using Illustrator, FreeHand or PageMaker 3.0, these faces can be used to produce special text and design effects to create stunning documents.

How long have you been using the same tired typefaces? Chances are, you use what you have because finding the right typefaces, installing them and learning to use them is more trouble than it's worth. so you compromise the overall look of your document by compromising on the one critical factor: the type. That's why FontBank is such an exciting product, easy to install, a pleasure to use — and a low cost way to improve the quality of everything you print.

Borders Complete Your Layout. Often the only thing between you and an attention getting layout is the lack of some visual ornament to pull it all together. Usually the answer is a border. But how many of us have the time to draw a border as the clock moves ever closer to the deadline hour? Recognizing that need, FontBank has introduced BorderBank, a collection of 100 imaginative, attention-arresting borders in EPS (Encapsulated PostScript) format.

It's yours free when you order the FontBank Type Companion.

Total Design Power. There you have it. For $99.95, you can buy the FontBank Type Companion with its 250 display typefaces — and get 100 EPS borders designed by T. Craig Smith free. And with a little imagination you'll be creating layouts that make people do what you want them to do.

FREE! 100 EPS BORDERS $149 VALUE

No question about it: borders add excitement to your layouts. Order the FontBank Type Companion and get the collection of 100 EPS borders designed by DTP guru T. Craig Smith. They are compatible with all page layout and most drawing programs.

Tiger Special Offer

FREE! Send in your FontBank registration card and get these 13 Photo-Lettering, Inc. Faces FREE! Chosen and edited by world renowned type designer Ed Benguiat. Also available separately for $9.95.

And they're yours free when you purchase the FontBank type Companion.

Circle 114 on reader service card

Call Us: 1-800-666-2562

We ship Federal Express.
**Reviewers' Notebook: The ScanMan Bundle begins with the instrument itself: the Logitech ScanMan 32 grayscale scanner. It's a marvel, packed with technological innovations and crafted into a rugged, ergonomic housing. The scans? Crisp. Clean. Perfect.**

We put the ScanMan 32 hand scanner through its paces, performing over 50 scans of various black-and-white images - photos, line art, logos, type, illustrations - even poor-quality photos. The ScanMan delivers 32 gray scale performance. Use scanned images in word processors, multimedia, desktop publishing, HyperCard, OCR and more.

The Science of Scanning. Logitech technology destroys the old barriers of scanning, increasing the speed and accuracy of your scanning. ScanMan delivers superior image quality, with the ability to produce halftones for reproduction. The set of output controls provide the best possible results on any printer or monitor screen. Its 4" wide scanning area allows full-page scans with just two quick passes.

The instrument itself is a masterpiece. From the genius of the respected industrial design firm, Frogdesign.
The WriteNow Hot-Pack!

REVIEWER’S NOTEBOOK: WriteNow is the word processor Mac aficionados swear by—it's fast, compact (requires just 32.5K), reliable, and brimming with great new features that give every document that you create an absolutely stunning look. NEW! Paragraph and character style sheets help you create a clean, consistent look. NEW! An incredible print preview that displays thumbnails and facing pages—optimized for your particular screen's size. NEW! Color text and graphics, along with new styles and graphics capabilities. NEW! One-step default document creation—just throw in the text and out comes a masterpiece.

If you're a Word user, just try WriteNow 3.0 and see what you're missing. From page layout and design, graphics and document management to printing, System 7 support and great style sheets. It just feels so nice. The columns snap to attention as you enter text, the headers and footers pop into exact position, the formatting and style sheets are crisp and professional—and WriteNow contains a giant 1.4 million-entry thesaurus, a 135,000 word spelling dictionary with ultra-convenient Auto-Find and Auto-Correct spell checking. WriteNow is compatible with other leading applications such as Microsoft Word, Works, MacWrite and WordPerfect (for DOS). There's more new stuff: lightning-fast scrolling for easy movement throughout your documents, unlimited paragraph and graphic sizes, triple-click paragraph selection, style sheet design templates, virus alert and more.

The Lean And Mean Word Processor. WriteNow has swept the industry, collecting Editor’s Choice awards and other top honors. Known for its incredibly swift performance and compact size. But despite the lack of size, WriteNow contains a complete set of state-of-the-art features. Everything you need is here—with powerful new page design features (that you'll actually use) to create great looking letters, memos, reports, presentation handouts and more. The print quality is excellent.

Great Looking Print Preview! The print preview is remarkable, featuring optimized thumbnails, multiple page viewing, facing pages (header and footer), and speedy magnification.

THE NEW 256K SHARP WIZARD!

REVIEWER’S NOTEBOOK: Imagine a 256K device the size of an ordinary checkbook. The new Sharp Wizard packs a powerful chachapow, enabling you to organize more information faster and easier with the help of its amazing built-in functions. It wasn't so long ago when 256K was the accepted memory standard in the computer industry. Now you can slip it into your briefcase... Only Sharp could have brought such an impressive technical achievement to the world. The Wizard OZ-8600 features an extra large, high-contrast display that measures a whopping 40 characters wide by 8 lines deep. There are 30 built-in functions (all superbly integrated): A Scheduler (with alarm), a To-Do List, 3 different Calendar Views, 3 Phone/Address Books, a Business Card File, Memo Pad, Outliner, Home and World Time Clocks and Calculator with a paperless center.

With more than 25 optional software cards available, the OZ-8600 becomes everything from a travel planner to a financial assistant to an arcade. With the optional interface and transfer cable, this tiny helicoid will exchange information with your desktop applications. Communicate with Macs or send faxes with the optional modem. With all of which makes the new Sharp 256K Wizard the perfect partner.

Organizer Accessories There's an optional modem, printer, fax and a slew of software cards that turn the Wizard into a fully functioning office.

Expand The Sharp's Mind When you add software and memory cards to your Wizard, you put all kinds of possibilities at your fingertips.

Time Expense Management A must software add-on for the Wizard. The powerful way to manage and prioritize your expenses and deadlines and account for time spent on projects or client meetings.

Spreadsheet Create fully functional, Lotus 1-2-3 file compatible, 26-column-by-98-row spreadsheets on your Wizard, or download a spreadsheet from your Mac! This card will hold 64K of data! Built-in features include: 10 templates, complete formatting, sorting and "freezing pane" functions, and financial calculations, spreadsheet-linking capabilities, cut & paste.

NEW Spanish/English Dictionary Just Released! The fast, handy Spanish/English translation software for use with your Wizard.

SHARP WIZARD

BC61010 ZQ-5200 Sharp Organizer $179.00
BC61080 OZ-7620 Sharp Wizard $269.00
BC61070 OZ-8600 Sharp Wizard $289.00
BC61090 OZ-8200 Sharp Wizard $239.00
BC61070 OZ-8600 Sharp Wizard $149.00
BC61014 Organizer Modem $199.00
BC61014 Organizer Talker (700 Series Only) $85.00
BC61014 Organizer Fax Modem $389.00
BC61011 Organizer Express $89.00
BC61021 Dictionary/Thesaurus $89.00
BC61035 American Heritage Dictionary $156.00
BC61022 Spanish/English Dictionary $175.00
BC61023 Money Planner $75.00
BC61024 Spreadsheet $139.00
BC61025 Fax Jacket $85.00
BC61031 Organizer Chess $85.00
BC61042 Teletext Game (700 Series Only) $39.00
BC61031 Organizer Bible $117.00
BC61040 Portfolio Card $89.00
BC61041 32K RAM Card $59.00
BC61042 64K RAM Card $89.00
BC61045 128K RAM Card $119.00
BC61047 IBM Ordeal Link $109.00
BC61048 NEW Macintosh Organizer Link II $85.00
BC61032 Battery Pack (for 8000 Series) $26.00
BC61043 Printer $119.00
BC61044 Dubbing Cable $24.55
BC61056 Spanish/English Dictionary $89.00
BC61058 Background $49.00
BC61058 Hot-Pack $652.90

THE WriteNow Upgrade

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WRITENOW

BCC2166 WriteNow 3.0 Upgrade “Hot-Pack” Bundle $99.90

Circle 114 on reader service card
LEARN TO PLAY THE PIANO IN 30 DAYS!

REVIEWER'S NOTEBOOK: It seems like everyone is talking about the Miracle Piano Teaching System. It's been featured on "Good Morning America," "Today Show," and "Arsenio Hall Show." It's been written about in Newsweek and The New York Times. It's become popular because it really works — anyone, at any age — can learn to play piano and achieve musical literacy in just a very short time. More importantly, they can learn at their own speed, without formal lessons — by connecting the Miracle to their Mac.

So how does it work? It's actually very simple. The Miracle software contains game-like exercises that make learning fun. Like the shooting range that knocks off ducks when you hit the right notes. You'll learn to play chords, as parachutists jump out of an airplane and learn melodies by repeating back what the Miracle plays. It's so much fun that you'll actually forget that you're learning.

The next thing you know, you're playing your favorite songs. The Miracle provides instant feedback as you go, recognizing problem areas and bringing up specific drills to help you get it right. If you're struggling in a certain area, The Miracle quickly connects to a Macintosh and includes software cartridge that combines an advanced MID! keyboard with full-stereo sound and brilliant on-screen graphics. In no time at all, students of all ages will learn and perform left and right handed melodies — while having a lot of fun!

There are exercises, musical pieces and drills (closely disguised as games), that teach hand positions, notes, fingering, rhythm, scales and more. The Miracle can be quickly set up for any age or expertise, and customizes itself to move the user along at a comfortable pace.

Unlike conventional piano lessons, The Miracle eliminates boring, repetitive routines. The super-creative, artificially intelligent software quickly teaches the basics and builds on them in very entertaining ways. And that makes all the difference.

The Keyboard. Dazzling music. Spectacular effects! Booming orchestras — all created by you and the Miracle. The Miracle quickly connects to a Macintosh and includes software cartridge that combines an advanced MIDI keyboard with full-stereo sound and brilliant on-screen graphics. In no time at all, students of all ages will learn and perform left and right handed melodies — while having a lot of fun!

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The Booklet. Dazzling music. Spectacular effects! Booming orchestras — all created by you and the Miracle. The Miracle quickly connects to a Macintosh and includes software cartridge that combines an advanced MIDI keyboard with full-stereo sound and brilliant on-screen graphics. In no time at all, students of all ages will learn and perform left and right handed melodies — while having a lot of fun!

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The Theoretical Section. Dazzling music. Spectacular effects! Booming orchestras — all created by you and the Miracle. The Miracle quickly connects to a Macintosh and includes software cartridge that combines an advanced MIDI keyboard with full-stereo sound and brilliant on-screen graphics. In no time at all, students of all ages will learn and perform left and right handed melodies — while having a lot of fun!

There are exercises, musical pieces and drills (closely disguised as games), that teach hand positions, notes, fingering, rhythm, scales and more. The Miracle can be quickly set up for any age or expertise, and customizes itself to move the user along at a comfortable pace.

The Practical Section. Dazzling music. Spectacular effects! Booming orchestras — all created by you and the Miracle. The Miracle quickly connects to a Macintosh and includes software cartridge that combines an advanced MIDI keyboard with full-stereo sound and brilliant on-screen graphics. In no time at all, students of all ages will learn and perform left and right handed melodies — while having a lot of fun!

There are exercises, musical pieces and drills (closely disguised as games), that teach hand positions, notes, fingering, rhythm, scales and more. The Miracle can be quickly set up for any age or expertise, and customizes itself to move the user along at a comfortable pace.

The Miracle Piano Teaching System allows you to create your own arrangements. You also get the Miracle keyboard, which controls the length of time each note is sustained and stereo earphones. The Miracle Piano Teaching System also allows you to create your own arrangements. You also get the Miracle keyboard, which controls the length of time each note is sustained and stereo earphones. The Miracle Piano Teaching System also allows you to create your own arrangements. You also get the Miracle keyboard, which controls the length of time each note is sustained and stereo earphones. The Miracle Piano Teaching System also allows you to create your own arrangements. You also get the Miracle keyboard, which controls the length of time each note is sustained and stereo earphones. The Miracle Piano Teaching System also allows you to create your own arrangements. You also get the Miracle keyboard, which controls the length of time each note is sustained and stereo earphones.

Here's What You Get Free With The Miracle — Only From TigerSoftware. When you buy a Miracle from TigerSoftware, we'll throw in everyting you need to create your own recording studio. Well start with the Miracle Piano Teaching System, Volume 1, containing dozens of popular songs from the Beatles, to Michael Jackson. Play along with your favorite songs, or break out into your own solo. These song collections are a great value and are yours free from Tiger.

Then we add a copy of TRAX, the MIDI recording software that allows you to create your own smash hits. Change the tempo, mix different instruments, add your own vocals, sound effects and more — controlling it all from your keyboard. The TRAX interface is simple and fast, enabling you to lay down tracks using your Miracle to create your own arrangements.

But That's Not All. You also get the Miracle keyboard stand. With all this, you'll be ready to create your own live performance or cut your own record.

With The Miracle, you or your child can learn to play without the boring drills and monotonous practice that music usually requires.

So not only do you enjoy the benefits of the world's most exciting piano teaching system, with The Miracle Song Collection, you get an educational workbook with 40 more ways to play instead of just learning to play.

Song Collection Volume 1. All Night Long (Lionel Richie); Another Part Of Me (Michael Jackson); Bad (Michael Jackson); Billie Jean (Michael Jackson); Born To Be Wild (Marc Bolan); Careless Whisper (Andrew Ridgeley, George Michael); Celebration (Kool and the Gang); Could It Be I'm Falling In Love (Melvin Steals, Mervin Steals); Do You Want To Dance (Gene McDade, John Whitehead, Dreams (Stevie Nick's); Everyday People (Sylvester Stewart, Forty-Second Street (Al Dubin, Harry Warren), and more...

As Seen On "Good Morning America," "Today Show" and Arsenio Hall!
THE CD-ROM SHOWCASE

Make a grand entrance into the amazing world of Wayzata CD-ROMs — or expand your library with selections from Tiger's collection of best-selling current releases. Dozens of new packages are available each week, so call us for late-breaking CD titles.

Quick Art Deluxe. Look out! Here comes a truckload of professionally drawn, top-quality images! Over 3000 in all, with 300 dpi crispness and available in TIFF format. Great desktop publishing companion — the only art library you'll ever need, on one CD-ROM! Includes a paper catalog to identify images. You get (in addition to topics listed above in Quick Art Lite) birds, buildings, education, fish, gardening, medicine, music, mystery, weather and thousands more!

EPS Professional Vol. 1. The definitive collection of CD-ROM graphic design. Includes an incredible 800 fully resizable, Encapsulated PostScript images. From the graphic design studios of Christopher Marshall Designs (CMD) and LasArt, EPS Professional contains design elements for T-shirts, alphabetic designs, four-color pieces, covers and backgrounds. Support's PostScript laser printers, imagesetters and other high-end output devices.

Space Time & Art. 300 fascinating 24-bit color images on the subject of space. Great disc — hours of exploring is in store for you — see NASA views of space and photos from Voyager missions along with a collection of astonishing original images by Josephine Haveman. Font Fun House. Hundreds of fonts, ready to use! Shareware and freeware fonts that capture any mood or make any statement. Go crazy with all kinds of faces from elegant to outrageous! Also includes screen fonts. MacWrite and Adobe. This is a great collection, and a must-disc for desktop publishers. If you can't get enough fonts, then Font Fun House is for you.

Ocean In Motion. A fascinating collection of enchanting coastal clips in Quicktime format. Over 400 QuickTime movie sequences of the thunderous beauty of the place where the ocean meets the land. Includes 60 still clips for fast, easy editing. Use these movie clips for backgrounds, presentations, announcements or just to savor the power of the sea on your screen.

MACnificent 7 Education & Games. Brimming with over 280 megabytes of System 7 games and educational shareware! Contains unique "Librarian" which provides instant information about what's in those 280 megabytes. Includes over 800 games, over 40 educational programs, over 50 free demos, over 1500 games support files, over 150 sounds & sound effects and 5000 files in all! The best bet for children.

Winning Elections. Interested in political office? This is the perfect source for everything you need to know to get elected. Assembled from a number of reference works on the subject of political campaigns, Winning Elections also provides insight into the process of government, how campaigns are funded and more. It's informative even if you're not shooting for the White House, the State House or a County Seat.

Wayzata World Fact Book 1991. The world almanac of the Federal government, based on the CIA World Fact Book produced annually by the CIA. Covers territories, countries, protectorates and disputed land claims worldwide. All kinds of information is included: socioeconomic, geo-political, demographics and more. Included are data from the Bureau of Census, National Intelligence Agency, Defense Nuclear Agency, Department of State, Department of Interior and US Coast Guard.

The Front Page News. Includes a year's reporting of events by the top news organizations — on a single CD. Over 300,000 articles, transcripts, government and business reports. Includes over 2250 Gulf War stories, 3194 on the environment, 207 on acid rain, 490 on the failure of Congress. Updated quarterly, subscriptions available. Also contains global wire services: TASS, Business Wire, The French News Agency, Latin American News Agency, Office of the US, Reuters and many more.

BBS In a Box, Vol. VI. The latest release! Another monster collection of goodies from The Arizona Macintosh User's Group and MacWizards. Includes over 9000 Mac files in compressed format with BBS direct access to over 1000 Mac-related BBSs, Games, Fonts, Adobe Screen Fonts, Newsletter Articles, HyperCard, Music, MIDl, MacII, QuickTime, System 7 Tools, Telecommunications and more.

DATA MODEM, FAX AND ANSWERING MACHINE IN ONE!
The Complete, Compact Communications System THAT USES ONE PHONE LINE.

REVIEWER'S NOTEBOOK: No better value for the savvy businessperson when it comes to communications — one machine that does the work of three! Turn your Mac into a data modem/fax machine/answering machine! Thanks to advanced line-switching techniques, phone calls are handled appropriately whether data, fax or voice automatically. Send e-mail, receive messages while you're away and more. Prometheous crafts three technologically superior models: The Home Office, The Ultima Home Office and The 24/96 SR Minifax.

The compact Home Office (Tiger price just $259) is one of the hottest devices in the industry right now. A speedster at 9600 bps, both receive and send, with Group III compatibility and a full-featured 2400 bps data modem, it's all you'll ever need.

The Home Office is Hayes compatible and includes MacKnowledge and MaxFax software, and all necessary cables. The Ultima Home Office delivers all the advantages of Home Office, and gives you the additional power of 14,400 bps data modem capabilities.

Prometheous gives you state-of-the-art performance at an affordable price.

The Home Office Digital Answering Machine. Simply connect your Home Office and you're instantly got a sophisticated voice messaging system. You can easily route incoming messages to any one of 599 mailboxes! Create your own personalized announcements for a specific caller or even custom messages that play on specific dates or times. Password-protect your playbacks, playback from a remote location and mini-toll-free with Home Office's unique Caller feature.

Send And Receive Faxes. Exchange fax documents with any Group III fax machine in the world. Create a letter on your Mac and zip it out in seconds — Home Office takes care of the details. With Home Office, you receive faxes from any standalone fax machine or another fax/modem. And when you send or receive a fax, you can continue to work; the faxing takes place in the background, out of your way.

9600 BPS, Error-Free Data Transmission. The Home Office provides incredible throughput (with V.42bis/MNP) for error-free operation and world-class compression. By utilizing V.42bis and MNP technologies together, you can take full advantage of all the latest high-speed fax machines.

The Home Office will automatically negotiate the highest possible setting with the modem you wish to call.

The Prometheous Ultima Home Office. An amazing instrument, packed with advanced technology, able to perform 14,400 bps, full duplex communications. A low-cost answer to the needs of high-speed transfers of large volumes, remote access computing and network bridging. The Ultima is compatible with a wide variety of communications packages and modems.

The 24/96 SR Minifax. It has the ability to exchange fax documents with Group III fax machines worldwide. Create a letter on your Mac and send it directly to another fax machine anywhere in the world. The 24/96's R Minifax will let you know when you receive fax transmissions from a standalone fax machine or even from another fax/modem. Sending or receiving a fax takes place in the background, so you can continue with your work until the transmission is completed.

PROMETHEUS

BCJ2932 Ultima Home Office $239.95
BCJ2932/96 SR Minifax $129.95

All models come complete with software and cables.

Circle 114 on reader service card
THE CDR-73 $349

REVIEWER'S NOTEBOOK: If you're ready to get into CD-ROM, Tiger has a spectacular offer on the fastest reader in the business. The NEC CDR-73, with a remarkable 350 millisecond response time — for just $349!

PhotoDisk 1100 Images. PhotoDisk delivers immediate and economical access to over 400 outstanding professional digital photographs. Each one ready to publish with virtually no use restrictions. Every PhotoDisk image is ready to be used instantly in advertising, newsletters, presentations, brochures, and multimedia projects.

Desert Storm: The War in the Persian Gulf. The acclaimed CD that lets you experience Operation Desert Storm in full sight and sound. Chronicling the war and the events that precipitated it, it provides news reports, eyewitness accounts, photos, sound recordings, detailed maps and more.

CIA Fact Book. The CIA has been busy — collecting, analyzing, and making it available to you. A seemingly endless array of facts, stats, maps, sound clips and more! They've assembled megabytes of inside information on one CD and made it available to you. A seemingly endless array of information about military issues, gross national product, population, personal income, standard of living, occupations, spending and hundreds more categories. CIA Fact Book contains high-quality maps and tables relating to historical events.

The Family Doctor. Provides invaluable home medical information in easy to understand language from multiple sources and perspectives. In addition, Dr. Bruchlehan, MD, FAAP (nationally recognized physician and syndicated columnist) answers over 1500 frequently requested medical questions in an easy-to-use Question and Answer format.

SuperMac Tool Kit. Contains an exciting, interactive video demonstration of one of the hottest developments in the Macintosh market today — QuickTime moviemaking with the VideoSpigot real-time digital-video capture card. Everything you need to run the demo — and experiment with VideoSpigot for yourself — is right on this CD-ROM.

Britannica Family Choice. Includes fifteen software titles for the whole family. Berenstein Bears, History, Geography, Designaaurus, The Body Transplant and many more!

Sherlock Holmes. The world's greatest detective, Sherlock Holmes, along with Dr. Watson plunge headlong into their greatest cases. The entire treasury of Sir Arthur Conan Doyle's classic tales on a single CD.

TIGER CD-ROM

NEC CDR-73 CDR 73 CD-ROM Reader $349.00

COMPLETE INTERFACE KIT Complete Interface Kit $99.00 Adobe Premiere Sampler 39.95

SpeedyCD 99.95

A $208.90 VALUE FOR $99

TIGER REFERENCE KIT

Personas Speaker $80.00

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Desert Storm CD-ROM 39.95

Toolworks Illustrated Encyclopedia CD-ROM 395.00

World Atlas CD-ROM 79.95

U.S. History CD-ROM 393.00

Timetable: Science & Innovation CD-ROM 99.95

SuperMac Tool Kit CD-ROM 39.90

Britannica Family Choice CD-ROM 69.95

Sherlock Holmes CD-ROM 69.95

Family Doctor CD-ROM 149.95

TOTAL FOR REFERENCE KIT $2,897.70

TIGER SPECIAL — A $3,395.60 VALUE FOR $199.

BC8173 CDR-73 CD-ROM Reader Interface not included $349.00

BC8295 Complete Interface Kit 899.00

BC8296 Tiger Reference Kit 9199.00

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PLUG & PLAY
TYPESETTING

Now Has a Big Brother

Multi-platform connectivity... 1000 dpi... Lots of fonts... Super-fast print speeds... When we introduced our Unity™ 1000, it seemed things couldn't get any better. But now they have.

Introducing the Unity 1200XL. It's got a host of great features like the Unity 1000. Plus, it handles up to 11" x 17" paper for all your oversized jobs! Just plug it in, and you get perfect, 1200 x 1200 TurboRes® output, from just about any computer out there.

Give us a call for sample output from our new Unity 1200XL. You'll see how plain-paper typesetting will save you money.

UNITY 1200XL FEATURES

- 1200 x 1200 TurboRes® output
- Internal hard disk with 135 pre-installed Type 1 typefaces
- High-speed, 33-MHz processor with floating-point unit
- 40K of fast-cache memory
- TurboGray™ halftone enhancement
- LocalTalk®, parallel, serial, and Ethernet® (optional) ports
- HotPorts™ automatic port switching
- SmartSense™ automatic emulation sensing
- Flexible paper handling up to 11" x 17" with up to 3 paper sources (optional)
- Expandable RAM
- Software-upgradable controller

And for the budget-minded...

The LaserMaster 1000/4 Personal Typesetter is the perfect alternative for budget-minded graphic arts professionals who do not need multi-platform capabilities. The low-cost, CPU-based controller of the LaserMaster 1000/4 produces 1000-dpi, camera-ready copy for just $3,995, PC or Mac version.
Lotus Notes for Mac

Lotus is expanding its presence in the Mac market with Lotus Notes, which is best described as a groupware generator.

Lotus Notes users design forms and put them out on the network, where their colleagues access them for such tasks as carrying on a structured discussion, following up on client contacts, or simply distributing finished documents. Notes includes an E-mail system and remote-access capability. It can perform calculations, supports Object Linking and Embedding (OLE) under Windows (but not publish and subscribe on the Mac); and provides routing management and security features. A programming interface allows you to tie Notes applications to databases or other third-party software.

The Mac product, which will ship this winter with the 3.0 release of Notes, is a client and requires an OS/2 server. Pricing was not set at press time. Lotus, 617/577-8500. — D.L.

RasterOps Multi-frequency Monitors

RasterOps has introduced two 20-inch multi-frequency color monitors that can work with Macs or DOS PCs. The RasterOps/20T MultiScan Color Display uses a Trinitron tube and is compatible with all display adapters from RasterOps and with VGA adapters. Its resolutions range from 640 by 480 pixels to 1024 by 768 pixels, also at refresh rates from 50Hz to 120Hz. The Hitachi-based $2499 monitor is also available now. RasterOps, 408/562-4200. — T.M.

PowerBook 145

Replaces the 140

For those who want the performance of a PowerBook 170 but aren’t willing to carry the hefty price tag, Apple has brought out the PowerBook 145, a

Trend

The Next Best Thing

NEED TO LOOK SOMEONE in the eye while you discuss a project over the telephone? Take a look at Northern Telecom's new Visit Video.

Visit Video includes a black-and-white video camera and a digitizing board that digitizes your mug at 10 to 15 frames per second and shoots it down a switched 56 or ISDN line to a window on another computer. Visit Video's software offers file transfer and screen sharing, and provides pencils, highlighters, and other tools for collaborating on on-screen documents.

The Visit Video package costs from $2900 to $3500 per person and may not be compatible with all digital phone systems. Northern Telecom is also working on a color camera and board. Northern Telecom, 214/684-5930. — D.L.

Apple's PowerBook 145 offers the performance of the PowerBook 170 with a less-expensive display.
Mac is Mac and Windows is Windows and WordPerfect* plays no favorites. If Macintosh is your idea of what a computer should be, WordPerfect has a powerful, elegant System 7 word processor that only proves you right. If Windows is more to your liking, WordPerfect has a best-seller that makes the most of it. Yet surprisingly, WordPerfect for Mac documents are compatible with WordPerfect for Windows. Which means that an office divided against itself can stand, after all.
EDI for the Mac

MANY LARGE COMPANIES and government agencies require contractors and suppliers to use Electronic Data Interchange (EDI), a paperless system of exchanging purchase orders, invoices, shipping notices, and other standard business information. Digit Software's MacEDI provides EDI support for the Macintosh.

MacEDI translates EDI-format data from other computers into a format that Macs can read, and translates Macintosh data into EDI format for other computers. It also supports direct communication with other computers and many third-party EDI exchange systems.

MacEDI 2.1 is $1950 and supports a new standard for exchanging engineering and technical information, called the X12 841 transaction. MacEDI Mapper, a companion product for relating fields in a database to EDI entities, is $1500. Digit Software, 301/593-8952. —D. L.

GCC's Fast Optical Drive

The UltraDrive 120MO from GCC is a 3½-inch magneto-optical drive that has a 3.5ms average access time, which brings it into the speed domain of hard drives. The drive's cartridges hold 120MB of data, and are compatible with the ISO standard incorporated in other vendors' 3½-inch erasable optical drives with about the same capacity.

The UltraDrive 120MO has a retail price of $1899, including one cartridge, cables, GCC's DriveManager hard drive-management software, and Central Point Software's MacTools Deluxe utilities package. Additional cartridges retail for $69, and GCC will include a second free cartridge with drives that are sold through September 15. The UltraDrive 120MO was slated to ship in August. GCC, 617/890-0880. —T.M.

Dataproducts' 600-dpi Printer

DATAPRODUCTS Corporation has announced the LZR 965, a PostScript Level 2 laser printer that produces 9 pages per minute at 600-by-600-dpi resolution. Based on a Sharp print engine, the device also includes a Weitek 8200 RISC chip for faster processing of complex images. The printer comes with 8MB of RAM expandable to 16MB, and it has connectors for SCSI, LocalTalk, Centronics parallel, and RS-232C serial ports. The LZR 965 can sense which ports are receiving files.

Dataproducts expected to begin shipping the LZR 965 in mid-September at a list price of $2995, including drivers for Windows and Macs. Dataproducts, 818/887-8000. —T.M.
Introducing the Bernoulli® MacTransportable 90 PRO.

BERNOULLI
System 7. Quick-Time. Graphics. They eat storage. And nothing handles storage like the Bernoulli MacTransportable 90 PRO from Iomega®.

The best removable storage system you can buy.
Bernoulli is better than a hard disk because it won't fill up. You simply insert another affordable 90MB disk.

It's better than conventional removable storage systems, too, because it was built from the ground up to be removable. No other removable drive has Bernoulli's 75,000-hour Mean Time Between Failure rate, Bernoulli's proven head-crash resistance, and the industry's most rugged disks—able to withstand an eight-foot drop.

And it's better than magneto-optical because you get twice the performance for half the price.

The lowest-priced Bernoulli for the Mac.
The latest entry in our complete line of products for the Mac, the new MacTransportable costs 40 percent less than previous models. Plus, it comes complete with an interface kit and 90MB disk. Advanced Transportable, dual drive, and Quadra Insider versions are also available.

Hard-disk performance.
Enhanced 90 PRO drives have a fast 18-msec effective access time. That's as fast as a hard disk.

The most recommended drive.
Bernoulli is the only removable drive to receive the Macworld World Class Award the last two years. And it has also won the Publish Reader's Choice award, making it the new choice in desktop publishing. We have a 99% customer satisfaction rate. And we're the only computer company to win the Shingo Prize for excellence in American manufacturing.

Call 1-800-374-8506!
Unfortunately, this ad isn't a Bernoulli. We're out of space. So call for a brochure. Because now unlimited storage is at an unbelievable price.

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Circle 240 on reader service card
Drafting a Ballet

The San Francisco Ballet's upcoming season includes 18 ballets, ranging from Swan Lake to Rodeo. That means a lot of scenery sliding in and out on the 68-foot-long battens that travel the width of the stage. It also means hundreds of changes in lights, backdrops, stage masking, and flying scenery. Production manager Michael Kane and stage manager Peter Butt begin each of these complex architectural productions by sketching out stage plans from all perspectives in Innovative Data Design's MacDraft, experimenting until they're sure the audience won't see lighting instruments, scenery won't take up too much dancing space, and flying scenery won't collide. Final plans go into an Excel spreadsheet for the carpenters, electricians, and flymen (who control flying scenery) to plan their tasks.—ANN GARRISON

Electronic Chamber Orchestra

COMPOSER GUY GARNEIT IS PLANNING TO CONDUCT AN UNUSUAL CHAMBER ORCHESTRA: HUMAN FLUTIST PRISCILLA CALL AND A YAMAHA TG77 SYNTHESIZER, WHICH WILL PLAY PIANO AND HARP-LIKE PARTS. IN ONE HAND, GARNETT WILL WIELD A CONDUCTING BATON THAT SENDS AN INFRARED SIGNAL TO CONTROL THE SYNTHESIZER'S TEMPO AND PHRASING. FROM GARNETT'S OTHER HAND, AN ELECTRONIC GLOVE WILL SEND SIGNALS TO A MAC RUNNING OPUS.

Games

How well can CB Sim, an artificially intelligent "agent," play the role of urban planner? During the next two years, University of Chicago computer scientists Kristian Hammond and Charles Martin will observe as CB Sim plays SimCity, the urban-planning-simulation game from Maxis. Hammond and Martin's AI software has two components: CB, an agent capable of "case-based reasoning," or reasoning from experience, and a database of cases. Thus, if asked to reduce crime in an industrial urban area, CB would consider past solutions to similar problems and might conclude that more housing would increase population, raise the tax base, and make more police affordable.—ANN GARRISON

For Network Managers

TechWorks is expanding its position in the Mac networking market with TechWorks Net Utilities, a collection of management utilities that comes with real-time conferencing software. NodeWatch is a background spy that informs network managers when devices appear or disappear from the network; it can watch across multiple zones and routers. Other utilities provide information about laser printers and other devices on the network. MultiChat allows users on a network to exchange text, sounds, Clipboard contents, and files. Discussions are presented in chronological order and can be encrypted, but MultiChat provides no store-and-forward capability. TechWorks Net Utilities lists for $129. TechWorks, 512/794-8533.—D.L.

Portable Floptical Drive

Mass Microsystems has joined the parade of peripherals vendors offering hybrid floppy-optical Floptical drives but with a small difference: the Floptipak 21 weighs under 2 pounds and measures only 1 inch by 9 inches by 5 inches. The 21MB Floptipak 21 achieves its small size in part because it gets its power from the Macintosh's floppy disk port and therefore does not need its own power supply. Like other Floptical drives, the Floptipak 21 is based on a mechanism made by Insite Peripherals that combines magnetic and optical recording on a disk the same size and shape as a 3.5-inch floppy disk. The drive can also read and write to 1.4MB Mac floppy disks. The Floptipak 21 has a suggested retail price of $699, and the disks retail for $49. It began shipping in June. Mass Microsystems, 408/522-1200.—T.M.
MicroNet's Rewritable Optical Systems Offer More Speed, Size, and Performance Options For Removable Data Storage.

Today's complex projects require forward-thinking storage solutions. That's why MicroNet has added a new 3.5" rewritable optical system to our Macintosh, PC, and workstation product lines. It's fast, reliable, and cost-effective. Store 128 MB on a shirt-pocket-size disk at a lower media cost than any other system. Access data in just 38 ms. And secure valuable files now, and far into the future with optical cartridges impervious to contamination and head crashes.

MicroNet also offers 5.25" optical storage options. Our 586 MB system is perfect for transporting or archiving large CAD, pre-press, or graphic files from work site to work site. And like our 3.5" system, it's ISO compatible, so media can be recognized in any ISO standard drive.

MicroNet's rewritable optical systems for the PC operating under NetWare, ship with our specialized driver for optimum performance. And systems on a PC network, when combined with Cheyenne's ARCserve or ARCserve/Solo, make archiving and retrieving Macintosh, OS/2, and DOS files fast and easy.

MicroNet's 3.5" and 5.25" drives are available in internal and external configurations for most computer systems. They ship ready to install with software, connectors, cables, and brackets as needed.

Find out why MicroNet's systems are the preferred choice in rewritable optical storage. Call the MicroNet Sales Department today for the name of a Reseller near you. 1-714-837-6033.

Quality You Can Count On.

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Circle 113 on reader service card
**Getting the Jump on Experiments**

**TIM REY IS A statistician at Dow Chemical Company’s Central Research and Development facility in Midland, Michigan, where 600 chemists and chemical engineers design new plastics, ceramics, and other chemicals and chemical processes. To save money and time, Rey’s group helps the chemists weed out unnecessary experiments using a statistical process called Design of Experiments.**

Rey is beta-testing SAS Institute’s JMP Design, which he describes as “very deep in terms of rigor, but quick to get the design [you need].” JMP Design is a stand-alone tool; results can be moved into JMP itself for further analysis.

JMP 2.0 lists for $695; JMP Design (including D-Optim, a special JMP add-on) lists for $295. SAS, 919/677-8000.—D.L.

**Virtual Dance World**

An artist, an architect, and a dancer are combining virtual reality tools with dance in Dancing with the Virtual Dervish. This fall Diane Gromala, Marcos Novak, and Yakov Sharir will transmit live video of their dance over telephone lines from the Banff Centre for the Arts to sites in Banff, Alberta, Canada; Austin, Texas; and Santa Monica, California. Video monitors at each site will show a dancer in gogles and gloves side by side with the virtual world that the dancer sees in the gogles. Audiences will manipulate the objects in that world and then see not only the dancer’s reaction, but also changes in the dancer’s virtual world. For more information, call Banff Centre’s Art and Virtual Environments Project at 403/762-6651.—ANN GARRISON

**Mac-Using Travel Agents**

Macintoshes are just beginning to appear on the desks of travel agents, reflecting a sea change in the travel industry.

New Department of Transportation regulations will require computer reservation systems (CRSs) like American Airlines-owned Sabre to let travel agencies use third-party hardware and software, and agencies will be able to store clients’ information on their own computers, instead of on the CRS mainframe, to use for business and marketing purposes.

Third-party suppliers are popping up. MicroAge, a big integrated-systems vendor, is selling Mac-to-Sabre systems that use hardware and software from Innosys. Travelogix is developing agency-management software that will provide everything from a CRS interface to an accounting system. MicroAge, 405/272-9655; Innosys, 510/769-7713; Travelogix, 512/794-5990.—D.L.

**Connecting Macs to Color Copiers**

HA TELECOM Corporation has created Color Connect and Color Connect Scan, software products that let a Macintosh II-series system use a Canon Color Laser Copier as a printer or a scanner, respectively. The Color Connect setup supports most applications for 32-bit QuickDraw version 1.2, and it can print in either Japanese or English. It has an added antialiasing feature, supports ATM outline fonts and TrueType fonts, and prints on a wide variety of paper sizes at resolutions ranging from 72 dpi to 400 dpi.

Color Connect Scan can also accept still video, NTSC or S-Video, RGB video, or film scanner input. Color Connect Scan permits scanning in color, grayscale, and black and white, at the same range of resolutions as with Color Connect, and with a film scanner at higher resolutions, from 600 to 3353 dpi. Both software products work with TIFF and PICT files.

The Macintosh II connects to the Color Laser Copier via the SCSI port. The products require at least 8MB of RAM, and a 24-bit display system is recommended. The products are available now, bundled together at a list price of $3500. In the U.S., contact HATNET, 408/725-2800.—T.M.

**Flying Logos**

Pixar is developing Typestry, a utility for creating 3-D text, adding all kinds of special effects, and animating it.

In Typestry you can enter text using TrueType or Type 1 fonts, or import text created or modified with such tools as Ares Software’s FontMonger, Altysys’s Fontographer, or Letraset’s FontStudio. Once in Typestry, you can extrude text into three dimensions, bevel the edges, rotate it, place a backdrop behind the image, and set up a key-frame animation.

Typestry provides RenderMan shaders for creating special effects such as making the text look like metal or stone. Typestry will list for $299. Pixar, 510/215-3469.—D.L.

**Design Flaws Noted**

**Sensible Grammar and Grammatik Mac** If you run a French- or Spanish-language document through either of these grammar checkers, they’ll zip right through without realizing they’re not looking at English. They find no mistakes and generate readability scores, and Sensible Grammar even scores the documents for how interesting they are.

**AppleLink and Internet** Hey, privacy fans, here’s a good one. Question: When are blind carbon copies of your E-mail delivered not-blind? Answer: When you send them from AppleLink to the Internet or from the Internet to AppleLink.

Macworld will send you a Turkey Shoot T-shirt if we shoot your turkey in this column. See How to Contact Macworld.
The new LZR 965 from Dataproducts gives you everything you want from a laser printer at a price that may startle you. This true 600 x 600 dpi, Adobe PostScript Level 2 laser printer gives you greatly enhanced gray scale capabilities for optimum detail in graphics and photographic images. Even 4-point type is made clean and easy to read. And since the RISC-based processor can provide fast, flawless delivery of higher resolution images your output can look like a masterpiece every time. In no time.

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Combine Mac and PC system compatibility and superior paper handling with a very small footprint and you'll begin to experience the whole picture.

You don't need a trained eye to see that the extraordinary image quality and technologically advanced features will make this printer a classic for years to come. Add the fact that it's easy to use and inexpensive to own and you'll know why the LZR 965 has everybody talking. For finer details, contact the Dataproducts dealer nearest you or call 800-334-3174.

Dataproducts
The high performance printer people.
MacProject Revised

FOLLOWING Microsoft’s big upgrade to Project (see News, Macworld, September 1992), Claris is revising MacProject to Pro status.

MacProject Pro fills some big gaps in the earlier version and adds new features. In the gaps-plugged department are a full suite of dependency constraints for task starts and finishes; an outline (that doubles as a table) for entering tasks; automatic generation of breakdown-structure codes—hierarchical numbering of tasks and subtasks—for tasks (though not resources); a customizable Gantt-chart view; and much-improved resource leveling.

In the new features category are support for publish and subscribe as well as Apple events; user-designed multiwindow reports that work as templates with other projects; unlimited tasks and resources (each can have its own calendar); and notes attached to charts or tasks. MacProject Pro lists for $599.

Claris, 408/727-8227.—D.L.

Automatic Haystack

TMS’s InnerView is a tool for putting large amounts of information, such as technical documentation and legal reference material, into a form that is easily distributed on a CD ROM. With TMS’s ViewDirector, InnerView applications can also include illustrations.

An application can have a table of contents and hypertext links; users can add notes and leave bookmarks; and the database can be expanded with new information stored on a hard drive. InnerView supports Boolean operators and proximity and complex searches.

Preparing data for a TMS system requires a DOS machine and involves developing special filters to structure the raw information (TMS provides consulting services to help first-timers). Pricing depends on application.

TMS, 405/377-0880.—D.L.

MISSOURI WHITE WATER

Have you ever wanted to be a smallmouth bass swimming up a stream in the Ozarks? No? How about a naturalist exploring the bass’s habits and habitats? At the Saint Louis Zoo in Missouri, you can experience life as the bass’s and the naturalist’s, and hear from a biologist and other experts, in the interactive Mac-based exhibit Explore Missouri Streams. The exhibit includes 60 minutes of video and a graphic, online atlas of 74 streams. It was produced by Monterey, California–based Sea Studios and programmed by Jeff Reynolds.

Saint Louis Zoo, 314/781-0900, ext. 316.—ANN GARRISON

TREND

Photo CD Drive

The Micro/CD-ROM series of CD ROM drives from MicroNet Technology can read several formats, including Kodak’s Photo CD photographic-image discs. The drives also support the ISO 9660 and High Sierra formats. The Micro/CD-ROM is an external device, and the company is also offering the Q9i-CD, an internal version for the Quadra 900 and 950. The drives transfer data at a sustained rate of 150K per second and have an average access time of 350ms, according to MicroNet.

Both drives come with a utility that mounts all data and photographic CDs and with a control panel for playing audio CDs. The Micro/CD-ROM lists for $995, while the Q9i-CD lists for $895. Both are available now. MicroNet, 714/837-6033.—T.M.
Now there’s a Doubler for every single Mac.

Data compression is an essential tool for Macintosh®. But different users need different functions. That’s why Salient offers a choice. Whether you want hard disk compression that’s completely automatic, or a hands-on utility with a variety of functions — or both — Salient has the “Doubler” for you.

**AutoDoubler™, the fast, automatic, hard disk maximizer.**

AutoDoubler is the effortless way to save hard disk space. You just double click to install and AutoDoubler does the rest. It compresses everything you want compressed, increasing disk space up to 100% or more.

AutoDoubler won’t interrupt your work. It compresses only when your system is idle. It’s compatible with other utilities. And it’s so fast, you’ll hardly notice it’s there — just click on a file and it opens, pronto.

AutoDoubler, the solution to your hard disk space problems, is now available in a 10-pack.

"The true beauty of AutoDoubler is its complete invisibility."

— Publish magazine, 2/92

**DiskDoubler™, the hands-on compression tool.**

DiskDoubler makes it easy to copy large files to diskette, speed modem transmission, archive data, or simply free disk space.

DiskDoubler shrinks files an average of 50%, so it saves you time and money when sending via modem. It also creates self-expanding archives, so files can be opened without DiskDoubler. "Split" and "combine" functions give you extra flexibility in archiving and copying.

DiskDoubler is fast and easy — use it for all your hands-on compression needs.

"Not only is it [DiskDoubler] among the top speed and efficiency performers, but it’s utterly safe for your data."

— David Pogue, MacWorld, 3/92

Two Doublers are better than one.

For complete flexibility, use AutoDoubler and DiskDoubler together. They’re 100% compatible, 100% safe.

The compression company has expanded!

Salient is now a part of Fifth Generation Systems. That means our customers will enjoy the backing of a world leader, including a one year money back guarantee and 24-hour, 7-days-a-week, toll-free telephone support.
Low-Power Macs

Apple and a number of other personal computer makers have agreed to redesign their desktop systems and peripherals to use less power, causing less damage to the environment. Under the terms of an Environmental Protection Agency-sponsored program called Energy Star Computers, Apple and the other hardware vendors will add features such as automatic shutdown when not in use, and low-power mode when idle. The energy savings may be 60 percent or more, according to EPA and NCR Corporation have called Energy Star Computers, Apple and a number of other vendors will add features to their systems.

Voice-Recognition Software

ARCTICULATE SYSTEMS, a pioneer in Mac voice-recognition systems, has introduced a software-only version of its Voice Navigator voice-driven interface. The software, called Voice Navigator SW, works in Macs with a built-in microphone: the Classic II, LC and LC II, IIsi, Quadras, and PowerBook 140 and 170. Owners of other Mac systems can still purchase the Voice Navigator II hardware for $699; Voice Navigator SW (the software-only version) lists for $399.

How to Make a Virtual Object

RARE ART AND ARTIFACTS are usually kept under glass and handled only by curators and preservation experts. Now Apple's Human Interface Group has prototyped a tool to make unique objects more accessible. The system has metal scaffolding with arms that hold a video camera, and a Mac cabled to both the camera and the camera arms. HyperCard scripts direct the camera to circle the object, shooting it from many angles. The still-video frames are then digitized into QuickTime format for random access. Dan O'Sullivan and Mike Mills designed the system, and Ian Small and Michael Chen wrote the software. The group may market the software as a tool kit, but has no plans for the hardware component.—ANN GARRISON

Mac Walks in Space?

At NASA's Johnson Space Center, a simple robot delivers mail to engineering offices by following a predesignated route, signaling at each door where it makes a drop-off. Meanwhile, NASA robotics engineers are using Mac Quadras to design circuit boards for future robots, whose advanced features may include vision systems and proximity sensors. Since the prototype robots use controller boards based on the Motorola 68000 chip that also drives the Mac, Macintosh compilers can be used to develop debug robotics programs. The prototype robots can be controlled by Macs via wireless modems. The robots are primarily research projects for evaluating future requirements and designs and are not likely to be employed building the space station.—PHIL CHEN

Just for Fun

Total Baseball

Have a friend who spouts baseball statistics at the mere mention of summer? I do, and I shudder to think of what will happen if he sees Creative Multimedia Corporation's Total Baseball, a CD ROM of baseball history that includes 2600 pages of statistics going back to 1871. Billed as the most comprehensive of baseball encyclopedias, Total Baseball contains stats on pitching, hitting, and fielding for major leaguers, as well as team standings and info on batting champions and other titans of the game. Covering more than 13,000 players up through the 1991 World Series, the CD ROM also offers images of historic ballpark articles on baseball scandals and oddities, and sound clips from famous personalities. Total Baseball lists for $69.95 and works with Macs and DOS machines. It is now shipping. Creative Multimedia, 503/241-4351.—T.M.

Artists' Attic

SOFTWARE TOOLS for dealing with enormous amounts of digital art are evolving.

Aldus recently took over publishing the archiving program from Fetch, adding support for many new formats including QuickTime, Kodak's PhotoCD, JPEG, and the AIFF and SoundEdit sound formats. Windows can be resized, keywords can be batch-entered, and catalogs can be password-protected. PhotoDisc, a company that publishes stock photography on CDs, is now marketing its archiving software as LightBox. LightBox supports Boolean searching on index terms and can save search criteria for reuse. It has a proprietary thumbnail format for resizable thumbnails, and a built-in slide show feature.

Pricing for both products was not set at press time. Aldus, 206/622-5500; PhotoDisc, 206/441-9355.—D.L.
IT MAKES CENTS. Take the magazine you're reading. To fill a single 8mm tape, you could backup every issue of MACWORLD for the next two years. A single issue costs just about 33 cents to store. Consider that you're spending less time backing up more data, and you're no longer dealing with small change.

Using our high speed, high capacity 8mm tape drives will save you time and money in manhours, media, storage, and shipping costs. In fact, our drives give you the lowest cost per megabyte on the market. On lightweight, reliable media. That is fast becoming an industry standard.

TRUE "PLUG-AND-PLAY" COMPATIBILITY WITH:

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AND IT MAKES SENSE. The menu driven software features a calendar for automatic operation. Schedule a backup to run at any time, day or night. Choose an incremental or complete backup. The software's directory will keep track of every file that you've saved. To restore a file, simply pull up the directory and click on the file you want; if you want to create space on the hard drive, just copy selected files into the archive.

Compatible with all Macintosh models including systems running A/UX, our drives give you between 2.5GB and 25GB of storage per tape. Features like a liquid crystal display, data compression, data encryption, and high speed search capability give our drives the flexibility to adapt to your changing needs. We can meet any site requirements with rack mounting options, hard disk configurations, and a variety of cable lengths. And we back every product in our line with a 12-month warranty and technical support.

It doesn't make cents to wait. Call today for more information at 804/873-9000.
Basic Black
Fractal Design is working on Sketcher, a new gray-scale package that replaces ImageStudio and simulates artist’s materials like Fractal Design’s color paint package, Painter.
Sketcher’s interface is similar to Painter’s, and the same texture files work in either program. Individual tools can be pulled off the palette and arranged around the working surface (Sketcher’s tools lack most of Painter’s high-end controls). Sketcher can take advantage of pressure-sensitive tablets—for example, drawing a wider line when pressure on the stylus is increased—and provides ways for mouse users to get similar effects. Type can be converted to friskets, Fractal Design’s term for masks. Sketcher can also record a series of strokes or other actions and play them back, for example, to apply the same changes to several images.
Sketcher will list for $149. Fractal Design, 408/688-5300.—D.L.

Faster 882MB Optical Drive
MICRONET Technology has begun shipping the SB-TM0-1000, a second-generation erasable optical drive with an average access time of 35ms. The 5¼-inch drive uses 1GB cartridges with a formatted capacity of 882MB. It has a data-transfer rate of higher than 900K per second over SCSI. MicroNet said.
Based on the Tahiti II drive mechanism made by Maxoptix, the SB-TM0-1000 is designed to be backward-compatible with the more common ANSI/ISO 650MB erasable optical drives from a number of companies. The retail price of the SB-TM0-1000 is $5345. MicroNet, 714/837-6033.—T.M.

Xerox’s Paperless Documents
A XEROX-FUNDED START-UP called Documentum is developing a system of the same name for managing documents in almost any kind of computing environment.
Documentum doesn’t incorporate the contents of documents in its own database, instead it maintains documents in their native format—for example, Word, FrameMaker, or Lotus 1-2-3. It manages document distribution, tracks revisions, and searches documents by attributes (such as who created a document or when) and by content. Documents can be linked hierarchically in complex groups—for example, from pages to chapters to volumes.
Documentum is client-server based and supports Macs as well as Unix and Windows machines. Documentum will develop versions that work with all major database systems and networks, and also plans to produce an end-user, shrink-wrap version. Price depends on configuration. Documentum, 510/460-4120.—D.L.

Survey: Computer Ability
Do you currently use a Macintosh computer, either at work, home, or elsewhere?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>97%</td>
<td>3%</td>
</tr>
</tbody>
</table>

How would you classify yourself in terms of your personal-computer abilities?

- Beginner
- Intermediate user
- Advanced user
- Computer professional

24% 33% 38% 6%

Figures are based on 956 respondents to a 1992 Macworld mail-in subscriber News survey. Multiple responses were allowed.

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Documentum is client-server based and supports Macs as well as Unix and Windows machines. Documentum will develop versions that work with all major database systems and networks, and also plans to produce an end-user, shrink-wrap version. Price depends on configuration. Documentum, 510/460-4120.—D.L.

Asanté’s Serverless Messaging
PersonToPerson from Asanté Technologies is network communications software that, among other things, supports the exchange of voice messages and text files without requiring a dedicated server. Intended to be used by departments and workgroups, the software includes an in/out board, monthly and daily calendars, and a customizable screen saver.
PersonToPerson has begun shipping at suggested retail prices of $149 for a two-user package, $399 for a ten-user package, and $699 for a package that supports a network zone. Asanté, 408/732-8388.—T.M.

Where the Time Goes
Timeslips Corporation, which publishes the time-billing package Timeslips, is developing LapTrack for analyzing how you use your time.
LapTrack sports some features designed for PowerBook-toting business travelers—in particular, its ability to upload, to a server back at headquarters, details on how you spend your time on the road. Managers can slice and dice the database to create graphs and reports showing budgeted versus actual expenses, who is racking up the highest percentage of billable hours, which types of clients are the most profitable, and so on.
It can read data from a Sharp Wizard or CE Software’s Alarming Events (Timeslips plans to add other filters later).
LapTrack will probably list for about $80 for one user. Timeslips, 508/768-6100.—D.L.

BETA WAIT
Long-awaited products

ACIUS’s 4D Server

FoxPro/Mac

Interleaf 5
Discussed publicly October 1990. No ship date projected.

AEC’s FilePower
Announced August 1991; planned to ship winter 1991/92. Ship date not set; may be ready to show August 1992.

CA-Cricket Graph 2.0

Claris’s MacWrite Pro

MACWORLD October 1992 125
Our sprc:tdshCCL Don "t mi «S
gaieraJiJlg a timcshl'C1 as you
AID Software
work.

Windowatch
WindowWatch to collect
crd. We are the only
processors this

The Norton Utilities for Macintosh 2.0
The Norton Utilities for Macintosh 2.0 combines and enhances the
features from two award winning products: SUM II and Norton Utilities.
The combination of these two products results in the first Macintosh utility
software package to offer fully integrated advanced disk repair & recovery,
automatic backup, data security, productivity tools and system enhancements in one informative, easy-to-use product. This unbeatable
combination allows you to protect valuable data and make day-to-day
functions a breeze. Whether working on your Macintosh at home or while
networked into a corporate-wide system, if you own a hard drive, the
Norton Utilities for Macintosh 2.0 is the product for you.
Publisher: Symantec UTO151

$95

FontBank PostScript
The FontBank PostScript Display Typefaces give you a
library of 250 Type 1 postscript display typefaces. Build a
versatile type library with designs ranging from the simple
sans serif to the extreme ultra serif. Use them to create
attention-getting headlines, sub-headings, titles, logos and
special text effects. Included in the package are traditional,
decorative, novelty, script, brush and calligraphic faces.
Use these faces as a counterpoint to the extreme ultra serif.

$49

Hard Disk ToolKit+ Personal Edition
Improve performance and make any drive System 7
compatible. Powerful, easy to use, affordable version of
FNB's acclaimed utilities that format and partition all
popular HD and CD drives, removable and optical drives.
Password protection secures your files and extensive
diagnostic testing ensures data integrity. High
performance driver updates on most devices without
reformatting (ideal for company-wide standardization).

$49

Capitalist Pig
Get motivated to work. Experience the challenges of business, scandals,
fires, terrorism, and more as you battle for billions—or
bankruptcy. Make crucial business decisions every minute,
and enjoy the rewards—or suffer the consequences. Packed
with sound, animation, and fun, it draws rare reviews from
would-be entrepreneurs of all ages. Capitalist Pig is the
most "game of the year." You never knew business could be so
simulating!

$90

Windowatch
Track the hours you spend on a project with Windowatch. It's
a must for professionals who bill their services by the hour (or
minute). Windowatch operates in the background, automatically
logging time to the nearest minute. Use Windowatch to collect
and store timesheets from team members over the network or
import timesheet information into a spreadsheet. Don't miss any
opportunity to accurately bill your clients. After all, time is
money.

$89

OPTIMA™ 96 or OPTIMA™ 24*
OPTIMA™ 96 or OPTIMA™ 24 for the Macintosh — low-cost,
high performance 9600 and 2400 baud modems provide the latest
terror control and data compression technology for maximum data
throughput. In addition to X.25/9600 baud transmissions, OPTIMA
96 provides 38,400 baud throughput and OPTIMA 24 provides
9600 baud throughput. OPTIMA modems practically operate
without any automatic feature negotiation creates the most
efficient combination of speed, error control, and compression
every time. OPTIMA 96 and OPTIMA 24 — the most modern for
your money. 

Hayes OPTIMA™ 96 MODEM $399
Hayes OPTIMA™ 24 MODEM $149

$35

StuffIt Deluxe 3.0 or StuffIt SpaceSaver*
StuffIt Deluxe 3.0 is the "Complete Compression solution". Only
StuffIt Deluxe 3.0 can solve all your compression needs from archiving
to transparent compression and includes StuffIt SpaceSaver. StuffIt Deluxe 3.0
is the fastest, most efficient compression product available. Our new Add
Magic intelligently stuffs only the files that meet the criteria that you specify.

UT01032 $69

StuffIt SpaceSaver
Unlike other compression products, StuffIt SpaceSaver increases disk
space (with lightning speed) without effort on your part. Have it work while
you're at it or when you say, "Compresse this for me." SpaceSaver
provides complete on-the-fly compression in one package. SpaceSaver
is also one of the least expensive, most productive and easiest to use
compression products available.

Publisher: Aladdin Systems, Inc.
UT01093 $35
Power User's Tool Kit 9.0

Power User's Tool Kit 9.0 is full of useful productivity enhancers and software to protect your data from viruses. A powerful collection of 8 programs, Power User's Tool Kit 9.0 includes 2 programs designed to take advantage of System 7. Here's what awaits you...

- CarpetBag makes resources (fonts, sounds, FKEYs, keyboard layouts), available on your Mac without having them installed in your System file.
- The Complete Delete overwrites space on a disk where a deleted file was and makes any sort of snooping in your deleted files impossible.
- Disinfectant 2.8 can prevent, find, and eradicate all of the newly discovered Mac viruses.
- RamPreserves automatically and consistently loads any Mac RAM disk with selected files each time you start up.
- alias Director is the most powerful System 7 alias management tool available.
- TrashMan automatically deletes files from your Trashcan after they have aged as long as you specify.

All Software works with System 7, two programs are designed to take advantage of its new features.

CPU Connectix PowerBook Utilities

Put more power into your PowerBook! Get even more from your PowerBook with Connectix PowerBook Utilities (CPU), the first software utility created exclusively for your PowerBook. CPU extends your battery life. That keeps your PowerBook up and working longer. CPU protects your sensitive data whether your PowerBook is running, shut down or asleep. Custom menu bar displays show accurate battery level, remaining battery life data and time. CPU gives you much more. Instant sleep and wake, LCD screen saver, keyboard shortcuts, cursor finder, mouseless mouse control, and over a dozen other enhancements make your PowerBook more effective. Get the power of CPU and put more power into your PowerBook today. Publisher: Connectix. Item #00297

Wallpaper

- Put some pizzazz on your monitor and watch it come to life! With the prize winning Wallpaper decorator program for your desktop, you can jazz up your screen with large patterns (up to 233 x 128 pixels square) in up to 56 colors per pattern, grasscloth or block and white. Includes hundreds of desktop patterns, or create your own with Wallpaper's expanded tools. Just drag, and drop patterns into place and try creation after creation. You can set Wallpaper to change patterns among your favorites and can create new patterns from any format. It's fun! Publisher: Thought I Could. Item #00022

IntelliDraw

- Aldus IntelliDraw defines an exciting new category of drawing program, with intelligent features that give you an easy new way to totally experiment, refine, and draw your ideas.0.000 computer-generated line graphics in your drawing so they respond to changes automatically. Create visual "what if" scenarios with features like intelligent clip art & templates. automatic symmetrical objects, and more. Publisher: Aldus. Item #00354

The Power User's Tool Kit 9.0 is FREE when you order from MacWAREHOUSE. You pay only $1.50 for shipping and handling. If you would like the disk, please ask for item #AAA0022.

Some of the programs are shareware, so you can try them free of charge. To continue using them, some authors ask that you pay a small fee ($5.00). Two of the programs are absolutely FREE! Details are explained on the disk, which is yours to keep, with our compliments.

Wallpaper

- Put some pizzazz on your monitor and watch it come to life! With the prize winning Wallpaper decorator program for your desktop, you can jazz up your screen with large patterns (up to 233 x 128 pixels square) in up to 56 colors per pattern, grasscloth or block and white. Includes hundreds of desktop patterns, or create your own with Wallpaper's expanded tools. Just drag, and drop patterns into place and try creation after creation. You can set Wallpaper to change patterns among your favorites and can create new patterns from any format. It's fun! Publisher: Thought I Could. Item #00022

IntelliDraw

- Aldus IntelliDraw defines an exciting new category of drawing program, with intelligent features that give you an easy new way to totally experiment, refine, and draw your ideas.0.000 computer-generated line graphics in your drawing so they respond to changes automatically. Create visual "what if" scenarios with features like intelligent clip art & templates. automatic symmetrical objects, and more. Publisher: Aldus. Item #00354

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DiskTop goes System 7!

- Find faster, launch icons and manage more with DiskTop, the System 7-compatible file management utility from CE Software! Find files faster, as you can search based on file name (spare), size, type, creator, when created or modified. If DiskTop can't find it, it ain't there! Once you've found what you're looking for, use the powerful copy, move, delete or rename functions to keep everything organized and up-to-date. A done in one window and without leaving your current application! And, when it's time to launch another program, don't quit or go to the Finder—launch any application from your DA menu with DiskTop Launch (included free with DiskTop). If you have a hard drive, DiskTop is a must!

Price: $63

PowerPad

- On the road or at your desk, PowerPad turns your PowerBook into a numeric powerhouse. With advanced ergonomics for comfortable and accurate entry, function keys at a touch: customizable keys to match your way of working. And a hard cover that opens to support the pad for easy use. A new desk accessory, 106x Tape, gives a paper tape work record. There's an extra ADB port for adding a mouse or other device. And a 24" removable cable. It's the number cruncher's dream—PowerPad. PowerPad is also available with QuicKeys II, the popular macro utility program.

Manufacturer: Sophisticated Circuits

Price: $139

TouchBase 2.0 or DateBook

TouchBase 2.0 stores information about personal and business contacts. Automatically capitilizes words and formats phone numbers. It has fields for storing alternative phone numbers, and you can customize the fields. TouchBase prints envelopes and mailing labels, including postbar codes, plus many other useful forms. DAT0076

DateBook is the ultimate personal time manager for Macintosh. Instant access and advanced scheduling keeps you on top of your appointments and things to do. DateBook makes it easy to plan your life. It shows your schedule in multiple formats including text, gantt chart and time bar. DateBook's views enable you to see your schedule in as much detail as you like as quickly as possible.

Price: $79 ea.

After Dark/More After Dark Bundle

- After Dark 2.0 displays over 55 screen savers including the classics, such as Fling Toasters and File. Also features sound password protection, Multi-Module logo and message display. XTO5119 $49.

- It's MAD'S More After Dark—Over 25 incredible displays for After Dark, the Ultimate Screen Saver. Features contest winners, Movin'Man, Tunnel, Graphite, many beautiful new Post, mission, and Line it's free bonus help you see screen from phosphoryl thions (Requires After Dark).

Publisher: Berkeley Systems XTO5230 $25.

Price: $45*

FileGuard

- It's about as much software based security as you can get in one package... manual, March 1992. Protect your hard drive from unauthorized access (including security bypasses with a system diskette), copying and erasure; applications and file folders (including System folder) from unauthorized access, deletion, and/or illegal copying; desktop from alterations by unauthorized users. Keep your eye on System usage with FileGuard's Users Log which continuously tracks user/group activity, System 7.0 Compatible. Publisher: ASD Software Single UT0135 $139

Price: $19*

Bridge 6.0 or Graal Quest

- Bridge 6.0 Now you can play a number of Bridge 6.0 with the Mac's three players. But with either the Newman or the Blackwood conventions, Bridge 6.0 handles all the bookkeeping and tactfully informs you of any mistakes in bidding or play. ENTO503 $29.

- Graal Quest Uses the Mac's sounds and graphics to put you inside the world of King Arthur's England. Best of all, its well-crafted plot and authentic settings are based on authentic tales of time by Geoffrey of Monmouth and Sir Thomas Malory. Publisher: Answer ENTO506 $19

Price: $79
MacEKG 2.0
- MacEKG can warn you of computer failure before it happens. EKG monitors over 200 aspects of your system, logging and reporting results each time you reboot. EKG features advanced chip-level tests that were only available to Authorized Apple Technicians until now. Using EKG's breakthrough technology, continuously reboot simulations of several days of heavy use to quickly diagnose intermittent failures. EKG can automatically run at startup or shutdown—making sure you are the first to know if your computer has failed a test or slowed down.

Publisher: MicroMat U10285

$99

MacPrint 1.3
- Use a Macintosh with non-Apple printers. Print Mac applications on HP Laserjet, Deskjet, or compatible printers including all Series B4, B5, and the Deskjet 500. Prints text and graphics at the printer's maximum resolution. Does not require PostScript.

Cable is included. Publisher: Insight Development U10049

$95

AccuText 3.0
- Enhanced accuracy through verification. AccuText 3.0 is Intelligent Character Recognition (ICR) software that scans documents to be recognized and captured to electronic files. AccuText's interactive Verifier increases speed and accuracy by inviting user interaction before processing. AccuText features include System 7 compatibility, format retention, automatic halftone removal, on-screen annotating, support for ten languages, and compatibility with most popular scanners and software applications. Publisher: Xerox Imaging Systems U10039

$639

Kaboom!
- Add more than 150 wild and wacky sounds to your Macintosh with Kaboom! Each sound can be played every time you start up your computer, insert a disk, empty the trash, and more! Amaze your friends with the sounds of traffic jams, screams, and ringing phones—even famous dialogue from "Twilight Zone," "I Love Lucy," "Ronald Reagan" and more! With Kaboom! you'll never have to settle for a simple beep again.

Publisher: Nova Development Corporation U10281

$29

Complete Lottery Tracker and Wheeler 4.0
- The most comprehensive lottery software package and NOW works with the new "Powerball" games and Pick-5, Pick-6, and Pick-7 lotto games. Choose up to 20 numbers, analyze and choose numbers from past drawings, create tickets through wheeling, record bets to check for later winners, and print charts to help you beat the odds. Comes with the FREE audio cassette, Lottery Winning Strategies and a FREE lottery database of the last 12 months winning numbers from the state of your choice when sending in an enclosed card.

Publisher: Triad Publishing, Ltd. ENT0401

$29

Crossword Creator or CasinoMaster
- Crossword Creator helps you create crossword puzzles quickly and easily on your computer. Just type in the words and Crossword Creator will instantly generate the puzzle. Build your own dictionaries and use them for future puzzles. Includes Regents I, II, III, and New Testament, with wild card search features. Save options include desktop publishing files.

Publisher: Power, and Macclarion U10281

$39

WristSaver/WristSaver MousePad or WristSaver Mini-MousePad
- WristSaver/WristSaver MousePad The WristSaver creates your wrist with a contoured mouse and a comfortable foam covering. It's ergonomically designed to support your wrist at the proper angle to help avoid the pain associated with Carpal Tunnel Syndrome. The WristSaver Mousepad provides a comfortable rest for your wrist, plus a conventional mouse pad. Your color will be chosen from WristSaver Mousepad $15.50. WristSaver $15.50. WristSaver Handset $25.

WristSaver Mini-MousePad The WristSaver Mini-Mousepad's success prompted the WristSaver Mini-Mousepad. It's only 1/5 wide and 1/8 long and 1/3 smaller than the original. Your precious desk space is saved and your wrist will thank you.

Manufacturer: Lit Innovators

Navy: ACC0757 or Red: ACC0758 or Black: ACC0799 or Gray: ACC0760

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A Power User Memory Expansion Kit will dramatically increase the power of your Mac. And our fast, reliable overnight service will have your Kit in your hands tomorrow!

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Never again will you have to quit your word processor just to answer a question about a spreadsheet. Install extra memory and you can leave a letter open while you refer to last month’s sales figures.

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Our helpful sales and technical staff is standing by to answer any questions and take the mystery out of memory upgrades. Memory cards come with one megabyte on each card and are usually sold in pairs — (2 @ $39 ea.).

The chart explains exactly what you need to achieve the desired level of performance.

To open your Mac Plus, SE, and Classics you’ll need a specially designed tool — it’s available from us as part of a handy tool kit for just $9.

WHAT YOU NEED TO KNOW

Memory chips come factory-installed on plug-in cards, called SIMMs (Single Inline Memory Modules). Each one megabyte SIMMs card holds eight top quality memory chips. We carry chips by all the major manufacturers like Texas Instruments, Intel and Samsung.

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Please call for the very latest prices and availability. Our sales staff will tell you what you need and help you make your choice an easy one.

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Do you need 80, 100 or 120 Nanosecond (ns) chips? Nanoseconds are billionths of a second, so an 80 ns chip responds faster than a 100ns chip. The original Mac used relatively slow 50ns memory chips. The 68020 processor needs 120ns (or faster) chip, and the 68030 Maos like the Speedliner model.

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CHP 0012 120ns SIMMs $39

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** Limited offer. Free video with purchase of 2 or more SIMMs.

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If, for any reason, you are dissatisfied with your Power User Memory Kit, you may return it for a full refund within thirty days of purchase. All you have to do is call us for a return authorization number and return this product, postage paid, in its original condition, with the original packaging and documentation.

ONE YEAR WARRANTY.

MacWarehouse also guarantees its Memory Kits against manufacturer defects for one year from the date of purchase. We will repair the item or replace it at our discretion.

MWK2P
The new Finder 7 is worth the cost alone. Access, organize, and view your folders, documents and applications faster and easier with the new improved finder.

Balloon Help
Use the new Balloon Help for interactive help while you work. Turn this feature on and point to anything on your screen - a menu item, icon, or tool - and a "balloon" appears, telling you what it is and what it does.

File Sharing
With the new File Sharing features you can share hard drives, folders, and files, with others on your network; it has never been easier. You can even set passwords so that only specific individuals or groups can see your files and work with them.

Fonts in System 7
Apple's new advanced font technology gives you clear, crisp type on screen in any size plus the ability to print to many different kinds of printers. No more struggle with font compatibility.

Multitasking
With System 7 Multitasking is always optional. Now you can run multiple applications at the same time, and switch from one to another with a click of the mouse. System 7 also supports background processing, so that while you're working in your word processor, you can print a document and have your spreadsheet recalculating.

System Folder Simplicity
Apple has completely redesigned and improved the System Folder, making it much easier to organize. Predefined subfolders are created automatically, to reduce clutter. The new System Folder includes a Control Panel Folder, Extension Folder, Apple Menu Folder, Preference Folder and Startup Folder.

Publish and Subscribe
You can "publish" any part of your document (a graphic, chart or piece of text), to another document even in another application - which "subscribes" to the original. Any changes you make to the original document will automatically appear in the other, even across a network. Now that's live copy and paste!

Plus Your FREE System 7 Tutorial from MacWAREHOUSE!

QuickTime Starter Kit
Play QuickTime movies right on your Mac! Pause, fast-forward, rewind, advance frame by frame. Copy video and animation clips and paste them together. Transform still images and information into a single movie. Use a video-capture card and sound digitizer to record movies with the touch of a button. QuickTime brings Multimedia to the Mac!

$169

Macintosh PC Exchange
Open PC files on 3.5" MS-DOS and Windows-formatted floppy disks. Read DOS files on your Mac desktop. Open, save, rename, move, copy and delete documents just as if they were Mac files! Customize the program for even faster access. Requires Apple SuperDrive or compatible.

$69

AccessPC 2.0
With AccessPC 2.0, your Macintosh can make MS-DOS files look just like Mac files, instantly. Pop any DOS floppy in your drive, and in a couple of clicks, the PC files are on your Mac desktop, looking and acting perfectly Mac-like. Edit, copy, save, print, play with the numbers, print again, and give the PC people back their diskette. It's that easy to use any PC file in any Mac application.

$60

DiskFit Pro
Fast, efficient, easy backup. For Finder-readable backup to floppy, cartridge or other hard drive. DiskFit Pro copies files from the hard disk to a "SmartSet" of floppy, and then updates that "SmartSet" with each subsequent backup. By replacing only the newest files in the backup set, DiskFit Pro keeps your SmartSet growing every time you back up. Backups stay fast, and backup sets compact. And since files stay in Finder format, retrieving files is easy. Don't leave your data at risk, backup with DiskFit Pro. System 7 Savvy. System B & compatible.

$74

SAM 3.0 or NUM 2.0*
SAM 3.0 detects viruses by monitoring the suspicious activities that characterized them. Version 3.0 has enhanced update and repair capabilities, faster scanning, and more. The CDEV portion operates during normal Mac usage, and offers a number of options for checking disks and folders as you work.

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Make System 7 even easier with this Personal Training Systems Tutorial!
Get up and running with System 7 in a flash! This Personal Training Systems Tutorial is the fastest, easiest way to put all the power of System 7 right to work on your Macintosh desktop. And it's yours free with your order! Free with your order for any product from MACWAREHOUSE. Just ask for item #AAA0323 when you place your order.

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Get the Adobe Type Manager program disk, user guide, and registration card free from MACWAREHOUSE when you order System 7. You'll also get a bonus, four Adobe Garamond typefaces from the Adobe originals. When you place your order for System 7 just ask for item #AAA0323.

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Make System 7 even easier with this Personal Training Systems Tutorial!

UserLand Frontier
Frontier is the power user's scripting system for System 7. Write and run your own utilities to customize the Mac file system, networks, and applications. Frontier has all the development tools you need to get your scripts running quickly, including a full script debugger and structured symbol tables you can watch and edit while your scripts are running. When your done, you can link scripts into Frontier's extensible menus (AutoDoubler or DiskDoubler) for easy access to the Finder desktop.
Publisher: UserLand Software
UT1055 $189

AutoDoubler or DiskDoubler 3.7
AutoDoubler is the easiest way to increase hard disk capacity. It's lightning quick and completely transparent, so it won't interrupt your work. The new patent-pending technique lets your Macintosh use files and applications while they are still compressed! It's fully compatible with almost all applications, disk accessories, and system extensions. UTF254 $49 ea.

QuickTime Starter Kit
Play QuickTime movies right on your Mac! Pause, fast-forward, reverse, advance frames by frames. Copy video and animation clips and paste them together. Transform still images and information into a single movie. Use a video-camera and sound digitizer to record movies with live touch of a button. QuickTime brings Multimedia to the Mac! GRA2547 Publisher: Apple Computer, Inc. $169

AppleShare 3.0
Gain direct access to information and resources from your AppleTalk network. Simply to set up and use, high performance is optimized for a broad range of modems. Provides multiple security levels, and requires only System 7 and a high-speed modem. No special hardware required. COMP131 Publisher: Apple Computer, Inc. $175

AppleTalk Remote Access
Gain direct access to information and resources from your AppleTalk network. Simply to set up and use, high performance is optimized for a broad range of modems. Provides multiple security levels, and requires only System 7 and a high-speed modem. No special hardware required. COMP131 Publisher: Apple Computer, Inc. $1059

QuickTime Player 3.7
QuickTime Player 3.7 brings Multimedia to your Macintosh desktop. Now you can run QuickTime movies right on your Mac! Pause, fast-forward, reverse, advance frames by frames. Copy video and animation clips and paste them together. Transform still images and information into a single movie. Use a video-camera and sound digitizer to record movies with live touch of a button. QuickTime brings Multimedia to the Mac! GRA2547 Publisher: Apple Computer, Inc. $169

Word 5.0 or Excel 4.0
Microsoft Word 5.0 simplifies word processing--whether you need to dash off a quick memo or create a complex report. Its Ribbon control panel makes changes with a single mouse click. Includes a grammar checker, spelling checker, and thesaurus. WRD059 $299.

Microsoft Excel 4.0 streamlines the tasks of creating and using a basic spreadsheet. Fully System 7 Savvy, it now allows you to include QuickTime audio/video clips in your spreadsheets. Wizards (Excel's on-line assistance) walk you through complex tasks.
Publisher: Microsoft
BUS223
MICROSOFT EXCEL 4.0 UPGRADE ONLY $99 ea.

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You want all your documents to look polished and professional. You've seen how graphics and charts can jazz up those otherwise dull memos and reports. But trying to do page layout with your word processor is almost impossible. And high-end page layout programs take too much time and effort. Introducing Personal Press 2.0 — the first page layout software that does it all for you automatically!

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**Personal Main Features**

- "Intelligent" Templates help you create, assemble and print professional-quality documents with ease.
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The phone rings. You pick it up without stopping to think. A computer doesn't have that luxury. Its "brains"—the central processor—must calculate every step needed for any action. People learn to perform complex actions without identifying the steps involved. By contrast, computers must string together a simple vocabulary consisting of two "words"—on and off—to handle complex actions. It comes down to intelligence versus brute force.

An Ever Smaller World As it sits on the computer's logic board, a processor looks rather dull—a dark gray block with a bit of gold for the wiring and black for the label. But if you peer under that drab cover, you glimpse what looks like a city seen from an airplane window. Thin strips of wire (called traces)—made of aluminum and so incredibly fine that you'd have to stack up 60 traces from a Motorola 68040 processor to equal the thickness of this page—crisscross the chip, connecting all of its many tiny parts.

Zoom in a little closer, and the processor takes on distinct patterns, one area looking as empty as a city's warehouse district, another as crowded as its downtown. Zoom in even further and you can see the individual regions—the processor's "buildings" that handle computations.

By zooming in closer yet, you can see the transistors—the basic components that do the processor's actual work. The 68000 processor, first introduced by Motorola in 1979 and still used today in the Macintosh Classic, has about 68,000 transistors (thus its name). The 68030 used in many Macintosh models has more than 300,000 transistors. There are more than 1.2 million transistors in the 68040 found in Apple's most powerful computers, the Quadras. And the next generation of processors may have tens of millions.

A World of Simple Choices Transistors do a very simple thing: turn on and off. Yet, they control everything that happens in the processor. It's as if stoplights controlled everything that goes on in a city.

A transistor either lets electricity flow (the on state) or prevents it from flowing (the off state). A series of transistors is called a circuit. Electricity flows through the circuit—the exact path that the electricity follows is determined by the on and off patterns formed by the transistors. The vast number of possible paths that electricity can take—each with its own meaning—coupled with the fast speed at which the transistor can move data along those paths lets the processor handle complex computations.

A transistor is made from silicon, which normally blocks electricity but can be forced to let electricity through (that's why silicon is called a semiconductor). In a transistor, an aluminum trace comes in at one side; a second trace comes out at the other. A strip of sil-

by Lon Poole
Modern processors like the Motorola 68040 contain well over a million tiny transistors on a 1/4-inch square of silicon. Magnified slightly, it resembles a city viewed aerially, with transistors laid out by the thousands in neat districts, each district with a distinct function, and all connected by metal traces so thin that 70 side by side across would fit within the width of a single hair. Although their scale lets integrated circuits be complex, they consist of simple transistors that all work alike and can be fabricated en masse. Manufacturing a processor takes scores of meticulous steps, which are performed mostly by machine under human supervision. The incredibly intricate product of this effort, the processor, goes to work for you every time you turn on your computer.

**How a Transistor Works**

A transistor is an on/off switch. It conducts electricity when a separate electrical charge (red) on the gate (purple) attracts electrons to the silicon below it. Without the charge (green), the gate does not attract electrons to the silicon, so the transistor does not conduct.

**Preparing Wafers**

**Creating the Silicon** Silicon refined from quartz is grown at 1500°C into a 5-foot-long, cylindrical ingot 5 inches across. A diamond saw slices it into wafers that diamond abrasives grind credit card-thin (24 mils) and polish mirror-smooth.

**Laminating Wafers** In super-clean rooms (less than one sub-bacterial particle per cubic foot) workers operate machines that build transistor circuitry layer by layer on the wafer. A 5-inch-diameter wafer has dozens of 68040 circuits on it.

**Slicing the Wafer** Spinning at 30,000 rpm, a diamond saw slices each wafer into individual processors, or dies. After clearing away the silicon sawdust, workers inspect each die through a microscope for defects and mark rejects with ink spots.

**Fabricating Transistors**

**Layering Circuits** Building each layer of a circuit takes several steps. Hot gases diffuse an insulating oxide film (the gold layer in the illustration) over the surface of the silicon wafer, or over subsequent layers. The wafer receives a coating of light-sensitive plastic (blue layer) called photoresist, which is photographically imprinted through a stencil-like mask with part of the circuit diagram. The exposed photoresist hardens, and more hot gases etch away the unexposed photoresist and the oxide beneath it, revealing areas of silicon. A machine shoots ions (charged atoms) at the wafer, where they become implanted in the spaces between the molecules of revealed silicon (gray layer) and create a conducting region. This etching is repeated for each successive layer.
ASSEMBLING CHIPS

MOUNTING THE DIE A robot picks up each good die in turn and places it squarely on a drop of adhesive in a waiting ceramic or plastic carrier. The robot's vision system sees the ink spots that mark defective dies and the robot ignores the marked dies.

ADDITION LEADS

STITCHING WIRES A robot weaves spider-web-thin (1-mil) wires between contact pads on the die and the pin-encrusted carrier. The impact of the weaving, together with a high-frequency vibration, bonds the wire leads to the pads.

APPLYING THE COVER

SEALING THE CHIP A robot clamps a solder-rimmed lid to the carrier and sends it through a 330°C furnace. The solder melts and hermetically seals the die inside the carrier. The final chip is then packaged for sale.

YOUR COMPUTER REVEALED

Inside the Processor

con called a gate sits between the two traces. Normally the gate keeps the electricity from jumping from one trace to the other—thus blocking the electricity's path. The gate is connected to a trace of its own; if that trace gives the gate an electric charge, the conductivity of the silicon changes and electricity flows from the incoming trace to the outgoing trace—thus turning on the transistor and letting the electricity continue down the path.

Turning Simplicity into Complexity The states of on and off represent the digits 1 and 0, and those two digits in turn can represent any kind of information—numbers, text, graphics, and more. Unlike the decimal number system, which has ten digits (0 through 9), the binary system has only two digits (0 and 1), so you need a longer string of binary digits than decimal digits to denote a value greater than one (see "Representing Data"). For example, the binary system doesn't have the digit 2; it denotes the value two with the two-digit combination 10.

Just as each additional digit in the decimal system stands for a higher power of ten (10 = 10^1, 100 = 10^2, and so on), each additional digit in the binary system stands for a higher power of two (10 = 2^1, 100 = 2^2, and so on). Each binary digit is a bit; eight bits make a byte.

The more digits a processor can handle at one time, the faster it can work: raw processing power overcomes the binary system's inherent inefficiencies. That's why all Macs use 32-bit processors, not 16-bit processors. And by processing 32 bits at a time, the computer can handle more complex tasks than it can when processing 16 bits at a time. A 32-bit number can have a value between 0 and 4,294,967,295, and you see why calculations that involve lots of data—everything from tabulating a national census count to displaying the millions of color pixels in a photo-realistic image on a large screen—need 32-bit processors.

Digits inherently denote numbers, not text. So how does a processor handle nonnumeric data like letters, punctuation, and other symbols? By encoding the data as numbers. The most common encoding scheme for English, called ASCII (American Standard Code for Information Interchange), encodes A through Z and a through z, the numerals 0 through 9, and common symbols and punctuation marks with numbers between 0 and 127. Accented letters are not part of the ASCII code, but they and other symbols are often encoded with numbers between 128 and 255.

Numbers can also specify graphics. In the simplest case—a picture composed of black and white dots—a 1 represents a black dot and a 0 represents a white dot. More colors or shades of gray require more bits per dot—2 bits for 4 colors or grays, 4 bits for 16 colors or grays, 8 bits for 256 colors or grays, 16 bits for 32,767 colors, and 24 bits for the 16.8 million colors in a photo-realistic image.

Instead of dots, graphics can be composed of shapes or objects such as lines, curves, rectangles, and ovals. Each object in a picture is specified by a list of binary numbers. For example, four numbers specify a line—the horizontal and vertical coordinates for each of its two endpoints.

Thinking Digitally In combination with other simple electronic parts in the processor, transistors can process digital information—move it, compare it, add it, subtract it, and more. The key is having enough transistors in the circuit to do the job. For example, it takes a circuit with 16 transistors and 2 resistors (which help direct
the flow of electricity when more than one transistor path is open) to add two single-digit binary numbers (see "How a Processor Adds Binary Digits").

Processors use both brains and brains for other types of math. For example, a processor can repeat a series of additions to multiply—this works because $6 \times 7$ is the same as $6 + 6 + 6 + 6 + 6 + 6$. Or it can use the labor saving trick of shifting digits. Shifting a binary number to the left multiplies it by a power of 2. For each digit moved, one digit to the left multiplies by 2, two digits by 4, three digits by 8, and so on. For example, shifting the binary number 101 by one digit (making it 100) multiplies it by 2. (Shifting a decimal number to the left multiplies it by powers of ten: shifting the number 5 by one digit makes it 50, which is the same as multiplying it by 10.)

Tasks like subtraction and division—which remove data—are more complicated. To subtract, a processor must first use resistors and special gates to invert the number to be subtracted—the number’s 1s change to 0s and its 0s to 1s. It adds the inverted number to the other number, and then adds 1 to the result. And you thought long division was hard! Division is a series of subtractions.

Still more circuitry lets the processor not only calculate data, but also evaluate it. For example, a processor can compare two binary values by subtracting them, seeing whether the difference is zero (meaning they are equal), negative (meaning the first value is less), or positive (meaning the first value is greater). The processor can also perform basic logic operations such as NOT, AND, and OR by comparing data bit by bit.

The NOT operation inverts a number so that the 1s become 0s and 0s become 1s (recall that this is part of subtraction). This is what the processor does when you choose a menu item and the normally black-on-white text becomes white-on-black.

The AND operation combines two or more numbers bit by bit. Combining a 1 and a 1 produces a 1; any other combination produces a 0. The AND operation is used when, for example, a program must find an exact match—like selecting all red in an image. The computer compares the binary digits for each color in an image against the digits that denote red. If the digits match, the result of the AND operation is a 1 (or "true"), which means the correct color matches red and is selected. If there is the slightest mismatch, the result is 0 ("false"), and the color is not selected, since it is not red.

The OR operation also combines two or more numbers bit by bit. But it outputs 1 if either bit is 1 (or both are); it outputs 0 only if both bits are 0. The OR operation is used, for example, when searching for text. By using OR operations, the processor can be told that whether the letters are uppercase or lowercase, the text still matches the search string.

Following Instructions While some circuits process information, other circuits control the processor itself. These control circuits follow instructions contained in a program, which is stored outside the processor in the computer’s memory, such as ROM or RAM.

To make the computer a tool for word processing, drawing graphics, creating and evaluating spreadsheets, or playing a game, a person must create a program by arranging instructions in the appropriate sequence. Each task must be spelled out in fine detail. Imagine having to consciously control every muscle movement needed to write
A circuit combining 16 transistors and 2 resistors (which resist electrical flow) can add two binary digits according to four simple logic rules. The digits themselves are added as follows: (1) The two digits to be added are input as on or off signals to two pairs of transistors. Each pair of transistors combines the inputs and produces an output according to the logic rules. Here, input A is 0, or off, and input B is 1, or on. (2) The first pair of transistors outputs 1 only if both input A and input B are 1; otherwise it outputs 0. Here, input A is 0 and input B is 1, so the output is 0. (3) The second pair of transistors does the reverse of the first pair: it outputs 1 if either input A or input B is 1; otherwise it outputs 0. Here input A is 0 and input B is 1, so the output is 1. (4) The output of the first pair of transistors is inverted by the combination of a transistor and a resistor. Here, a 0 is inverted to a 1. (5) The inverted output of the first pair of transistors and the output of the second pair become the inputs for a third pair. This third pair combines its inputs according to the same rules as the first pair: the output is 1 only if both inputs are 1 (here, they are). The output of the third pair is the sum of the original two inputs. (6) The carry digit, if any, from adding the original inputs is the output of the first pair of transistors (in this case, there is no carry). (7) The result of the addition is then moved to a second set of transistors in the addition circuit, which adds the result to a carry digit from a previous circuit's calculation. The second set works the same way as the first set (see steps 2 through 5). Here, the carry digit is 0 (which means there was no carry from the previous calculation). (8) The carries from both sets of circuits are merged and sent on to the next addition circuit. Here, neither set results in a carry, so the carry output is 0. If either or both carries were 1, a 1 would be passed on. (9) Thus, the output of the bit adder is the sum of three digits: inputs A and B (added in the first set of transistors) and the carry from adding the two previous digits. The carry output of each one-digit adder feeds into the carry input of the next one-digit adder to the left (the first adder has no carry coming in, and needs no transistor to handle one). To add two bytes requires eight adders, one for each set of bits.
Tracing a Calculation

Discrete regions of the processor have specialized jobs. The Motorola 68040's integer unit, for example, does arithmetic and manipulates data in other ways by executing a program of instructions stored in the computer's memory. The instruction cache and data cache help the processor execute programs faster by storing frequently used instructions and data within the 68040 for quick reuse.

EXECUTING AN INSTRUCTION

The 68040's integer unit executes instructions piecemeal in a six-stage pipeline. An instruction enters the pipeline at the instruction fetch stage and progresses sequentially. As soon as stage one finishes an instruction, the processor passes the result to stage two, and stage one can begin the next instruction. At any instant, the integer unit could be executing up to six instructions in parallel.

Here you see what each stage of the pipeline does with an instruction that adds the value in a register (a scratch-pad portion of memory inside the integer unit) to the contents of a memory address. Typical programs contain thousands of instructions, many executed repeatedly in loops. A fast microprocessor like the 68040 can execute more than 20 million instructions per second.
your name—that's what a processor must do for every task.

The processor executes instructions in series (see "Executing an Instruction"). Each instruction is a binary number, and the processor must decode the number to identify the type of operation to perform, where to find the binary data on which to perform the operation, and where to put the result.

Eventually the processor encounters an instruction that tells it to branch to an instruction out of sequence and to continue from there. A branch can be conditional, perhaps happening only until a register or memory location contains a certain value—for example, a dialog box stays displayed until a user clicks Cancel or OK. Often a branch instruction returns to an instruction earlier in the program, creating a program loop. Programs commonly loop until an event such as a key press or a mouse-click occurs.

**Improving Processor Speed** To make loops run faster, some processors—the 68020, 68030, and 68040—have their own memory, called an instruction cache, for storing recently executed instructions. Often, an entire loop fits in the instruction cache, and the processor can repeat the loop any number of times without slowing down to repeatedly get instructions from the computer’s memory. The 68030 and 68040 also have caches for data.

Processor speed is usually stated in millions of clock cycles per second, or megahertz (MHz). No instruction can take less than one clock cycle (if the processor completes the instruction before the cycle is over, the processor must wait). Common processors operate at speeds from 8MHz to 50MHz. At 8MHz, each clock cycle lasts 0.125 millionths of a second; at 50MHz, 0.02 millionths of a second.

But raw speed is not enough to squeeze the most performance out of a processor. Smart design augments the newest processors’ brute force.

Some processors contain a group of circuits that can work on several instructions at the same time—just like a factory that has several assembly lines running simultaneously. The more instructions a processor can work on at once, the faster it runs. The Motorola 68040, for example, can work on six instructions at once. The 68030 is limited to four. That’s why a 25MHz 68040 is faster than a 25MHz 68030.

**Working for You** The next time you turn on your computer, think about the tens of thousands (perhaps millions) of transistors switching on and off slavishly millions of times every second. Think about the processor shuffling bits of binary numbers that may represent any kind of information along incredibly thin metal traces. It's enough to make you wonder what’s going on inside your own head—but that’s another story.


Informational graphics by ARNE HURTY.
BY THE TIME YOU READ THIS, there will be hundreds of titles—from multimedia encyclopedias to animated children’s books—available on CD-ROM discs. QuickTime movies, using Apple’s new system extension that enables the computer to play back digital video in a small window on the screen, will also be widely disseminated on CD-ROM. So be forewarned: if you don’t have a CD-ROM drive, you’ll be left out of one of the most dynamic areas of Macintosh software development. Meanwhile, drive prices aren’t likely to fall much more than they already have; in March, even Apple introduced a new drive, the CD150, that cost $200 less than its predecessor, the AppleCD SC Plus. Seven of the drives we examined retail for less than $600.
But before buying, consider that CD ROM drives are specialists; they read information from CD ROM discs but don’t work as storage devices. And even the fastest CD ROM drives are slow. Fast hard drives have access speeds of about 16 milliseconds (ms); the fastest CD ROM drive tested for this article, the NEC InterSect CDR-74, has an average access time of 280ms, while the slowest, Optical Access International’s Performer CD ROM and the Panasonic LK-MC501S, have an average access time of 300ms. But regardless of the drive, expect plenty of long delays while it reads data.

CD ROM versus CD Audio

IF YOU HAVE RECENTLY BOUGHT A DÉCENT AUDIO CD player for about $150, paying four times that price for a CD ROM drive that seems similar (but has fewer LCD readouts and fewer fancy buttons on the front) can be a shocking surprise. How come CD ROM drives cost so much more than their audio cousins? The CD ROM drive market is much smaller than the home-audio market, so there is no economy of scale to keep prices low. CD ROM players also have higher-quality components and need to be much more accurate than CD audio players do (see “Why CD ROMs Cost More than CD Audio Players”). And because an audio player has no SCSI interface, you can’t hook one up to a computer; even if you could attach it, there are no electronics in an audio player to decode data on a CD ROM disc.

Evaluating Drive Performance

DRIVE PERFORMANCE IS MEASURED BY two numbers. Access speed, measured in milliseconds, is the average time it takes a drive to locate a random piece of information; transfer rate, measured in kilobytes per second (Kbps), is the time it takes a drive to transfer information to the CPU (central processing unit).

Access time is the critical performance measurement when you are repeatedly searching a large database and pulling out small amounts of information, such as that on the text-only CDs. In an application like an encyclopedia, dictionary, or database, the drive spends most of its time looking for information on the disc; once it gets there, the drive can transfer that information rapidly.

Transfer rate matters most to people using multimedia titles. In those applications, finding data is secondary to transferring it rapidly and smoothly to the CPU for display. Once a 24-bit image or QuickTime movie is located, a large amount of data, sometimes many megabytes in size, must be transferred quickly to the CPU. But CDs offer a narrow pipeline for transmitting large data files. At 150 Kbps, the standard transfer rate for CD audio files, it should take a little over a minute to transfer a 10MB file. Add overhead from CPU processing, and the actual data-transfer rate for most drives is nearly 90 Kbps, so that the same file actually takes closer to two minutes to transfer.

The NEC InterSect CDR-74 doubles the data-transfer rate to 300 Kbps for data and drops back to 150 Kbps for audio. (Without the drop in speed, music would sound like a 33-rpm record played back at 78 rpm.) The InterSect CDR-74 is a great multimedia playback machine, with the smoothest video of any drive tested. The rest of the drives had transfer rates between 150 Kbps and 153.6 Kbps, but even so, there were subtle differences in how smoothly big data files played back in our tests, largely due to how evenly the data was transferred to the CPU. Drives with the Sony and Hitachi mechanisms all had smoother video performance than did the slightly faster drives with Toshiba mechanisms.

Nearly all the drives we reviewed have a 64K buffer, or internal storage area (exceptions are the Performer CD ROM and the Panasonic LK-MC501S, which have 32K buffers); this buffer smooths out fluctuations in a drive’s data-transfer rate. The better the buffering scheme, the more smoothly data flows to the CPU; the drive feels faster because there are no noticeable gaps or pauses while running applications.

But access times and transfer rates are both measured in ideal settings that have little to do with how well a drive actually performs in the real world. The average access times (listed in our features table) are useful for comparing one drive to another, but we did a series of three tests to measure how well the drives perform with applications and titles you’re likely to use, and two tests designed by Apple to show how well drives can play back QuickTime movies (see “CD ROM Speed Tests”).

Although our video-performance test confirmed that the NEC InterSect CDR-74’s data-transfer rate was twice that of the other drives we tested, that innovation didn’t translate into doubled performance in any of the real-world tests. Although the InterSect CDR-74 was one of the drives at the front of the pack, it was the fastest performer in only the graphics retrieval test, where large graphics files were loaded into Adobe Photoshop. In the other two real-world tests, the InterSect CDR-74’s performance was comparable to that of drives using the speedy Toshiba mechanism; these include the CD Tech-
become engrossed in the story and forget about the player that makes it happen.

QuickTime movies are decompressed by the CPU as they are transferred from the CD ROM, and this requires processing time. QuickTime keeps track of how long it takes to decompress and display each frame of a movie, and skips frames if necessary to keep the movie synchronized. This behind-the-scenes monitoring means that the faster the storage device and CPU work together, the more smoothly the movie appears to play back. We tested all the drives on a Mac IIci as well as an LC II to gauge relative digital video performance. On the LC II, even the fastest drive produced slightly jerky movies; some frames froze for an instant as more of the movie loaded into RAM. QuickTime is still in its infancy, and as better decompression software is written and distributed, movies will play back more and more smoothly on slower Macs. For now, the NEC Intersect CDR-74, the Sony- and Toshiba-based drives, and the Hitachi CDR-1750S all offer adequate video performance, with the NEC being the smoothest performer.

Picking the Right Drive

Speed is certainly the most important criterion in choosing a CD ROM drive, but it's not the only one. Reliability, ease of setup, audio support, aesthetics, bundled software, price, and technical support also matter when you're shopping for the long term.

Dust can be a problem for CD ROM drives. If it gets inside, it interferes with the optical mechanism's ability to read the laser beam that is reflected from the CD ROM's surface, causing errors. All the drives we looked at have automatic self-cleaning mechanisms that brush the internal lens of the optical mechanism. The NEC Intersect CDR-74, the Hitachi CDR-1750S, the Todd Enterprises TCDDR-7050, and the Toshiba mechanism drives also have a second door that stays closed after you insert a disc, further sealing the inside of the player from dust. Although this requires an extra step for you when inserting a disc, it provides added protection from dust.

Listening to Audio CDs

If you are secretly plotting to buy a drive so that you can listen to Mozart while crunching numbers, you're in good company. CD ROM drives are basically CD audio drives with additional features, so they can be used to play music if you have software to play the audio files from the disc and you have a pair of headphones or amplified speakers. All the drives but the Sony (which comes with no software at all) come with audio software for listening in.

But headphones aren't your only option. All the reviewed drives except the MacProducts Magic CD-ROM, the Relax Vista CD-ROM, Texel America's DM5021 CD-ROM, and Todd Enterprises' TCDDR-7050 offer preamp output jacks in the back of the players so that you can set up amplified desktop speakers or connect to a stereo amplifier. All the output jacks have separate right- and left-channel output RCA jacks except the DynaTek CDS 650, which offers monochannel output only. If you buy NEC Gallery, or Procom MacCD Station packages, you receive a pair of desktop speakers, complete with batteries.

And if you're going to blast your music, you need a drive that can produce loud sound when you've got the volume pumped up: the Apple CD150, the Liberty 115 CD-ROM, the NEC Intersect CDR 37 and Intersect CDR-74, the PLI CD-ROM, and the Texel DM5021 CD-ROM all offered better-than-average volume levels in our tests.

Aesthetics

I prefer drives that have an indicator light on the front that shows whether the drive is on or off. The Apple, CD Technology, DynaTek, Hitachi, Liberty, MacProducts, NEC, Optical Access, Panasonic, Relax, and Todd Enterprises drives all have a power-on light.

The NEC Intersect CDR-74 and the Hitachi are the only drives that have the on/off switch conveniently located on the front of the drive.

Kodak's Photo CD

The big news in CD ROMs during the next 12 months should be the debut of the Kodak Photo CD. As this article goes to press, Kodak plans to bring its innovative new system to consumers by the summer of 1992. Consumers will be able to bring in rolls of 35mm film to participating photofinishers and get their photos back as high-resolution, color-corrected scans on a Photo CD for about $20 for 24 images.

The scanners used for this process will be of extremely high quality, so at less than $1 per image, the Kodak process could take a serious bite out of the desktop slide-scanner market as some consumers transfer their scanning tasks from the desktop to a Kodak outlet. Each Photo CD holds up to 100 images, so you'll be able to bring in multiple rolls of film and keep adding images until the CD is full.

In order to be considered fully Photo CD-compatible, CD ROM drives must understand the data format Photo CD uses and be able to read data that has been written in multiple sessions as each new roll of film is added to disc. Companies whose drives meet both of these criteria will be able to license a Photo CD logo from Kodak for their drives, to help consumers identify which products will work with the system.

At press time, there were no Photo CD-certified drives, although Apple, Phillips, Sony, Pioneer, and Toshiba have all announced new drives that will be fully Photo CD-compatible and available in late 1992. These drives will be known as multisession drives.

Today, only the Sony-based drives can read a Photo CD, and they can only read the first set of Images written to it. This is known as single-session capability (see "CD ROM Drive Features"). If you bring your Photo CD back to a photofinisher and add another set of images to your CD, even your current Sony-based CD drive will not be able to read the new information; when you mount the CD on your desktop it will still look as if there is just one set of images on the disc. This happens because the drive's internal instructions (its firmware) haven't been updated yet to recognize data that is recorded in more than one session to a CD (until Photo CD came out, no CDs were written in this way). Still, if you're in a hurry to use Photo CD right away and you already own a Sony-based drive, or you don't need to fill up each Photo CD by adding new images to it, single-session capability might serve your needs.

Reading a Photo CD is one thing, but accessing the images in applications requires special software because Kodak writes images to Photo CD in a proprietary compressed-image format called PhotoYCC color encoding, which requires translation into standard Macintosh formats. Apple has announced that the next version of its QuickTime system software (which should be available by the end of the year) will provide direct access to Photo CD images for any application that currently supports PICT. Kodak is also selling Photo CD Access, an application for previewing and retrieving images, and the Kodak Photo CD Access Developer Toolkit, a tool for developers who want to build direct Photo CD support into their applications.
### Why CD ROM Drives Cost More than CD Audio Players

CD ROM drives cost more than CD audio players because CD ROM drives are designed with more expensive, and more rugged, components.

A CD ROM drive contains extra electronics that double and triple check the data that the drive reads from the disc. The human ear cannot detect individual missed bits of data in a piece of music, but the same amount of erroneous information can crash a computer program in milliseconds.

The motor that spins the compact disc is located directly below the spindle. Spindle motors for CD ROM drives must be more durable and reliable than those used in most audio players. To search for random data, a CD ROM drive must increase and decrease speed constantly, while an audio CD usually plays only from beginning to end.

### CD ROM Speed Tests

<table>
<thead>
<tr>
<th>Color Key</th>
<th>Overall Fastest</th>
<th>Overall Slowest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastest</td>
<td>NEC InterSect CDR-74 (NEC)</td>
<td>OAI Performer CD ROM (Matsushita)</td>
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<tr>
<td>Up to 10%</td>
<td>Relax Vista CD-ROM (Toshiba)</td>
<td>Panasonic LK-MC501S (Matsushita)</td>
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<tr>
<td>11%–20%</td>
<td>Mirror CD-ROM Drive (Toshiba)</td>
<td>OAI CD Allegro CD ROM* (Toshiba)</td>
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<td>21%–29%</td>
<td>CD Technology Porta-Drive (Toshiba)</td>
<td>OAI Intersect CDR-37 (NEC)</td>
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<td>30% or more</td>
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<td>Panasonic LK-MC501S (Matsushita)</td>
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<tr>
<td></td>
<td>DynaTek CDS 650 (Sony)</td>
<td>NEC Intersect CDR-37 (NEC)</td>
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<tr>
<td></td>
<td>PLE CD-ROM (Sony)</td>
<td>NEC Intersect CDR-37 (NEC)</td>
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<td></td>
<td>Liberty 115 CD-ROM (Sony)</td>
<td>NEC Intersect CDR-37 (NEC)</td>
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<td>Sony CDU7211W* (Sony)</td>
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<td>Apple CD150 (Sony)</td>
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<td>OAI CD Allegro CD ROM** (Toshiba)</td>
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<td></td>
<td>OAI Performer CD ROM (Matsushita)</td>
<td>NEC Intersect CDR-37 (NEC)</td>
</tr>
</tbody>
</table>

* The Panasonic and the Sony drives were tested with Trantor's driver software.

** In June, OAI shipped version 1.5 of the Access Allegro driver, spot tests showed that the Allegro drive now runs at speeds comparable to those of the other Toshiba-based drives.

The drives are listed from best overall performance (top) to worst overall performance (bottom), based on both application and low-level QuickTime playability tests. The manufacturer of the mechanism the drive uses is listed in parentheses.

For application tests, we measured each drive's ability to find and retrieve specified text from a reference work, find and retrieve images from an image database, and load screens containing text and graphics from a multimedia presentation.
The Panasonic LK-MC501S and the Optical Access International Performer CD ROM—both based on the slow Matsushita CD ROM mechanism—require an annoying manual ejection after the drive is unmounted on the desktop.

**Bundled Software**

APPLE, MACPRODUCTS, MIRROR TECHNOLOGIES, Optical Access International, PLI, and Relax all ship demonstration CD ROM discs with their drives. Only the Apple CD-ROM Titles Sampler and the Introduction to Nautilus offer much in the way of entertainment. The Apple Titles Sampler lists over 200 titles available on CD and includes demos of most of the titles, as well as pricing and contact information. The Nautilus disc is a compilation of the kind of multimedia information and software that comes with a subscription to the Nautilus service—13 disks yearly for $18 (U.S. residents) or $30 (international residents). The other demonstration discs are less enticing HyperCard stacks.

The choice for best CD bundle is among NEC's Gallery, Procom's MacCD Station, and Mirror 'Technologies' six-pack. NEC's Gallery, which includes seven CD titles (CD Companion Series: Beethoven Symphony No. 9; Desert Storm; Cinderella, The Original Fairy Tale; Cosmic Osmo; The Software Toolworks World Atlas; Grolier's Illustrated Encyclopedia; and Time Table of History: Science and Innovation), headphones, and speakers, adds $107 to the cost of the NEC InterSect CDR-37 and $159 to the cost of the InterSect CDR-74. The Procom bundle, which includes seven titles (Sherlock Holmes, Consulting Detective; The Software Toolworks World Atlas; The Software Toolworks Illustrated Encyclopedia; CD Companion Series: Mozart String Quartet in C Major; Introduction to Nautilus; The Mega-ROM; and the Procom audio sampler) plus headphones and speakers, is an extra $204. The Mirror six-pack (Grolier's Illustrated Encyclopedia; The Software Toolworks World Atlas; Time Table of History: Science and Innovation; US History; Desert Storm; The Orient) is $189 (with no extra hardware). These bundles are excellent deals, since each title retails for $39 to $395.

**Price**

PICKING A CD ROM DRIVE IS A QUESTION of deciding how much speed you can afford, followed closely by software and support. The NEC InterSect CDR-74 is one of the fastest drives in our tests, and offers the best video performance. It retails for $712—not the cheapest drive, but overall the top pick.

In the budget category, I eliminated the MacProducts Magic CD-ROM ($399) because it has only the clumsy playCD stack for audio playback, the Procom MacCD/LX ($395) because of a low tech-

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### CD ROM Drive Features

<table>
<thead>
<tr>
<th>Model</th>
<th>Product (manufacturer)</th>
<th>List Price</th>
<th>Average Access Time</th>
<th>Transfer Rate (in KBps)</th>
<th>Buffer Size</th>
<th>Double Dust Door</th>
<th>Vertical Orientation</th>
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<td>CD150 (S)</td>
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</table>

* = yes; O = no. 1 H = Hitachi, M = Matsushita, N = NEC, S = Sony, SH = Sharp, T = Toshiba. 12-14 = excellent, 9-11 = very good, 7-8 = good, 5-6 = satisfactory.
nical-support rating, and the Relax Vista CD-ROM ($579) for a low technical-support rating and the lack of preamp audio output jacks. The fast Mirror CD-ROM Drive ($599), with its good manuals, software bundle, and service rating, therefore emerged as my top budget pick.

The Sony-based Apple CD150 ($599) and the Procom MacCD/LX ($595) are my next choices. They both offer respectable performance for a reasonable price, and have slightly smoother video performance than the Toshiba-based drives. If you’re looking for a drive primarily to play QuickTime movies, and you can’t afford the InterSect CDR-74, buy one of these.

**Is It Time to Buy?**

Prices aren’t likely to fall much farther for CD drives. Instead, at the top of the market we’ll begin to see drives with additional features (see “Kodak’s Photo CD”). More drives that double the data-transfer speed will also appear on the market soon. Sony has announced the CDU-561, a double-speed mechanism with an expanded 256K buffer that should be available in late 1992. Texel America will be replacing its DM5021 CD-ROM with the DM5024, a 280ms double-speed drive ($658) by September 1992. In early 1993 Optical Access will be updating its Performer to a new 350ms mechanism with an automatic eject feature, and its Allegro will debut with a 275ms access time, double-speed data transfer, and a 256K buffer.

I’ve always felt that the trailing edge of high technology is where the bargains are. Right now, CD ROM drives offer the best performance for the lowest prices ever, and more titles are available than ever before. Now is a good time to buy in on a sure thing.

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**Editors’ Choice**

**High Performance**

InterSect CDR-74  This drive offers speedy performance and smooth video, comes with Tranter’s driver and Music Box Software, has a second door for dust prevention, and offers good technical support. For an extra $159 you get five CD titles, a pair of speakers, and headphones. Company: NEC Technologies. List price: $712.

**Budget Choice**

Mirror CD-ROM Drive  This drive comes with a fast Toshiba mechanism, driver and Music Box software from Tranter, solid technical support, a second dust door, and a good manual. And for an extra $189 you get a six-pack of excellent CD titles. Company: Mirror Technologies. List price: $599.

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### Titles Sampler

<table>
<thead>
<tr>
<th>Internal Fan</th>
<th>Type of Indicator Lights</th>
<th>Can Read 1st Sessions of Photo CD</th>
<th>SOFTWARE</th>
<th>Bundled Titles</th>
<th>Audio Software</th>
<th>SUPPORT</th>
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<tr>
<td>power/busy</td>
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<td>•</td>
<td>Apple CD Setup</td>
<td>Educory CD Sampler, Introduction to Nautilus, Apple CD-ROM, Titles Sampler</td>
<td>CD Remote DA</td>
<td>NA 12</td>
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<td>•</td>
<td>CD Tech (OMI)</td>
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<td>playCD and CD Remote DA</td>
<td>10 parts 24; labor 12</td>
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<td>13 12</td>
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<td>9 12</td>
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<td>Music Box DA</td>
<td>6 24</td>
</tr>
</tbody>
</table>


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See Where to Buy for contact information.

Macworld Lab testing supervised by TIM WARNER.
ALL ABOUT SCANNERS

UNLESS YOU'RE A DESKTOP PUBLISHER OR A prepress operator, you probably don't own or have easy access to a scanner. But if present trends are any indication, that situation is about to change.

Thanks to the continuing, significant decline in scanner hardware prices, many people who thought they would never want a scanner—those who work primarily with word processing, spreadsheet, presentation, and database applications—are going to find scanners difficult to resist. Consider this: Two years ago, the majority of 24-bit, 300-dots-per-inch color scanners cost from $7000 to $9000. This fall, Microtek plans to ship the ScanMaker II, which could be the first 24-bit, 600-dpi color flatbed scanner boasting a street price of about $900.

There are other encouraging developments, too, that could make a scanner a must-have. The technology is improving, as many manufacturers are selling scanners capable of higher resolutions and better image quality than previous, higher-priced versions. And a new generation of software with automatic controls is making scanners easier to operate for someone with little graphic-arts or desktop-publishing skill.

Before you take the plunge into scanning, there are important decisions to make. Should you buy a flatbed model, or will a hand-held device do the job? Do you need color, or can you get by with gray scale or black and white? Is the advertised scan resolution real or simulated? Should you care about three-pass versus one-pass scanning? Do you need new features like Twain support, or added features like optical character recognition (OCR) and image-editing software?

Hand-Held or Flatbed?

THERE ARE SEVERAL TYPES OF SCANNERS FOR THE Macintosh: hand-held, flatbed, slide, sheetfed, overhead, and drum. Because they're generally low-priced and well suited to a variety of applications, flatbed and hand-held scanners are the most common choices for first-time and general-use scanner buyers. (For an overview of the other scanner technologies, see “A Scanner Sampler”; for a review of slide scanners, see “Seeing Through Slide Scanners” in this issue.)

Pros and cons of hand-helds

Because they're inexpensive (it's easy to find one for about $300), hand-held models can be an ideal way to get into scanning without making a hefty investment. They're small (typically about 4 inches wide), so you can keep them in a drawer or hang them on the side of the Mac to free up desk space. Hand-held devices are portable, so you can take one on the road with your laptop (battery-powered hand-held scanners are rumored to be in the works). The method of scanning (you slowly drag the device over the object to be digitized) also lets you scan some objects you otherwise couldn't—the logo on the side of a large box, for instance.

Now the bad news. Because you must sweep a hand-held unit's scanning head over a graphic by hand, it's easy to end up with waves or other align-
with low-resolution (laser-printed) output, needs a portable device, and doesn't usually need to scan images larger than 4 or 5 inches wide.

As for color hand-held scanners, don't even think about buying one except for the kids. With the prices of some color flatbed scanners hovering around $1000, color hand-held models (which retail for $700 to $900) are getting squeezed out of the market. Mouse Systems, Sharp, and NCL America are among those dropping their color hand-held scanners.

**Pros and cons of flatbeds** For several reasons, a flatbed scanner is clearly the better choice.

First, there's a greater diversity of models and features from which to choose. At the high end are $8000 to $10,000 color flatbeds that can scan originals up to 11.7 inches by 17 inches at resolutions of 1200 dpi and higher; some include an attachment for scanning transparencies. At the other end of the spectrum are 300-dpi, 8-bit gray-scale models that usually don't include any transparency or sheet-feeder attachments (but they're often available as options), are limited to scanning originals up to 8.5 inches by 11 or 14 inches, and cost from $900 to $1300.

Second, flatbed scanners usually offer better-quality scans than hand-held devices do. Most hand-held devices, for example, use a technique called **interpolation** that results in coarser images (more on interpolation later).

Third, it's easier to align images on a flatbed because the scanner head records the image by moving underneath the graphic (like a photocopier's mechanism does) rather than by having you rake the scanner over the graphic by hand.

So what's wrong with flatbeds? Most important, they cost more than hand-helds. And all too often, the scanner's software interface is unfriendly, particularly to inexperienced users.

Also, the quality of scans often varies from one model to another, despite the fact that their guts may have been engineered by the same manufacturer—the variations ordinarily arise from differences in their software interfaces and image-quality controls. If you have several scanners in-house, this can lead to inconsistent results even for the same image.

Still, in the long run, a flatbed model is the better scanner investment, even if you're in a cash squeeze. Once you buy a scanner, you will find uses for it that you didn't anticipate. And the more you scan, the more you'll begin to resent the limitations of a hand-held device.

**Gray-Scale or Color?**

Because the prices of color scanners have dropped so dramatically, why buy a gray-scale scanner when a color model doesn't cost much more? Why, indeed.

When you consider that the cost of color printers is also nose-diving, color scanners take on an even

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**Scanners come in several forms— which is right for you?**
stronger allure. Meanwhile, some vendors are working on ways to improve and simplify the processes of color scanning and printing. Savitar's ScanMatch program ($199), for instance, promises to match the RGB (red, green, and blue) values of the image you see on a monitor's screen to the color values of the original scanned graphic. From there, Adobe Photoshop's calibration options fine-tune how Photoshop converts the RGB colors to the CMYK process-color values of the intended output device. In addition, company claims to be a scanner's true resolution is not always what it really is.

As mentioned earlier, many scanner vendors are using a technique called interpolation to boost perceived resolution. In interpolation, the scanning software creates extra pixels by calculating the range of hues (levels of color or gray) between the pixels it actually sees. For example, if a scanner sees 100 pixels per inch, it may calculate 300 pixels per inch by dividing each pixel it sees into three smaller pixels. It also adjusts the hue of the newly created smaller pixels to make the shift between hues appear smooth. (A scanner's actual resolution is limited by its array of charge-coupled devices, or CCDs—tiny silicon elements containing photon detectors that convert light reflected from an image into pixels the computer understands.)

Interpolation is useful when enlarging a color or gray-scale image after scanning it. Without interpolation, the pixels that make up an image scanned at, say, 300 dpi become more visible the more you enlarge the image. With interpolation used to scan it in at 600 dpi, that same image—because it has more pixels—is less likely to have an undesirable pixelated (blocky) quality when enlarged.

People who regularly scan line art (black-and-white drawings, for example) will also find interpolation to be an advantage. Line art is characterized by fluid lines and curves, which at lower resolutions run the risk of being plagued by aliasing (jaggies).

Because interpolation creates additional pixels by dividing existing pixels, it smooths out the jagged lines. But the process doesn't enhance the level of detail in an image. Thus, a shadowy image with poor

Beware that claimed resolution may not be true resolution

ColorSync, the color management system in Apple's upcoming QuickDraw GX, promises to provide color consistency between the Mac and its peripherals; QuickDraw GX is scheduled to be available later this year. And Light Source plans to release later this year a color version of its ground-breaking Ofoto software that will automate many color-calibration tasks.

Your best bet is to pay a little more for a color scanner now rather than try to save money by buying a less-expensive, gray-scale model that you'll soon outgrow. You can still scan in gray-scale and black-and-white modes with a color scanner, and then advance into color graphics when you're ready.

Understanding Optical Illusions

A GROWING NUMBER OF INEXPENSIVE FLATBED scanners are offering the ability to scan images at resolutions above 300 dpi. But beware that what a

How Gray-Scale Interpolation Works

In interpolation, the original image (A) is sensed by the scanner hardware as a pattern of black and white dots (B), which the scanner software translates to gray levels (C). The interpolated result can be slightly muddier than the original.

In true gray-scale scanning, the scanner hardware detects the levels of gray in the original image (A) and assigns the level detected to each pixel when creating the image file (B).
Scanning Methods

Another marketing claim to consider is the difference between one-pass and three-pass scanning. One-pass scanners generate RGB values by using three separate lights that flash on and off throughout the scanning process. As the scanning mechanism moves across the image, the scanner's internal red light comes on to capture the image's red information. After the red light shuts off, the green light comes on to capture green, then shuts off so the blue light can follow the same procedure. Thus, the scanner captures the color information in one pass.

A three-pass scanner uses only one light source and three color filters to create RGB values. The scanner head passes along the image three times, once while the red filter is in position, again for the green filter, and so on. The scanner's internal lamp comes on to

A Scanner Sampler

Aside from flatbed and hand-held devices, there are several other scanning technologies for the Macintosh, ranging in price from $250 for hand-held scanners to more than $70,000 for prepress scanners.

Sheetfed scanners, such as Microtek's MS-II ($1195), are similar to fax machines in that you feed the original page into a slot, where rollers move the page over the scanner's stationary light source and charge-coupled device (CCD) array. Thunderware's ThunderScan Plus ($249) is an unusual example of this genre; its hardware replaces the ribbon cartridge in an ImageWriter, turning the printer into a sheetfed scanner. Sheetfed scanners are ideal for OCR applications and light desktop publishing but are limited by supporting few page sizes. It's easy to inadvertently insert a page at an angle.

With overhead scanners, the scanning head and CCD array are mounted over the platen (glass) to capture the image from above rather than from below (as traditional flatbed scanners do). With this method, you can capture 3-D materials (a telephone, for example), but because light is projected onto the object, high-quality scans are difficult to obtain. Travel sells a 24-bit color overhead scanner, the TruScan 3D Color Scanner, beginning at $8695.

With slide scanners, a piece of film is placed in a slot inside the scanner; light is directed through it and into the CCD array. The results are highly saturated colors and a greater level of detail than you'd get with a reflective scan (with a typical flatbed scanner). Dedicated slide scanners are frequently used for color prepress and other high-end photographic applications and usually offer greater resolution than do traditional flatbed scanners with transparency options. Barneyscan Corporation's $4495 CIS 3515 and Nikon's LS-3510AF Film Scanner ($3935) are two examples of 35mm slide scanners.

Drum scanners are the most expensive, and advanced, scanners for the Macintosh. They originally were available only for high-end Crosfield, Linotype-Hell, and Sixel prepress systems. With this drum process, the original transparency or reflective art is mounted on a scanning drum, while the photographic film to be exposed is mounted on an exposing, or recording, drum. A small spot of light illuminates the copy being made on the film; as the scanning drum rotates, the light spot scans a fine line of copy for every resolution. The result is an extremely-high-quality scan. Because they're expensive—consider that Howtek's Scanmaster D4000 unit represents a significant price breakthrough at nearly $40,000—not to mention complicated to operate and maintain, drum scanners aren't recommended for anyone other than high-end desktop publishers and service bureaus.
record the red information, goes off, comes back on for the green information, then repeats the process for the blue information.

Some scanner vendors are moving toward the one-pass method for several reasons. One is that these devices can sometimes scan faster than three-pass models. (Because implementations often differ widely, there's no guarantee that a particular product will be faster than another.) Another reason is that a one-pass scanner, because it digitizes the image in one fell swoop, is often less likely to cause registration problems than is a three-pass scanner.

But a one-pass scanner sometimes creates slightly fuzzier scans than a three-pass model does. Because a one-pass scanner uses three lamps that flash on and off, it can introduce lighting errors into the process, which translate into reduced sharpness.

Ultimately, the one-pass versus three-pass debate shouldn't be a substantial consideration for anyone buying an inexpensive color scanner. Indeed, don't worry about speed at all—generally, the slower the scan, the better the results.

### Improved Ease of Use

No matter how inexpensive, advanced, or efficient scanners become, they aren't worth much if you can't easily operate them. With this in mind, Light Source developed Ofoto, a breakthrough program that automates a variety of gray-scale scanning functions and controls so that anyone can get acceptable results with a minimum of pain. (For more on Ofoto, see "OneScanner," Reviews, Macworld, February 1992.)

Ofoto (bundled with some scanners and available as a separate program for others) automates most common scanning tasks. For example, Ofoto scans and sharpens an image, straightens it on screen (in case you've inadvertently inserted the original at an angle), and crops the white space around the image. Most important, Ofoto determines for you the image's best scanning resolution and bit-depth values (hue or levels of gray) for the intended output device—a task that has perplexed many scanning novices. This ensures that you get the best-quality output on your printer, without scanning an image at a needlessly high resolution.

In addition, Ofoto offers some basic image controls (rotating, inverting, scaling, and flipping), although you still need Adobe Photoshop or MicroFrontier's Enhance to perform any sophisticated image enhancement (such as blending pixels to rid an old photograph of its scratches). As is the case with auto-everything 35mm photography, you get the best results from Ofoto by taking the time to learn how to adjust controls yourself, as not every scanning job is the same. (Ofoto offers manual control options as well as automatic mode.)

Ofoto is not alone in tackling ease-of-use issues. Flamingo Bay's new ScanPrep Resolution Calculator ($275) calculates resolution for gray-scale and color flatbed scanner users. Tell the program the

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**WHO SELLS SCANNERS UNDER $3000**

<table>
<thead>
<tr>
<th>Company</th>
<th>Hand-Held Scanners</th>
<th>Flatbed Scanners</th>
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<tbody>
<tr>
<td></td>
<td>Black-and-White</td>
<td>True Gray-Scale</td>
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<td>Abaton</td>
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<td>Advanced Vision Research</td>
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<td>The Complete PC</td>
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<td>HSD Microcomputer USA</td>
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<td>Prime Option</td>
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<td>Relax Technology</td>
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<td>Tamarack/Artix Technologies</td>
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<td>XRS</td>
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O = yes; 0 = no.

ADF = automatic document feeder, used for optical character recognition (OCR) applications.

S = slide or transparency mount.

1 A subsidiary of Everex Systems.

2 A subsidiary of Mouse Systems.

3 Gray levels simulated through software interpolation.
resolution of your scanner, the dimensions of your original image, and its final output size, then answer a few multiple-choice questions, and ScanPrep tells you the optimum resolution at which to scan your image. Flamingo Bay sells ScanPrep versions for use with transparency scanners and for transferring high-end scans from a Linotype-Hell or Crosfield system to the Macintosh for PostScript output.

Perhaps taking a cue from Ofoto, Hewlett-Packard recently began shipping an enhanced version of its DeskScan utility for the HP ScanJet IIP and IIC. DeskScan was originally shipped with HP's ScanJet Plus and included the Auto Exposure feature, which automatically adjusts brightness and contrast. For the latest DeskScan version, HP has added AutoFind, which determines if an image is continuous-tone or line art so it can switch automatically to gray-scale or black-and-white mode. DeskScan also now lets you easily select a calibration path.

While they aren't perfect—Ofoto's autocropping feature rarely eliminates precisely what you want it to, and DeskScan, while much improved, can still be cryptic for neophytes—these programs are ultimately as important as price cuts in making scanners accessible to a wider number of users.

There's another ease-of-use development for scanner users—called Twain—but at the time of this writing, it was still on the horizon. Developed by Hewlett-Packard, Caere, Aldus, Logitech, and Eastman Kodak, Twain is an application program interface and protocol—a kind of political unification between scanning hardware and software. (Hence the name: twain means “two,” as in “never the twain shall meet.”) Twain's promise is to let you input an image directly into any DOS or Mac application, as long as both the program and the hardware support Twain. This would work like Photoshop plug-ins but would not be application-specific.

Several companies have announced support for Twain in upcoming products, but ultimately, Twain will most likely benefit product developers more than you or me. The ability to scan directly into an application probably won't be a major advantage to most. With System 7's Finder—which lets you open as many programs as your Mac's memory allows—and enough memory (at least 8MB), moving between an application and a scanning utility on the Mac is only a matter of a few mouse-clicks, anyway.

Bundles and Add-Ons

People don't scan in a vacuum—Their images are meant to be used for real projects—so scanner vendors are increasingly bundling with their scanners valuable software programs—among them, Micro-Frontier's Enhance, Aldus Consumer Division's Aldus Digital Darkroom, and Ofoto for gray-scale images, and Adobe Photoshop and Letraset's ColorStudio for color scanning.

But many vendors bundle only limited editions of some software. Photoshop LE (Limited Edition), for example, which comes with many scanners, lacks the full-blown color-separation capabilities of Photoshop. But it's fine for anyone not involved in prepress work, which means that it's fine for most business users.

If you're buying a scanner for your office or department, you might consider a model that offers an automatic document feeder option, which lets you easily scan pages of text for OCR purposes. OCR packages have shown strong signs of improvement recently. (For a review of OCR packages, see "From Page to Pixel," Macworld, July 1992.) A document feeder can add about $400 to the cost of your scanner, and an OCR package will set you back another $300 to $900, depending on its sophistication.

No Need to Wait

If you're waiting for color scanners to come down even further in price before you buy, that's fine. But as with any computer device, you can count on the fact that tomorrow there will be something cheaper and better than what you buy today—which means you might end up never making a move. And that would be too bad, for scanned images can enliven your documents and presentations, offering images where words just aren't enough. The simple truth is that together, words and images are an unbeatable combination.

See Where to Buy for contact information.

Scanners in Focus

Looking for further information on scanners? Here's where to start.

The October 1991 issue of Macworld contains a Macworld Lab review of 13 gray-scale flatbed scanners ("Scanners in View"). The June 1991 issue of Macworld offers a review of 15 low- to mid-priced color flatbed scanners ("Affordable Color Scanning") and 8 hand-held models, including black-and-white, gray-scale, and color ("One in the Hand"). The Verbum Book of Scanned Imagery, by Michael Gosney, Linnea Dayton, and Phil Inje Chang (M&T Books, $29.95), explains scanning technology in easily understandable terms, offers how-to advice, and includes plenty of sample scanned images.


Macworld Complete Mac Handbook, by Jim Held (IDG Books Worldwide, $26.95), includes a chapter on scanners that provides useful information on how they work as well as tips for getting the best results.

Image '92 is a three-day seminar devoted entirely to the subjects of color and gray-scale scanning, desktop stripping, and color separations on the Macintosh. The seminar, aimed at graphic designers, prepress technicians, and anyone with at least some knowledge of scanning, is held in major cities around the country throughout the year and costs $995. For more information, call ImageXpress at 404/979-8811.
Macworld Lab tests 13 scanners that digitize slides and transparencies

Users of transparency scanners are a varied lot. Artists, archivists, print-production people, designers, businesspeople with slide presentations, multimedia producers—each group has different hardware and software needs. But whatever the job, scanner users want the best image quality possible at the price they can afford to pay.

To sort out how to find a scanner that does the job you need done, and to determine which units deliver the best scans, Macworld Lab tested 13 scanners for ease-of-use and speed, and applied a half-dozen tests for quality-related criteria such as sharpness, color fidelity, and dynamic range—the ability to capture shadow and highlight detail. The price cutoff for this roundup was $16,400; we looked at any model below that price that can scan transparencies, including 5 dedicated slide scanners, 8 flatbeds with transparency attachments, and a couple of inexpensive hybrid designs.

Types of Scanners

35mm slide scanners are straightforward to use: open the door on the bread-box-shape device, slip the slide into metal clips on a movable stage, close the door, and scan. These scanners do only one thing—scan 35mm slides and negatives—but they generally do it better than all but the most expensive flatbeds.

Flatbed scanners resemble small photocopiers. You open the door, lay the artwork on a glass platen, close the cover, and scan. Most of the transparency attachments in this review replace the scanner cover with a panel that opens and closes on a hinge and illuminates the transparency from above. A few units do away with the cover altogether and simply suspend a light source above the scan bed.

In either case, flatbed transparency attachments are awkward, retrofit affairs. To use them with slides you have to do things like cut windows in plastic sheets to make masks (these stop light from flooding the image), unmount the slide, and then tape the slide to the mask and the mask to the scanner. And only expensive flatbeds have resolution ratings approaching those offered by inexpensive, dedicated 35mm scanners.

The advantage of flatbeds with transparency units is that they can scan just about anything in the two-dimensional world, from X-ray film to watercolor sketches to dried flowers. One would like to say that flatbeds with attachments can do the job of two scanners, but the limited resolution and image quality of all but the most expensive models makes the cross-breed feel more like one-and-a-half machines. Unfortunately, flatbed makers tend to price transparency units as though they were half a scanner.

Coming to a Resolution

Scanner resolution ratings tell you how many image measurements, or samples, a scanner makes per inch. A higher-resolution scanner typically can produce bigger, sharper images. But scanner makers charge high prices for high resolution. How much resolution is enough for your needs?

The answer depends entirely on how you're going to use your scans. Producing film separations for print is a resolution-hungry application. If this is your reason for buying a scanner, the easiest way to figure out your resolution needs is to check the table "Resolution and Print Dimensions," which shows the maximum enlargements possible from a 35mm slide using various scanners and assuming some typical halftone resolutions. As you can see, 600-dots-per-inch resolution is the bare minimum for 35mm slides intended for print.

Printing to a film recorder also requires lots of data. If you use a 35mm recorder, look for a scanner that has resolution at least equal to the resolution you use for film-recorder output.
Image sharpness increases progressively as scan resolution approaches twice that of the output figure; after that, you get diminishing returns.

People who make scans for on-screen display don’t have to worry much about resolution unless they typically crop slides severely. The smaller the image scanned, the higher the scanning resolution required to enlarge the image. The only scanners in this article that can’t produce a photographic-looking image larger than an Apple 13-inch monitor are the Raster-Ops Expresso Personal Slide Scanner and the Niscan Spectra.

When comparing scan-resolution ratings, be sure the number you’re looking at is the optical resolution. Scanner makers and salespeople have a bad habit of quoting figures for interpolated or nonproportional resolutions instead. Interpolation is an image processing technique by which a program simulates a higher resolution than the scanner actually captures—helpful for avoiding jaggies when you blow up a scan beyond its normal limits. But like most synthesized commodities, interpolated data is a poor substitute for the real thing.

Nonproportional scanners collect more data in the vertical direction than in the horizontal one, then use interpolation to build up the resolution on the weak side. Nonproportional files offer about the same amount of image detail as scans with a resolution midway between the nonproportional rates. So, having a 300-by-600-dpi scanner is almost as good as having a 450-dpi machine. The disadvantage
SEEING THROUGH SLIDE SCANNERS

is that the files you create take up as much space as 600-dpi files—about 78 percent more space than 450-dpi files.

Tonal Control: Hardware Factors

ANYONE WHO HAS USED A GOOD camera knows that taking good pictures involves adjusting exposure. Scanners have much more flexible controls than cameras, but the idea is the same: adjusting the scanner so that it responds differently to different slides is essential to making optimal scans.

This is true not only because slides vary considerably, but also because all slides contain a lot more visual information than Mac scanners can capture. A 24-bit scan captures 256 shades (8 bits) per red, green, and blue color channel, while a color transparency can contain thousands of shades per color. Without the ability to adjust the scanner’s tonal response, your chances of capturing the 256 shades that best represent the slide’s information are slim. Unadjusted scans typically miss shadow detail or drop the highlight information—or both.

Scanners achieve tone corrections in three basic ways. Two ways make a difference in getting the best possible scan. The third is irrelevant—but it’s the cheapest and easiest to implement, and therefore the most commonly found.

The method that doesn’t make a difference I call 8-bit processing. In 8-bit processing, a scanner simply takes 8 bits of data per color channel from the device within the scanner that converts analog light signals to digital information. It then runs the data through a software lookup table that adjusts the values—for example,

### RESOLUTION AND PRINT DIMENSIONS

<table>
<thead>
<tr>
<th>Input (device) Resolution</th>
<th>Output (effective) Resolution</th>
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</thead>
<tbody>
<tr>
<td>128 dpi (85 lines at 1.5:1 ratio)</td>
<td>200 dpi (133 lines at 1.5:1 ratio)</td>
</tr>
<tr>
<td>225 dpi (150 lines at 1.5:1 ratio)</td>
<td>300 dpi (150 lines at 2:1 ratio)</td>
</tr>
<tr>
<td>600 dpi (Imapro QCS-600)</td>
<td>1000 dpi (Bernerscan CIS 3515)</td>
</tr>
<tr>
<td>1850 dpi (Mikrotek ScanMaker 18505)</td>
<td>3175 dpi (Nikon LS-3510AF)</td>
</tr>
<tr>
<td>4000 dpi (Leaf LeafScan 35)</td>
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</tr>
<tr>
<td>4.4&quot; X 6.6&quot;</td>
<td>7.4&quot; X 11&quot;</td>
</tr>
<tr>
<td>2.8&quot; X 4.3&quot;</td>
<td>4.7&quot; X 7&quot;</td>
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<tr>
<td>2.5&quot; X 3.8&quot;</td>
<td>4.2&quot; X 6.3&quot;</td>
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<tr>
<td>1.9&quot; X 2.8&quot;</td>
<td>3.1&quot; X 4.7&quot;</td>
</tr>
<tr>
<td>13.6&quot; X 21.2&quot;</td>
<td>8.7&quot; X 13.1&quot;</td>
</tr>
<tr>
<td>7.8&quot; X 11.7&quot;</td>
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<tr>
<td>29.5&quot; X 44.3&quot;</td>
<td>18.9&quot; X 28.3&quot;</td>
</tr>
<tr>
<td>16.8&quot; X 25.2&quot;</td>
<td>12.6&quot; X 18.9&quot;</td>
</tr>
</tbody>
</table>

Why buy a high-priced, high-resolution scanner? The most common reason is a desire to print at larger sizes and finer line screens. This table shows maximum output dimensions of 35mm slides scanned on various machines and printed at typical line screens. For output resolution, effective refers to the resolution achieved after a scan has been enlarged (enlarging reduces resolution, since image samples are spread over a larger area). Ratio refers to the relationship between scan resolution and halftone linescreen. A ratio of 1:1 is the minimum; 1:5:1 provides good image sharpness; 2:1 provides maximum sharpness.

A scanner creates a screen image by converting light from a transparency image into electrical impulses that can be interpreted as digital data. A charge-coupled device (CCD) changes the light to electricity. CCDs consist of a silicon semiconductor and a series of electrodes. When light passes into the silicon, that light frees electrons within the silicon atoms. The brighter the light at a given point on the image, the more electrons are freed. Those electrons build up a negative charge in the silicon around the CCD’s positively charged electrodes (A). Then the charges are moved, in inchworm fashion, to the scanner’s electronics for conversion into digital data. To move the charge, the CCD first turns the current on for a pair of electrodes, and the charge gather around both (B). Then the current to the first electrode is cut, and the charge moves completely to the second (C)—CHARLES PILLER

Charles Piller

McWorld

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enhancing brightness—according to your instructions. While this technique can make a scan look better, it can’t buy you any new information about the image. You’re simply optimizing the appearance of the 256 values you’ve already collected.

Eight-bit processing is the type of processing Adobe Photoshop and most other Mac image editors perform—which is exactly why it’s irrelevant to scan quality. In most cases where 8-bit processing is the only option, it’s easier to just make post-scan corrections in Photoshop, where you have more control over the results.

The other two tone-correction methods actually bring new information—and therefore new image detail—into the scan. One method involves adjustments made before the data hits the analog-to-digital converter. To brighten a scan, for example, many scanners simply crank up the light source or increase exposure time. Another common technique is to reset the sensitivity of the analog-to-digital converter by changing its reference voltages—the electric charge values it interprets as black and white.

The Nikon LS-3510AF Film Scanner passes the charges through circuitry that boosts or dampens their strength, effectively causing the scanner to read the charges as brighter or darker light impulses. While hardware tone corrections make more meaningful changes than does 8-bit processing, the level of control they offer typically isn’t as precise as that provided by digital image processing. Relatively precise analog methods, like the Nikon’s, are expensive to implement.

The third adjustment strategy involves simply collecting more than 24 bits of data. For example, instead of 256 shades per color channel, the LeafScan 35 captures more than 65,000 values (16 bits per channel). With all that extra input, you can sift, sort, and select quite a bit yet still deliver a full complement of 256 (optimized) values to the Mac when you save the file.

Collecting more than 8 bits per channel also helps to get around the electronic noise problem that afflicts all the scanners in this article. Scanner noise is inaccurate data caused by interference from a variety of physical and electronic sources. The more data the scanner collects, the less significant the noise is as a percentage of the total information available, and the fewer errors noise causes. (Noise usually forms streaks or random tone variations in dark areas of an image.)

**Tone Controls: Software**

**HARDWARE CAPABILITIES CREATE THE potential for meaningful tone adjustment, but software gives you the tools for working your will on an image. The most critical controls are those that enable you to match the tones the scanner captures with the brightness range of an image. The clumsy way to do this is through brightness and contrast settings.

Imagine a scanner as a net that you cast out over a stream of fish representing brightness values. The net can hold only 256 fish, and you’re trying to catch a particular school. Brightness adjustments control how far up-or downstream you throw the net, while contrast settings determine how broadly or narrowly you cast. Obviously, catching the fish you want—those fish and no others—requires both controls.

Actually, using brightness and contrast to control the range of a scan is just about as precise as the fishing simile suggests. The process usually involves scanning, measuring the scan in Photoshop, adjusting one or both settings, and then rescanning—over and over.

The better scanners use more-elegant approaches to solving this problem. The Nikon and Leaf automatically analyze the prescan and make a stab at an automatic adjustment. For those who want more control, the Set Highlights tool in Barneyscan’s CIS 3515, Leaf Systems’ LeafScan 35, and Imapro’s QCS-600, and the Set Shadow tool in the Leaf machine let you click on areas of the prescan to identify which parts of the image the scanner will assign to values 256 (highlight) and 0 (shadow). Other scanners can crop the prescan so that only a limited area is considered in the scanner’s automatic range calculations, which achieves almost the same purpose.

The Leaf and Imapro units, as well as the Sharp JX-600S and the Umax UC-1200S, offer a further level of tone control. Once you’ve staked down your highlight and shadow points, it’s often desirable to adjust the distribution of tones between those poles. Entering a new gamma number enables you to assign a disproportionate number of the 256 shades at your disposal to, say, the midtones of an image, thus sharpening details in that part of the slide.

**Good, Better, Out of Our Price Range**

Scans by an $80,000 Scitex SmartTwo (top), the Nikon LS-3510AF (middle) and the Barneyscan CIS 3515 (bottom). The CIS 3515 gives very nice color, but showed marked noise problems in some scans. Also, notice the variations in shadow detail in the Asian woman’s hair.

Even more advanced is the ability to create custom tone curves that let you reassign values in the highlight, midtone, and shadow areas individually. At this writing, only the LeafScan 35 offers this capability. By the time you read this, new software for the Nikon scanner should give tone-curve control to those with the 12-bit option installed.
You should be aware that while many of the scanners in this review appear to have a complete set of the tone tools just discussed, it's not uncommon for scan programs to mix controls that invoke 8-bit processing with other, more meaningful types of adjustment. "Slide Scanners at a Glance" lists only those tools that we determined make changes you couldn't make in Photoshop.

"Slide Scanners at a Glance" also includes a number of software features that are useful but do not directly relate to a scanner's ability to produce top-quality scans. This list provides an index of the care that went into producing a scanner package.

A few items require a word of clarification: "Calculate Output Size and Resolution" refers to a program's ability to tell you what a scan's final, effective resolution and dimensions will be once the image has been enlarged by the amount chosen. "Maintain Prescan between Scans" refers to an ability that's essential in my book. Without it, every time you need to rescan an image for whatever reason, you also have to re-create the prescan.

"Magnify Prescan" is the ability to zoom in on the prescan. This feature can save quite a bit of rescanning time by keeping you from missing your intended subject when you are cropping a tiny, 35mm prescan.

**Recommendations: Flatbeds**

The good and somewhat surprising news about flatbed scanners is that it's possible to use them for color publishing—which is great if you need the flexibility flatbeds afford. The bad news is that if you want a flatbed that has the ability to do prepress work, it'll set you back at least 14 grand.

Unless you always print at low resolutions or small sizes—or from large transparencies—and you are not very 

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**SLIDE SCANNERS AT A GLANCE**

<table>
<thead>
<tr>
<th>Company</th>
<th>Model</th>
<th>Price</th>
<th>Price Transparency Option</th>
<th>Bundled Software</th>
<th>Bits Channel</th>
<th>Optical Resolution (in dpi)</th>
<th>Maximum Scan Area</th>
<th>Maximum Scan Reflective (in days)</th>
<th>Warranty</th>
<th>Technical Support Rating</th>
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<tr>
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<td>CIS 3515</td>
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<td>1850</td>
<td>35mm</td>
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<td>365</td>
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<td>LS-3510AF</td>
<td>$9535 (8-bit)</td>
<td>NA</td>
<td>Photoshop or ColorStudio 1.5</td>
<td>8 and 12</td>
<td>3175</td>
<td>40mm</td>
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<td>Expresso Personal Slide Scanner</td>
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**FLATBED**

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<td>$495</td>
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<td>Nisa Spectra</td>
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<td>8.5° X 13.5°</td>
<td>365</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

* = yes; 0 = no. *12-14 = excellent, 9-11 = very good, 7-8 = good, 5-6 = satisfactory, 1-4 = poor, <1 = unsatisfactory. *1 For tested scanners, credit given for exposure and other tonal adjustments only if controls affect analog data or lookup tables of greater than 8 bits. *2 Highlight only. *3 To avoid confusion over differences in definitions between companies, features listed only for scanners tested. *4 12-bit board as an upgrade is $1780. *5 12-bit version. *6 AS6000, with 600-by-600-dpi resolution available for $1699. *7 Scan-X Grayscale available for $1295. **See Table on slide scanners at a glance.***

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**SEEING THROUGH SLIDE SCANNERS**

The good and somewhat surprising news about flatbed scanners is that it's possible to use them for color publishing—which is great if you need the flexibility flatbeds afford. The bad news is that if you want a flatbed that has the ability to do prepress work, it'll set you back at least 14 grand.

Unless you always print at low resolutions or small sizes—or from large transparencies—and you are not very...
fussy about quality, the only models I can recommend are the Imapro QCS-600 and the Sharp JX-600S. Both units are based on the same design, by Sharp, and both provide high-quality separations.

Of course, quality isn’t everything. Both machines are large, slow, and awkward to use, and they don’t carry adequate warranties. And both provide only the minimum resolution for 35mm.

If I had to pick, I’d probably go for the Imapro, which has some added processing circuitry that eliminates the streaking the JX-600S is prone to. In addition, the Imapro software helps you get the right exposure, instead of dooming you to trial and error as the JX-600S’s extremely basic package does. And Sharp’s tech-support line is so busy as to be virtually worthless, while Imapro was accessible and helpful.

If you want a flatbed-and-slide scanner for less demanding jobs such as producing mock-ups or on-screen presentations, you have two choices: the ArtiScan 6000C and the Sharp JX-320. Both machines can produce good-looking scans larger than an Apple 13-inch monitor, in under 30 seconds. Scans from the JX-320 are noticeably sharper, but the Arti-Scan lists for $600 less and comes with a one-year warranty instead of the 90 days covered by Sharp.

A new machine, the Agfa Arcus Color Scanner, should have a transparency option by the time you read this. The Arcus has similar hardware features to the Umax UC1200S but, including the transparency attachment, it beats the UC1200S’s price by $1440. From what I’ve seen, it also comes with much more useful software than the Umax’s.

If you need to scan 8½-by-14-inch items, don’t be tempted by either the XRS OmniMedia 6cx or the Umax UC630 Color Scanner. Both were among the poor-
### Scanner Speed

**Times are in seconds; shorter bars are better.**

<table>
<thead>
<tr>
<th></th>
<th>Gray-Scale Prescan</th>
<th>Color Prescan</th>
<th>Final Scan</th>
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<td><strong>35mm Scanners</strong></td>
<td></td>
<td></td>
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<tr>
<td>BarneyScan CIS 3515</td>
<td>19</td>
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<td>98</td>
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<td>Leaf LeafScan 35</td>
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<tr>
<td>Microtek ScanMaker 1850S</td>
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<td>115</td>
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<tr>
<td>Nikon LS-3510AF/12 (fast)</td>
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<td>Nikon LS-3510AF/12 (high quality)</td>
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<td>Nikon LS-3510AF/8 (fast)</td>
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<td><strong>Flatbed Scanners</strong></td>
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<td>Sharp JX-320 (fast)</td>
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<td>Sharp JX-6005 (fast)</td>
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<td>Sharp JX-6005 (high quality)</td>
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<td>Umax UC1200S</td>
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<td>XRS Omnil/Media 6xc (high quality)</td>
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A 35mm color slide was scanned for all tests. Flatbed resolution was 300 dpi; 35mm scanners were tested at 1000 dpi. The test computer was a Mac IIci with an Apple cache card and 8MB of RAM. Some scanners operate faster in either landscape or portrait mode; all times are for the faster orientation.

*est performers in our color-response tests. The XRS—basically a Microtek 600ZS with a transparency attachment added—is blurry and extremely noisy, which leads to very bad shadow-detail discrimination.*

**Recommendations: 35mm**

**IN THE 35MM ARENA, ONCE AGAIN**

the only options for the prepress set are expensive. Both Leaf and Nikon offer capable machines and include polished software modules that help you to get excellent results. The units do have their respective strengths and weaknesses, however.

The main point in the Nikon LS-3510AF Film Scanner’s favor is that it was better able to resolve small detail in our tests, despite the Leaf’s higher resolution rating. The problem here seems to be the Leaf’s fixed-focus design; the scanner is focused at the factory, where an assumption is made about the thickness of the slide holders you’ll use. The Nikon focuses automatically during prescan.

Our experience also showed the Nikon to be the more reliable machine. We had to get Leaf to ship us three different LeafScan 35’s into the lab before we found one that didn’t have some kind of problem. This might just have been bad luck, but it casts the Leaf’s 90-day warranty in a worrisome light.

The LeafScan’s edge is that it has a higher bit depth than its direct price competitor, the Nikon with an 8-bit option. This gives the LeafScan more dynamic range, and it gives experienced users who know their way around a gamma curve more tonal control than they would have with the Nikon.

The 12-bit option for the Nikon, which you install as a plug-in board, should give the LS-3510AF capabilities similar to the LeafScan’s—albeit at a higher price. When this was written, the Nikon software driver wasn’t able to effectively access the 12-bit data, so we weren’t able to test the upgrade.

If you need a less expensive 35mm scanner, your choices are a mixed bag. The BarneyScan CIS 3515 produces far better color than does the Microtek ScanMaker 1850S, and the BarneyScan software is much more useful. On the other hand, the Microtek sells for less than half the price and offers almost twice the resolution. Both scanners have problems holding shadow detail, but either one will provide better quality than a low-price flatbed. The mira 35, from Santos Technology, is the first inexpensive 10-bit Mac scanner. It offers a resolution of 2700 dpi and has a projected price of $2695. It began shipping after our test deadline.

By the time you read this, another new medium-price 35mm scanner should be available. An upgrade to Eastman Kodak’s Rapid Film Scanner, the RFS 2035, is a 10-bit, 2100-dpi device that will sell for $7995.

Two other units not covered in this article will be of interest to people who want to scan transparencies up to 4 by 5 inches in size. Microtek should be selling its new 12-bit 45T by the time you read this; at press time, the company had not announced a price. And Leaf has announced that it will be holding a closeout sale on the current implementation of its Leaf 45 before bringing in a new version. The scanner, which usually sells for $22,995, will go for $14,900.

**Scanning on the Cheap**

MY BASIC ADVICE ABOUT THE RASTER-OPS Expresso Personal Slide Scanner and the Niscon Spectra: don’t bother. Even for

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The Good and the Mediocre

Scans by the Imaprio QCS-600 (facing page, right) and Tamarack/Artix Artis 6000C (facing page, left) give an idea of the quality flatbeds are capable of. Compare the sharpness of the Imaprio versus that of the Tamarack/Artix to appreciate the difference between the Imapro’s true 600-dpi and the Tamarack/Artix’s 300-by-600-dpi files.
Dynamic Range and Saturation

Good and poor dynamic range.

LeafScan 35
Omnimedia 6cx

Dynamic Range
This test measures a scanner’s ability to detect subtle differences in brightness at the extreme ends of the tonal scale—100 is black, 0 is white. This is important, because highlight and shadow detail are what give an image the illusion of three-dimensionality.

Saturation
This test rates scanners by how efficiently they separate the color spectrum into the three primary colors red, green, and blue. A small amount of “crosstalk” between color channels can be desirable. But for our purposes, the lower the number, the better the scanner’s ability to distinguish among colors.

Video scanner: saturation test not applicable. ** Scanner can produce corrected scans only.

35mm Scanners
BarneyScan C1S 3515
Leaf LeafScan 35
Microtek ScanMaker 1850S
Nikon LS-3510AF (B- and 12-bit)
RasterOps Expresso

Flattened Scanners
Imapro QC5-600
Nisca Niscan Spectra
Sharp JX-320
Sharp JX-620S
Tamarack/Artix ArtiScan 6000C
Umax UC630 Color Scanner
XRS Omnimedia 6cx

Longer bars are better. Shorter bars are better.

For some users, however, the best way to meet their scanning needs may be to buy a CD ROM player. Kodak’s Photo CD program, which should be up and running by the time you read this, promises high-quality 35mm scans at about a dollar apiece (see “CD ROM Drives: Into the Mainstream,” in this issue).

If you decide to buy your own device, remember that using a scanner is a lot like using a camera. You can always operate in automatic mode, but getting professional-looking pictures requires know-how and practice. If you’re really interested in quality imaging, your efforts at learning about how scanners work won’t end when you’ve finished this article.

Contributing editor Joe Matazzoni writes about desktop publishing and multimedia. He lives in Oakland, California.

Macworld Lab testing supervised by Mark Hurlow.
Human eyes are superb at locating edges and color in images, and at estimating sizes of objects in a view with known perspective. For our first half million years, these functions were necessary for survival. But our eyes are not particularly good at deciphering a mass of text with a quick glance and yet a table of numbers is usually the most accurate representation of business and scientific data.

Thus, if you can translate a table of numbers into a picture, people will perceive your data much more easily. But if you're not careful about presentation—particularly in matters of perspective and scale—a picture can be remarkably misleading. It's easy with gee-whiz features in today's presentation, graphics, and publishing software to obscure or even alter the data's real message by using the wrong effects or by using the right ones incorrectly.

The best software for translating numbers into pictures runs on the Mac, but you may find little documented guidance for the actual process of translation. This article presents a gallery of data-representation examples.

**Distortion from Special Effects**
Consider the first graphic in "Distorted Data." It was drawn in DeltaGraph Professional, one of the most capable and easiest-to-use graphing programs. DeltaGraph takes advantage of 3-D presentation features that are only partially implemented in the newest spreadsheets. The graphic makes a dramatic conference-room slide. It's also a fairly misleading picture of the underlying numbers.
This ribbon chart has two problems. You cannot simply look at the picture and decipher, point by point, the original numbers underlying the table—you can do this more easily with a simple line chart. The second problem is that the viewing angle deemphasizes the last numbers in the series. By inadvertently rotating the “glass brick”—the 3-D grid in which the ribbons float—you can make the ribbons appear to zoom away from each other (if viewed from the right corner) or nearly converge (if viewed on a slant from the chart’s origin).

The same data would also be distorted, although perhaps not to the same extent, by the familiar 3-D bar chart format offered in most business graphics packages. It turns out that, in this case, the least-imaginative graphic, the line chart (also shown in “Distorted Data”), gives the least-biased representation of the original numbers.

As luck would have it, several other ways to make plain numbers into exciting graphics are also fraught with problems. For example, suppose you want to represent the net worth of executives as a row of money bags, as Macworld did in its February 1992 article “Year in Review” (reproduced here as “Overstating the Case”). If you make the bag for Microsoft’s Bill
WHAT'S WRONG WITH THIS PICTURE?

Distorted Data  The dramatic presentation-quality ribbon chart (top) makes a 3-D graphic out of data that's really only two-dimensional, making an accurate reading more difficult. A bar chart's straight-on perspective (middle) eliminates the confusion introduced by the ribbon chart's skewed perspective, but the alternating bars make it hard to follow the data's trend. The much plainer line chart (bottom) presents the same data in a way that lets you reconstruct the underlying numbers easily by eye.

Overstating the Case  When using basic shapes to show differences in scale, it's typical—but wrong—to double the size both vertically and horizontally to show that something is twice as big as something else. But doubling along both axes makes the difference 4 to 1 rather than 2 to 1. Macworld made just this mistake in an earlier issue's graphics.

True Differences  For regular objects, such as triangles and bars, people can see small changes in edges better than they can see small changes in area—it's far easier to pick out differences in this data looking at the bars. By the way, if you need to present numerical data to cats, always use bars. Cats basically just see edges, according to recent research.

Gates, who is worth $4.8 billion, twice as big as the bag for Microsoft's cofounder Paul Allen, who is worth $2.3 billion, you will show a symbol with four times the area of the single worth unit (as was done in "Year in Review"). If, more accurately, you use a bag for Gates twice as high as the bag for Allen, you find that you can't represent much range without ridiculous distortion of the symbol. If you make Gates's bag have twice the area, it won't appear to be twice as big, since people are better at estimating size differences of regular objects along one dimension than along two or more dimensions.

Does this mean that all attempts to liven up a presentation result in distortion? Not necessarily, but it means that the effects of filtering our new reams of data through our old Stone Age visual system need to be considered carefully. Properly applied, graph elements, space, and color can make data representation both interesting and accurate.

A Table of Elements  Virtually all programs that handle numbers let you make up pie charts, bar charts, and line charts. So when do you choose one type of chart over another? Consider the data table and associated Microsoft Excel 3.0 charts in "True Differences." That image demonstrates how hard it is to pick out small differences in angles but how easy it is to pick out small differences in bar height when the bars are adjacent. Pie charts work well to show relative, gross differences. For example, in "True Differences," the pie chart shows that the three pieces of data are roughly equal. Bar charts work well to show slight differences among similar data, as the figure shows. Which you pick depends on what you want to emphasize. Bar charts also work better when you have many small quantities, since small quantities can get lost in a series of small pie slivers; in a bar chart, each bar has the same weight along one dimension, and the small data are readily apparent in the other dimension by their obvious lack of presence.

There are, in statistics programs, more-exotic ways to represent any set of data. Because people are very good at picking out differences in the areas of irregular objects, advanced statistics programs give you the option of displaying quantities as "blobs"—stars, sunflowers,
and other symbols that provide you with several outside edges.

An even more imaginative use of graphic elements was introduced by the American statistician H. Chernoff in the 1970s. Not only is a person's visual system good at discriminating certain kinds of small differences in objects, but it's really impressive at evaluating facial expressions—you can probably detect a slight frown from three blocks away. "How Did You Do?" shows a sales data set represented by SYSTAT 5.2 in this whimsical but surprisingly useful mode. The faces are most useful for large data sets; it is possible to devise a ratings scheme in which people can pick out the "happiest" face (using ratings of several variables) from a set of nearly 100 faces printed in a small area.

**Scattered in Space**

*LooK AT THE DATA IN THE TABLE IN "Scattered Scatterplots" and then look at the standard spreadsheet scatterplots. This is an exceptionally clear example, formulated by F. J. Anscombe, in which the tabular data shows you almost nothing—the statistics for the two data sets are nearly identical—but simple scatterplots make the underlying trends in the two data sets absolutely clear.

The scatterplot is the preferred vehicle for scientific exposition (you can find scholarly journals in which it is the only type of graphic displayed throughout an issue) because it's intrinsically nondistorting and can handle lots of data. Where pie charts start to get cluttered at 6 values and bar charts look like cityscapes beyond 15 categories, several hundred points can fit on a scatterplot with no visual problems.

The standard scatterplot is good for two-dimensional (x-by-y) cases, like housing starts per county versus county family income, or weight at age 40 versus lifetime doughnut consumption. For data comparing more possibly related variables—different types of crime, for example—another representation is needed. That's why the graphics in "Scattered Scatterplots" wouldn't work for such kinds of relationships. The trick for extending the usefulness of the scatterplot is to find a way to represent higher-dimensional spaces.

The first space-expanding technique developed for this situation was the scatterplot matrix. The principle is simple, as shown in the SYSTAT 5.2 scatterplot matrix in "Correlating Crimes." If you have four crime variables to inspect, you make up scatterplots of each set of pairs of variables and arrange them in a grid. You can then view the set of scatterplots, looking for cases where the data clusters along a line or curve.

The scatterplot matrix exploits two strengths of the scatterplot. First, a scatterplot can be reduced to a fairly tiny scale and still give the same information on quick inspection. Second, even a black-and-white dot matrix printer can do a respectable job of hard-copy production (the method appeared in early statistical computing on mainframes in the 1960s). As a technique to help you in a blind search for some sort of connection in a group of variables, it's hard to beat.

But now that computer displays have progressed from monochrome character-based output to movielike 3-D, there's another method that's a sort of scatterplot on steroids—the rotating 3-D scatterplot. In this technique, you select three variables at a time from your data table, and the Mac creates a plot of points inside a small area.

**Data-Representation Software Picks**

There is no shortage of Mac products designed to enhance the graphical display of data. Among the better ones are the following.

- **Presentation packages** Although their flashier chart types should be used with caution, many presentation packages offer effects that will wake up a figure-weary audience. DeltaPoint's $295 DeltaGraph Professional and Bravo Technologies' $199 MacGraphX are notable for a variety of graphs and charting control, while Aldus's $495 Persuasion, Microsoft's $395 PowerPoint, and Computer Associates' $199 CA-Cricket Present are leaders at producing charts as slides and overheads.

- **Exploratory charting** The giant $895 program SYSTAT 5.2, from SYSTAT, includes nearly every data representation ever developed, right down to QuickTime movies of scatterplots. Other programs with strong exploratory-data charting are Data Description's $595 Data Desk and SAS Institute's $695 JMP. Still the champion at 3-D visualization is Abacus Concepts' $295 MacSpin.

- **Scientific analysis** The leading color 3-D visualization system for the Mac is a suite of three programs—the $495 Transform, $195 Format, and $495 Dicer—from Spyglass. For visualizing computational data, the $399 95 symbolic math program Theorist, from Prescience Corporation, is probably easiest for beginners to use, while Wolfram Research's $599 Mathematica ($895 for the coprocessor version) offers more scope at the cost of a steeper learning curve. Later this year, the powerful numerical computation package MATLAB from The MathWorks is expected to add to the Mac version (currently $795) the impressive color 3-D graphing capabilities now available in its $2995 Unix workstation version.
WHAT'S WRONG WITH THIS PICTURE?

In Orbit Because color scales can represent arbitrary quantities, they can represent things that can't be seen or felt. This plot shows electron density in an atom's orbital shell.

Seeking a Relationship in a Data Stack This 3-D plot relating automobile gas mileage to engine displacement and number of cylinders is another type of spatially expanded scatterplot. With appropriate color coding (here yellow indicates the large engines and red indicates small engines), a rotatable 3-D plot is the most powerful tool for visualizing data.

Scattered Scatterplots The two data sets shown here are characterized by the same statistics (mean, standard deviation, and regression line). The scatterplots in this case make obvious the differences that the statistics do not.

Correlating Crimes A scatterplot matrix lets you survey many relationships at once. Here, from data on 50 states, you can see a correlation between murder and rape but not between murder and auto theft.

The Importance of Correct Colors IN THE PROFESSIONAL HANDBOOKS ON graphing, color has two recognized uses: quantization and categorization. The concept of color quantization is not profound—orange as hot, red as very hot, blue green as cold, and blue as freezing is the most typical use of this technique in everyday life. The familiar USA Today weather map is an example.

But some uses of color quantization are more subtle. Color can be used to add another dimension to a 2-D plot, as well as to plot quantities that have no direct sensory analog, as is often the case with scientific data. A common use of color quantization in science divides an arbitrary numeric scale into a color scale. An example is the colorization of charts dis-

transparent cube that you can rotate around any of the three axes. (We used Abacus Concepts' MacSpin 3.0 to show the plot in “Seeking a Relationship in a Data Stack.”)

Picking out a relationship in this kind of plot is simple. You set the cloud of data points to rotate slowly around the axes, one axis at a time. If the cloud always looks like intergalactic mush, it means that there isn't a strong relationship between one variable and another. On the other hand, if some viewpoint on the cloud makes the points appear to compress or somehow line up, as in the example plot, you have discovered an underlying connection.

In the classic example given here, one view of the cloud simply shows that larger engines generally get worse gas mileage, but the technique works just as well for less commonplace observations.

In an advanced three-dimensional scatterplot application, you can actually display a fourth variable (usually time) by letting this variable control an animation. You can watch the cloud of points evolve in time as you rotate them, so that time trends in data can be picked out separately from correlations between variables. With a little experience, you will be able to perform qualitatively correct analyses by eyeball, in a few minutes, something that would have constituted month-long studies with mountains of printouts only a few years ago.

The message is this: With the right representation of data, you can simply see what the data is telling you.
WITH THE RIGHT REPRESENTATION OF DATA, YOU CAN SIMPLY SEE WHAT THE DATA IS TELLING YOU

The way to Moscow follows the actual route they took. Its width is based on the number of soldiers alive at each point along the way, graphically showing how many soldiers died. The black path follows the route of their retreat. Below the paths is a temperature chart showing the temperatures during the dates of the retreat. From October 18 to December 7, 1812, the temperature ranged from 0 degrees Centigrade (32 degrees Fahrenheit) to -26 degrees Centigrade (-15 degrees Fahrenheit), which was a main reason that so many soldiers perished during the retreat.

It's tempting to make the effects of the temperature more obvious by colorizing the retreat path so that the color changes (perhaps from light blue to dark blue) as the temperature declines. But the path is too thin to effectively show such color changes, and using color changes without the temperature graph would make it too hard to see the actual temperature on any given day.

The Tools Are at Hand
WITH THE HUMBlest INTEGRATED software package for beginners, and a few days of practice on a Mac LC, you can produce data graphics that would have astounded the world ten years ago. With the most advanced graphing software (and equivalently powered Mac hardware), you can produce results that will astound the world now. Despite the orientation of many programs toward the producing of “conference room” three-dimensional bar charts, you are likely to find unusual and impressive styles of graphics that lend themselves to experimentation if you poke around in the program’s features. m

See Where to Buy for contact information.

A research analyst and consultant, CHARLES SEITEr is also a Macworld contributing editor who usually writes about mathematics, spreadsheets, and statistics.
HOW TO MAKE YOUR FIRST
DIGITAL MOVIE

APPLE'S NEW DIGITAL-MOVIE TECHNOLOGY has hit the streets, and there are already enough QuickTime products for sale to make your head spin. Wasn't QuickTime supposed to make moviemaking simpler?

Fear not: here's the recipe. First, though, some psychological prep work—steel yourself to pay between $500 and $8000 for a digital movie-editing studio inside your Mac. Prepare to learn some new terminology. Make a lot of room on your hard drive—or, if you have a Bernoulli or SyQuest drive, grab a couple of blank cartridges. Understand from the get-go that we're not talking about Technicolor quality here—more like Max Headroom. And without an extra converter box, or a high-priced video board, you can't record the finished product with your VCR.

But rest assured that the jerkiness, high disk-space overhead, and tiny picture size of today's QuickTime movies will be state of the art for about as long as the 400K floppy disk was. By the time you read this—or much sooner—newly engineered products will flood the market. They'll make your movies smoother, more colorful, and more compact on your hard drive.

One Unpeeled Mac

LOGICALLY, DIGITAL MOVIES ON THE Mac shouldn't be possible at all. If you've worked with graphics, you know that just one color picture can take up a megabyte of disk space. When you watch TV, you're watching 30 pictures, or frames, per second. So you're going to ask the Mac to store—and play back—30MB per second? What are you, crazy?

That's why QuickTime is such an achievement. It pulls every trick in the book to reduce the amount of information necessary to display video. First of all, most QuickTime productions play in a rectangle that's 160-by-120 screen dots (pixels) square—that's ¼ the size of the standard screen and much less information to store. Next, QuickTime compresses the file, discarding redundant information as it analyzes the color information in the movie.

Despite these data-reducing shenanigans, the Mac must still process a huge amount of information every second. Therefore, the first item in your equipment list for Desktop Pictures, Inc., is a fast Mac. At minimum, you need a 68020 processor Mac; you also need at least 5MB of memory and System 7. If you want to make your own movies with a camcorder, instead of just playing other peoples', you need a digitizing board. Technically, you don't need a color monitor, but QuickTime isn't very impressive in black and white. Finally, you need the QuickTime extension itself—a 440K file you can get from a user group, Apple dealer, or online service.

Stir In Video

TO MAKE YOUR OWN DIGITAL OPUS, BEGIN with a video source. A TV cable, VCR, or laser disc is fine if you want to play around with existing footage and can get permission to do so legally; get a camcorder if you want to shoot your own. With the relatively low quality of today's QuickTime flicks, the tape format doesn't much matter: composite, or home-video gear (like the VHS, VHS-C, and 8mm formats) make just as good digital movies as the more expensive component gear (S-VHS and Hi8 formats). (Better yet, of course, are professional ¼-inch tape decks, which produce the highest-quality picture signal of all—the three-channel RGB signal.) As 1992 wears on, though,
higher-quality QuickTime products will dramatically improve the picture. The caliber of your video setup will start to make a difference in your finished product. If you are buying a camcorder right now, it's probably worth planning ahead—get Hi8 or S-VHS equipment.

Once you have your footage in hand, shop for a digitizing board. This NuBus or PDS board slips into a slot in your Mac and provides a jack or two into which you can plug your video source.

Here's where the market gets interesting. There are three general types of digitizing boards: frame-grabber boards, which were originally developed for capturing still frames from live video, but have been modified to work with QuickTime; the VideoSpigot; and boards not available to evaluate by press time. The third category is the most intriguing of all.

Frame-Grabber Boards

WHAT MAGIC SPELL TURNED THESE former still-frame-grabbing boards into movie-making machines? A special component of the QuickTime software family called a VDIG. ( Pronounced VEE-dee, it stands for video digitizing component, but nobody calls it that.) When you drop a VDIG into your System Folder, any program that can record QuickTime works with your digitizer board. For a list of digitizing boards with VDIGs, see "QuickTime Input Features."

These born-again frame grabbers are often loaded with non-moviemaking features. They may double as full-color display boards for your monitor, let you watch real-time TV, or let you attach a secondary circuit board (a piggyback board) to provide extra features like acceleration or stereo sound.

It's important to understand that although these are excellent boards rich with features, you're likely to be disappointed with the captured footage—not by the picture quality (16-bit and 24-bit images are dazzling to look at ) but by the frame rate (smoothness of motion). While TV is 30 fps, movies are 24 fps, and the QuickTime movies you've seen at user groups are usually 15 fps, these frame-grabbing boards average 6 fps to 12 fps at the smallest size (about 2 inches square).

Spigotville

THE NEXT CATEGORY OF DIGITIZER board has only one occupant today: the $599 VideoSpigot, from SuperMac Technology. It is not a display board for your monitor. Nor is it meant to be a frame grabber, although it can capture an absolutely frozen image at half-screen size (a VCR on pause generally isn't quite still enough). It has only one video input—for composite video, so you lose the high quality of S-VHS or Hi8 equipment. Instead of those frills, every centimeter of this specialized board was designed with low-cost, high-quality movie-digitizing in mind.

The VideoSpigot doesn't need a VDIG to record (but at press time it began shipping with one that is also available from SuperMac's folder on America Online, and in SuperMac's forum on CompuServe.) Instead, the Spigot comes with its own recording program, called Screen Play.

Frame-grabber-style boards can put the incoming video into one of two places: RAM (at a high frame rate but very short movie lengths); or, using the VDIG, directly onto a hard drive (at a low frame rate, but long movie lengths). The Spigot has no such trade-off; it records directly to a hard drive with a high frame rate. It accomplishes this feat, first, by devoting every iota of the Mac's processing power to the task of furiously storing video information into a temporary file on the hard drive; second, by performing some compression on the video (about 3:1) before it goes to that temporary file; and third, by displaying only a crude, 1-inch-square, black-and-white, choppy preview while you're recording; this saves the CPU's energy for the first step. (See "How the VideoSpigot Works"

How the VideoSpigot Works

Recording video to a hard drive at a high frame rate isn't easy. A video signal contains much more information per second than a hard drive can record. In order to capture video to a hard drive, much of the video information must be thrown away, and the remaining video information must be highly compressed. This image processing must happen quickly so that the changing images can be recorded without discernible skips and gaps. To win its QuickTime stripes, an input board must figure out how to preserve image quality and still record 12 to 15 frames per second.

The VideoSpigot resizes the remaining image to 160 by 120 pixels using image processing techniques that preserve image quality.

The VideoSpigot further compresses the video by converting the incoming color video signal to a new method of describing color that requires fewer bits of information. This method splits the signal into two components: chrominance, which contains the color information, and luminance, which contains the light intensity of the image. These components are then compressed.

Because the VideoSpigot doesn't digitize the audio signal that comes out of a video camera, you must use the Mac's built-in microphone or an external sound digitizer like Macromedia's MacRecorder to get your video sound track into a QuickTime movie. Screen Play, the VideoSpigot's recording software, synchronizes the sound track by stamping each incoming sound chunk with a time code that shows hours, minutes, seconds, and frame numbers. After the video has been compressed, the stamped time code is used to synchronize each video frame with its corresponding sound chunk.
VideoSpigot Works" for a technology lover's description of the process.)

Once the Spigot has created its large temporary file on a hard drive, you still haven't actually used QuickTime. Only when you use Screen Play's Save command does the footage get converted into QuickTime format and compressed.

Boards Not Available Yet
YOUR DIGITIZING BOARD CHOICES ARE SOON TO MULTIPLY. In the fourth quarter of 1992, SuperMac plans to release Digital Film ($5999), a new video board that can grab full-screen video and record to hard disks at 30 fps with stereo sound. Digital Film will come bundled with Adobe Premier 2.0, will drive monitors up to 16 inches in 24-bit color, and will provide expansion capabilities. RasterOps' SQuick Pak piggyback board (circa $1800) will add high-octane circuitry to any RasterOps TV-line of boards, boosting your movies' playback speed to 30 fps even at full-screen size, without requiring the purchase of a Quadra.

Especially tempting is the VideoVision board from Radius ($2399 including DiVA's VideoShop and Action from Macromedia). Using a special technology licensed from Apple, VideoVision will feature integrated audio, video, and full-color output to a VCR, as well as special slots to accommodate expansion boards (for QuickTime acceleration or compression) from other companies. Using increasingly sophisticated high-speed compression circuitry, both of these boards will make QuickTime movies smoother, more colorful, larger on the screen, and smaller on the hard drive.

Sounding Boards
OF COURSE, CRAMMING DIGITAL VIDEO INTO THE MAC IS ONLY HALF THE BATTLE. Then there's sound.

Fortunately, the Macintosh world is already familiar with digital audio. That's what you create whenever you use the MacRecorder, or the microphone that comes with recent Mac models. This sound isn't exactly CD-quality, but it's good enough for QuickTime. To record sound with your movies, you can use either the Mac mike jack (plugged into your video source's audio-out jack) or a MacRecorder. But if you have a MacRecorder, you have to have its driver software, which you drop into the System Folder. (This driver is available as part of SoundEdit Professional [$295] or MacRecorder Sound System Professional [$349], both from Macromedia; the driver is also available for free on AppleLink and America Online.)

If you meet those conditions, the QuickImage and RasterOps boards can record sound and pictures simultaneously, as long as you're using a QuickTime recording program that supports a SDIG to do so. The VideoSpigot's Screen Play program can record sound, too. The QuickView Studio QT can't use the Mac's mike jack or the MacRecorder; you must purchase QuickView's $395 sound piggyback board.

If 8-bit, Mac speaker-quality sound isn't hi-fi enough for you, then you can pay $1295 for an Audiomedial II board from Digidesign, which, when seated into another slot in the Mac, gives you CQ-quality sound. Otherwise, wait for some of the new QuickTime-production boards that are being readied for prime time.

How Small Do You Want It?
SUPPOSE YOU'VE SELECTED A DIGITIZING BOARD, HOOKED UP YOUR VIDEO TAPE PLAYER, AND CAPTURED A JUICY SEGMENT OF VIDEO. You play it back on the screen; it looks great. You want to save it as a movie file on your hard drive, but without taking over all 40MB. Enter QuickTime.

When you save the file, you'll be asked to choose a compression method. If you want to sound impressive at cocktail parties, use the term codec—that's techie shorthand for compressor/decompressor, the piece of software that determines how a movie file should be condensed. Most QuickTime products come with a selection of codecs: one works best for video, another for animations, another for still images, and so on. More codecs are being developed. Each strikes a different balance between picture quality and the space the file takes up on a hard drive.

Welcome to the world of QuickTime, where you eat, sleep, and breathe tradeoffs. The better the quality of the movie, the more disk space it's going to take. The options you're given when you save your movie are all variants on that theme. Smaller files mean worse quality, because more color information has been discarded. More frames per second result in smoother motion but bigger files. Twenty-four-bit color equals bigger files and choppier playback, because the Mac is being asked to process much larger chunks of information in the same amount of time. (Record in 16-bit color if you can;
it looks almost as good as 24-bit color, but requires the Mac to process only half as much data.) A larger movie window equals slower motion; once again, the Mac has to skip frames of the movie to keep up with the flow of picture info. Sound, too, muddies the issue: if you're recording sound with your picture, you get a slower frame rate, because part of the Mac's attention is devoted to recording sound.

Keeping in mind that a lower frame rate means a jerkier movie, here are some examples. On a Mac IIfx with 8MB of memory, the VideoSpigot can capture a soundless 8-bit movie at about 15 fps—if the window is at its smallest size, 160 by 120 pixels. (Record directly into memory, and you get an impressive 24 fps—but the top movie length is 8 seconds.) Record sound simultaneously, and you lose 3 fps. Double the window size, and you get half the frame rate. Use the VideoSpigot VDIG software instead of its Screen Play grammar to assemble them into some kind of artistic order. The $99 Apple QuickTime Starter Kit is one possibility; it's a CD ROM full of video clips and some floppy disks containing simple moviemaking programs, one of which lets you copy and paste pieces of your movies. But if you want to edit sound tracks, do cross-fades, or superimpose titles, you'll need one of the Big Two: Adobe Premiere 1.0 ($495; bundled free with the VideoSpigot) and DIVA VideoShop 1.0 ($599).

When you run VideoShop, the screen changes completely. You still see your disk and folder icons, as though the desktop were still there, yet VideoShop hides everything except QuickTime documents (and the folders that contain them). To prepare a QuickTime movie for editing, you drag its icon from its folder into a time-line window, where you see each frame side by side like a filmstrip (see "In the Shop").

Editing is simple. You drag to select frames, just as you select letters in a word processor. If three frames of a shot are ruined because a truck drove past the camera, select those frames and press the delete key. Presto: history rewritten. At any time, as frequently as you wish, you can view your movie-under-construction in a playback window, which has the usual movie controls—play, stop, back up a frame, fast forward, and so on. To make navigation easy, you can drag the playback window's "scrubbing" control back and forth (and watch/hear the movie backward and forward) to locate a specific frame, then double-click on the picture. Instantly the time-line window jumps to that frame, so that you can go to town with the editing tools.

Those tools include much more than just cut, copy, and paste. If you place a second movie end-to-end with the first, you can create a smooth transition between them: a cross-fade, a page-turning effect, and so on. A Paste to Fit command lets you paste some footage into a preselcted slice of time; in other words, you can create slow-mo (or fast-mo) effects. There's also a series of special-effect filters. Some are Photoshop filters, which you can apply to any stretch of your film. Others affect the movie over time, such as the fade-to-black filter. VideoShop also lets multiple video tracks play simultaneously. You can position these independent movie screens side-by-side or superimpose them.

You can designate one particular color of a superimposed scene to be transparent, so that (for example) the forests of Brazil are visible through the transparent-white of your best friend's teeth.

VideoShop's most attractive feature, though, is that it's currently the only QuickTime editing program that lets you record directly from any VDIG-equipped video board. VideoShop's arch rival, Adobe Premiere, doesn't yet support VDIGs, so you can't capture movies directly within Premiere, you have to import them into the program.

Not all is light and clarity in VideoShop, though. The bare-bones manual was written so far in advance of the program that it's measured in errors per second. Applying transitional effects takes a long time. And, as the Too-Much-Data-for-the-Mac-to-Handle Theory suggests, playback bogs down when you use some

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### QuickTime Input Features

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<td>Expandable (with expansion board)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>Includes QuickDraw acceleration</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>On-board video compression</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>Still-frame grabber</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hardware pan and zoom</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>Built-in TV tuner</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Built-in sound digitizer</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>OUTPUT TO VIDEOTAPE</td>
<td>Converts signal to NTSC scan rate</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Encodes Mac RGB signal to composite</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>Requires add-on for tape output/size</td>
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<td>NA</td>
<td>0</td>
<td>$499</td>
<td>0</td>
<td>0</td>
<td>NA</td>
</tr>
</tbody>
</table>

* = yes; 0 = no; NA = not applicable. 1 Board due to ship in fourth quarter of 1992. 2 Board due to ship in July 1992. 3 Available with DIVA VideoShop as MovieProducer ($3195). 4 PDS adapt.
QuickTime Input Boards

Selecting a video-input board isn't quite as easy as choosing an ice cream flavor. Some boards, for example, are regular display boards for a monitor (which—if you use any two-piece Mac except the IIsi, IIC, and Quadra—you already have). If you already own a Mac, a display board may be redundant; if you don't, getting a display and movie-making board in one package may be a good deal. A note to IIsi, IIC, and Quadra owners: Even though you don't technically need a display board for your monitor, don't forget that adding a display board anyway can significantly speed up your display. Even if you decide to get a board that's also a display board, life doesn't get much simpler. You have to worry about what bit depth the board is. (Apple recommends 16-bit color for the best QuickTime movies.) You should also take into account which monitor sizes the display board can handle; some of them, for example, work only with 13-inch monitors, which isn't much help if you've spent a couple months' salary on a larger color monitor. Finally, check to make sure you have enough slots in your Mac to accommodate the board you're considering—the occasional board listed in the table is actually two boards, requiring two slots.

**Feature Attractions**

Some boards give you hardware pan, which sounds like a bad equipment review but is actually the ability to display an image that's larger than the glass of your monitor; you can shift the picture to bring hidden portions into view. **Hardware zoom** lets you blow up each dot of the screen to twice its size, magnifying the image. If you plan to record your movies onto videotape, you have another set of stats to study. Unfortunately, the Mac video signal and a TV signal are different enough that special converters are necessary. There are two steps to converting one to the other: converting the scan rate of the signal to the type required by your VCR, and converting the color information. Most boards that provide tape-output features handle both steps. You can see in "QuickTime Input Features," by the way, that some boards don't have tape-output features built in, but offer that function as an additional-cost add-on.

And speaking of TV, you'll have to decide how important sound and picture quality is to you. There are three kinds of video-signal types for your QuickTime footage, and each requires a separate kind of jack on your video board: composite, which is the usual TV, VCR, or VHS camcorder connector; S-video, like the S-VHS and Hi8 videotape recorders that provide a sharper picture; and RGB, the pro format that has separate jacks for red, green, and blue color signals. Check the table to see which boards accept which signals. Also check to see what kind of sound recording you can expect. If the table shows that a board can record in 8-bit mono, that's the same quality you get when you record with the Mac's included microphone or with a MacRecorder. 16-bit sound is CD quality but takes up more disk space. And stereo, of course, is stereo.

---

### QuickTime Input Boards

<table>
<thead>
<tr>
<th>RasterOps</th>
<th>RasterOps Corporation</th>
<th>RasterOps Corporation</th>
<th>SuperMac Technology</th>
<th>SuperMac Technology</th>
<th>Truevision</th>
<th>VideoLogic</th>
<th>Workstation Technologies</th>
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<tbody>
<tr>
<td>RasterOps 240T</td>
<td>VideoTime</td>
<td>MediaTime</td>
<td>RasterOps MxTV</td>
<td>VideoSpigot</td>
<td>VideoSpigot Pro</td>
<td>Digital Film ²</td>
<td>DIVA-4000/ Macintosh</td>
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<td>$3499</td>
<td>$1499</td>
<td>$1999</td>
<td>$2199</td>
<td>$999</td>
<td>$1999</td>
<td>$999</td>
<td>$2995-$4795</td>
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<td>1/NuBus</td>
<td>1/NuBus</td>
<td>1/NuBus</td>
<td>1/NuBus or PDS</td>
<td>1/NuBus</td>
<td>1/NuBus</td>
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<td>24 bits</td>
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<td>B, 16, 24 bits</td>
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<tr>
<td>13, 16, 19, 21</td>
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<td>13, 16, 19, 21</td>
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</tr>
<tr>
<td>16-bit stereo</td>
<td>16-bit stereo</td>
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<td>16-bit stereo</td>
<td>16-bit stereo</td>
<td>16-bit stereo</td>
<td>16-bit stereo</td>
</tr>
</tbody>
</table>

---

1. 24 bits at 13"; 16 bits at 16"; 8 bits at 19"-21". ² Accepts two inputs displayed in separate windows simultaneously. ³ Not available from SuperMac.
But unlike its competition, Premiere removes you from the immediacy of seeing what you've just done. Each time you want to view part of the assembled movie, you select a region in the time-line view, then invoke the Preview command. Premiere displays the stopwatch for a while as it computes, then it shows you a low-quality, jerky preview of the selected snippet. Once. You can't rewind it, scroll back to see a particular frame, slow it down, or even see it again (without using the Preview command a second time). It's reminiscent of Adobe Illustrator, where you edit your artwork in a wire-frame view; you can see colors, shadings, and objects' opacity only in Preview mode (where you can't make any changes).

Navigation is tough in Premiere, too. When you watch a raw, unassembled clip (this viewing doesn't require the time-consuming Preview process), you can slap a numbered marker onto any frame. Then, by pressing a number key, you jump instantly to that frame.

Unfortunately, that navigational aid is pointless, since you can't edit anything when you're viewing a raw clip. You can edit only in the time-line window — yet there aren't any markers in that view. You can jump to the first frame of any clip — but beyond that, the only navigational control in the editing window is a scroll bar. While you're dragging the scroll box, you get no feedback as to where you are in the movie (like “frame: 100”). You have to guess where you are, let go, wait for the entire window to redraw each color frame, discover that you're in the wrong place, and go for the scroll bar all over again when you're trying to make changes in your clip.

Premiere's editing strength is its ability to manipulate several layers of information (see “Making Tracks”), although it can't play back side-by-side clips. Sound tracks appear as additional strips, and they can be edited independently — you can adjust each sound track's volume graphically, and you can mix several audio tracks.

The program's editing weakness, though, is that it thinks in clips, not frames. You can't select a few frames and snip them out, as you can in VideoShop. To delete that passing truck in Premiere, you'd have to create two copies of the clip — one cropped to end just before the truck appears, and the second cropped to begin just after the truck has passed.

And there's no Undo.

**Rough Cuts**

**IN PREMIERE 1.0, YOU CAN'T SEE HOW THE FINAL PRODUCT WILL LOOK UNTIL YOU USE THE MAKE MOVIE COMMAND. MUCH LIKE VIDEOSHOP'S SAVE COMMAND, MAKE MOVIE TAKES QUITE A WHILE. IT CREATES A COMpletely NEW QUICKTIME FILE THAT INCORPORATES ALL THE EDITING AND EFFECTS YOU'VE SPECIFIED. THE BEST PART OF THE WHOLE PROCESS IS WATCHING THE FINISHED MOVIE — BOTH PREMIERE AND VIDEOSHOP HAVE A SPECIAL COMMAND THAT CENTERS THE PLAYBACK WINDOW ON A BLACkENED SCREEN. IT LOOKS TERRIFIC.

Like everything in the QuickTime world, of course, the editing-software market is rapidly expanding. Nearing completion is VideoFusion, from VideoLake, for example, a high-power editing program that can pan, zoom, filter, and distort movies to a new high in desktop-produced special effects.

Adobe hopes to address some of Premiere's shortcomings with version 2.0, which is expected to ship by August 1992. According to the company, the new version will provide better interactive editing, support VDIGs (so you can record directly into the program), and have multiple levels of Undo. The program will also let you open a sequence of frames in Photoshop, called a Filmstrip, for retouching or colorizing.

Until those improvements materialize, VideoShop makes a more natural and creative editing environment, since you have a clear view of your work in progress at all times. Premiere's method of applying transitions between shots is much superior, and it's easier to learn. But the cumbersome Preview feature teaches you to avoid viewing your work as much as possible; in a medium as visual as moviemaking, that's like trying to sculpt clay with your eyes closed.

**Final Print**

**WHEN YOU FIRST SEE WHAT ALL THE FUSS IS ABOUT — A TINY, JITTERY MOVIE THE SIZE OF A MATCHBOX, WITH TINNY SOUND — YOU MIGHT WONDER WHY IT'S WORTH SPENDING THE MONEY AND LEARNING THE TERMS. BUT A HUNDRED COMPANIES RUSHING PRODUCTS TO MARKET MUST KNOW SOMETHING. THEY PROBABLY REMEMBER THE PRIMITIVE BEGINNINGS OF DESKTOP PUBLISHING.

Whoever coined the term QuickTime must have been thinking of this technological revolution's speed. Already The NEC Video Sequencer (a program from Light Source) lets you control the NEC PC-VCR, frame by frame, from your Mac. Zorro, software from Mass MicroSystems that is due out in the third quarter of 1992, promises frame-by-frame control over supported video devices through the use of a proprietary serial interface remote controller. In other words, one day soon, a QuickTime movie will be only a mock-up of a real movie — which your Mac, controlling a pair of tape decks, will automatically construct. Within a couple of years, analog (tape) machines may disappear from the loop entirely: the quality of digital movies on the Mac will be so high that they can be used as actual broadcast material. For thousands of Mac fans and video pros, the arrival of that time can't be quick enough.
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IT'S AMAZING
Pixar Typestry is great for adding pizzazz to your documents, creating riveting presentations, and designing classy logos.

You can place your text wherever you want it and dress it with any number of interesting Looks. You can choose lights to add highlights or cast shadows and use dingbat-type fonts as decorative ornaments.

IT'S POWERFUL
Just by picking from a menu, you can add motion blur, perforations, shadow patterns and gels to your picture. If you want, you can even animate your text and make a QuickTime™ mini-movie.

IT'S PRACTICAL
Typestry images can be gracefully imported into other applications like Photoshop™, PageMaker™, and Quark™. Our alpha channel eliminates the need for time-consuming editing. High resolution images can be generated for slides, print or video.

IT'S RENDERMAN
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Pixar Typestry retails for $299 at your favorite Macintosh store or call 1-800-888-9856.

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Microsoft Excel 4.0

**PROS:** Many new convenience features; customizable tool bar; added analytical tools. **CONS:** Slower than 3.0 at most tasks; Wizards a workaround rather than a solution; Toolpak of uneven quality. **COMPANY:** Microsoft Corporation (206/882-8080). **REQUIRES:** Mac Plus; 2MB of RAM for System 7 or MultiFinder; hard drive; System 6.0.2. **LIST PRICE:** $495.

**WHAT DO YOU DO FOR AN ENCORE** when you're already the hottest act in town? That’s Microsoft Corporation’s problem with Excel, which has dominated the Macintosh spreadsheet market. Microsoft expanded the working tool set in the spreadsheet and made Excel easier to customize. The result is a product that needs 2MB of RAM for practical use and runs a bit slower than its predecessor, but includes everything you could wish for (and more) in a spreadsheet.

**The New Look**

MICROSOFT’S DILIGENT MARKET RESEARCHERS have concluded that the typical user spends much more time formatting spreadsheets than recalculating, so Excel 4.0 is loaded with new formatting features. First, the tool bar, introduced in 3.0, features a different default set of items (outlining is off, font sizing is on). But since Microsoft also worries that perhaps its statistically validated cross section of users might not represent you exactly, the entire tool bar is now customizable. You can drag items away, replace them with icons for other tasks from a predefined set, or make up your own icons on your own named tool bar and link them to Excel commands, or, for that matter, to macros. If you don’t want to learn anything new, you can just call up the Excel 3.0 tool bar, also provided. If you are too lazy to drag the mouse all the way to a tool bar, ⌘-option-click calls a pop-up menu of likely menu choices right under the cursor. And if you don’t want to format spreadsheets yourself, Autoformat gives you a choice of 14 nice formats, which, we are earnestly assured, were produced by professional designers.

There are numerous other “sheet management” functions. You can now select blocks of cells and drag them around with the mouse (the Drag and Drop function). There’s an Autofit function to adjust column widths and row heights. There’s an Autofill function that fills in the rest of a predictable series from a single entry—select Jan and drag down, and you’ll see Feb, Mar, and so forth fill in order. Always losing track of files? Now you can keep related files in a workbook that opens them all at once. Can’t spell? There’s a spelling checker. Forget charting procedures? There are Wizards (really just a dialog box—plus-help) to step you through the still-clunky sequences for chart modification (at least there’s a new chart tool bar). Need to do a presentation? There’s a Slide Show manager. Keep different spreadsheet views, detailed or condensed? Ah, that would be the function of the new View Manager. Coffee getting cold? Excel 4.0’s context-dependent Help will probably realize this and tell you to...
put the cup on top of your monitor. None of these functions is a particularly monumental programming accomplishment (in fact, many of them have appeared in other software first), but they have a cumulative impact: you can put together a professional-looking, amaze-the-boss report in 4.0 as fast as you can type in the numbers.

**But Wait**

There's more! The list of financial functions has been expanded past old standbys like PMT to include TBILLYIELD and about 20 other money marketeers' favorites. New engineering functions include Bessel functions, imaginary arithmetic, and all sorts of number-base conversions. Even the time function list has new entries—NETWORKDAYS is one example. Building on the new function lists, Excel has included an analysis Toolpak with an array of statistics tests from simple descriptive statistics to ANOVA, and a Fourier analysis routine (the Toolpak is called up as needed from the Utilities menu to save memory).

More to the point for business users, who may in fact seldom be called on to solve circularly symmetric vibration problems at work, are the new Scenario Manager and database crosstabs. Excel still has the best Solver of any current application, and the Scenario Manager (an add-in module, meaning again that it's called up from disk when needed) basically lets you organize a set of "what-if" Solver problems as a group, recording outcomes for changes in input parameters. This is a serious improvement over the facilities in 3.0, for two reasons. First, most realistic business simulations call for a large spectrum of "what-if" analyses rather than single-variable tests, and Scenario Manager can keep track of all the tests you are likely to formulate. Second, the new set of statistical distribution functions (Weibull, for example) built into 4.0 makes possible really sophisticated work—before 4.0 you needed third-party simulation programs to make models at this level. Crosstabs are another useful feature, new in the Database menu. You can save different Crosstab views (one might be sales per quarter by region, one might be sales of each brand of product by region) from the same database, and print them in sequence for a report.

**Charting the Way**

It's easy to sample charting styles with the new icon menu for charts, and chart drawing itself is faster. Wizards will step you through the details of chart modification, but the details are for the most part the same old Excel procedures.

Excel 4.0 has picked up as excess baggage some functions at which it is not particularly good.

On balance, though, Excel 4.0 is the premier business tool on the Mac. Almost all 3.0 users will want to upgrade; almost no one will want to defect to another spreadsheet; hybrid Mac-PC offices will love 4.0's perfect compatibility with the Windows version released earlier; and product managers for competing spreadsheets will just have to dive for niches. This program will dominate for a long, long time.—Charles Seiter

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**Disk Utility Packages**

**MacTools 2.0**

**PROS:** Automatic disk scanning and repair; includes antivirus utilities; fixes damaged Word and Excel files.

**CONS:** CP Backup could be easier to use.

**COMPANY:** Central Point Software (503/690-8099).

**REQUIRES:** Mac Plus; 2MB of RAM; System 6.0.5. **LIST PRICE:** $149.

**Norton Utilities for Macintosh 2.0**

**PROS:** Excellent disk repair and file recovery.

**CONS:** Inconsistent interface between utilities.

**COMPANY:** Norton Utilities for Macintosh (800/441-7234).

**REQUIRES:** Mac Plus; System 6.0.4. **LIST PRICE:** $149.

Until now, the champion of file-recovery packages has been Symantec's Norton Utilities for Macintosh (NUM). But with the release of Central Point Software's MacTools version 2.0, NUM will have to share the top of the data-recovery heap.

**Norton Utilities for Macintosh NUM VERSION 2.0 ADDS SOME NEW**

features to the previous version and incorporates portions of the now-discontinued Symantec Utilities for Macintosh. This amalgamation of the two packages gives NUM 2.0 a wide range of utilities, but the package lacks focus; it's the everything-including-the-kitchen-sink approach.

NUM's main business is disk repair and file recovery. It provides three approaches to dealing with a damaged disk. The first is FileSaver, a control panel that makes invisible backup files of the drive's directory, on your hard drive. To be able to create these backup files, FileSaver must be installed and running before you continue.

---

**Spreadsheet Speeds**

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<th>Recalc Math</th>
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Tests were run on a Macintosh IICi with 4MB of RAM and System 7.0.1. Files used were in native file formats and consisted of 10 fields with a database of 1200 records; worksheet size was 2 sheets, with 10,000 cells. The Autorecalc and Undo features were turned on. Times are in seconds.
experience problems. FileSaver can automatically update the backup of the directory on shutdown, or you can update when you press a user-definable hot key. The FileSaver files are used by two other utilities in the package: UnErase, which recovers files that have been put in the Trash Can; and Volume Recover, which resurrects your entire hard drive if you've accidentally erased it. The next approach is the excellent Norton Disk Doctor, which attempts (and usually succeeds) to repair damaged hard drive or floppy disk directories. And the last approach, used when Disk Doctor doesn't work, is to use UnErase or Volume Recover to recover individual files to another medium.

The combination of these utilities does an excellent job diagnosing and repairing damaged hard drives and floppy disks. Disk Doctor fixes most damaged hard drives; UnErase seems almost miraculous in its ability to bring back erased files. And if you haven't installed FileSaver, NUM still has a good chance of recovering your files, although it might take longer and be less reliable.

Norton Backup backs up files to floppy disks, removable cartridges (SyQuest, Bernoulli, and optical), or to another hard drive (but not to tape drives). You can choose between full, partial, or incremental backups. Unlike Dantz Development's DiskFit Pro, Norton Backup doesn't erase old versions of backed-up files, so the backup disks are ever-growing. NUM includes a scheduling extension that lets you back up untouched if the backup medium is large enough, or it reminds you to back up if you're using floppy disks.

Speedy Disk, a hard drive optimization utility, is mostly unchanged since the last version of NUM. It does a good job of defragmenting hard drives for better performance. Directory Assistance II modifies the Open and Save dialog boxes, adding a menu bar that lets you move casually between drives and folders, and view the file list by Name, Date, Size, and so on. DiskLight puts a small icon in your menu bar that flashes to indicate disk activity. Wipe Info and Norton Encrypt are security utilities. Wipe Info performs multiple overwrites on erased sectors to ensure that file recovery is impossible, and Norton Encrypt requires a password to read the scrambled files. Fast Find is a high-powered file finder. Floppier improves on the Finder in copying and formatting floppy disks. Keyfinder shows you the entire contents of a font set at a glance, and tells you which key to press to get the character you want. It's a little better than Apple's Key Caps DA, but not much. Layout Plus lets System 6 users adjust the view files, the font used, and so on, of the Finder. And Norton Disk Editor lets you view and modify the bits and bytes on your hard drive or floppy disks.

The NUM manual is laid out well for the panic-stricken user who has bought the package specifically to save a bad drive, with step-by-step instructions for recovery, and a section on common problems and their solutions. The manual explains the utilities well, and it includes the Norton Disk Companion, a terrific, clearly written guide to how hard drives and floppy disks work. Symantec's technical support was prompt and knowledgeable when I called.

**MacTools 2.0**

The MacTools 2.0 package has a tighter focus than NUM, zeroing in on disk and data protection. Central Point includes a complete virus-protection program in the package. CP Anti-Virus has an application and a control panel to scan your hard drive and floppy disks for any viruses. Updates to the virus detector for new viruses are widely available; since they are simply character strings that are typed into CP Anti-Virus, Central Point notifies registered owners by postcard and publishes the strings on America Online, CompuServe, and other networks.

MacTools' equivalent of NUM's FileSaver is called Mirror. DiskFix is MacTools' disk- and file-repair utility. It works as well as does Norton's Disk Doctor, but with several useful differences. The best of these differences are that all repair operations can be undone and that DiskFix can save a snapshot of the catalog file it is working on before the repairs are complete. This is a great idea, since in rare cases, using any file-repair utility can make matters worse instead of better. DiskFix uses Mirror's backup catalog files to unerase hard drives. I found DiskFix considerably slower than NUM's Disk Doctor, but no less efficient at fixing hard drives. In fact, DiskFix repaired some directory damage on my hard drive that Disk Doctor reported it was unable to repair. DiskFix can also be set, using the CP Scheduler evr (control panel in System 7), to scan your hard drive at specified intervals and automatically repair any damage it finds. CP Undelete uses Mirror's files to recover erased documents, but also works without Mirror's help.

CP FileFix recovers damaged Microsoft Word 4.0 or Excel 2.2 and 3.0 files. It extracts the text from the damaged Word file and copies it to a new document. Excel files that can't be opened in Excel are similarly read and the readable portions copied to a new spreadsheet.

Central Point's backup program has much the same feature set as Norton Backup, with the exception that CP Backup can back up to some tape drives: the discontinued Apple 40 Mb DC-2000 drive and WangDAT's 1300 and 2600 DAT drives. According to Central Point, more varieties of tape drives will be supported in future versions.

MacTools' 3-D-style interface makes it easy for the inexperienced to move around the many parts of the package. NUM suffers in comparison; its various components have wildly differing interfaces. MacTools also includes a disk-editing utility, a hard drive optimizer, and finally, DriveLight, another hard-drive-utility-on-the-menu-bar utility.

Central Point's tech support was good. When I couldn't reach it on the first try, I left a message and received a prompt callback. The MacTools manual isn't up to the standard set by NUM's, but it's complete and more than adequate.

**Comparing**

Both packages provide useful, effective tools for hard drive and floppy disk file recovery. Which package to buy depends on the utility software you have. The two packages use different methods to recover files and volumes, and sometimes one package works where the other fails. If you're a consultant or a corporate support specialist, you want all the firepower you can bring to bear on a crashed disk, and you should own both NUM and MacTools. For the individual Mac owner who wants only one package, my pick is MacTools, because of its automated hard drive and floppy disk repair capabilities, antivirus capabilities, and tighter focus on data protection.—TOM NEGRINO
33MHz Accelerator Boards

**Performance/040 (33MHz)**

**PROS:** Easy-to-use software; compatible with all Mac II's; two-year warranty. **CONS:** Slow, not virtual memory-compatible; requires on-board RAM.

**COMPANY:** Impulse Technology (404/889-8294).

**REQUIRES:** Mac II with Rev. B ROM, IIX, IICX, IIci, IIsi, IIsi (with NuBus adapter board); 2MB of RAM for System 7; as much RAM (or more) on accelerator board as on system board; System 6.0.5: Recommended: 8MB of RAM on Performance/040. **LIST PRICE:** $2399.

---

**Radius Rocket 33**

**PROS:** Fast; many software features; multiprocessing capability through optional software; a good value. **CONS:** Not virtual memory-compatible; requires on-board RAM; incompatible with IIFX and IIsi. **COMPANY:** Radius (408/434-1010).

**REQUIRES:** Mac II with Rev. B ROM, IIX, IICX, IIci, IIsi; 4MB of RAM; 4MB of RAM on Rocket; System 6.0.7: Recommended: 8MB of RAM on Rocket. **LIST PRICE:** $2499.

---

**TokaMac II FX 33**

**PROS:** Excellent performance; doesn't require on-board RAM. **CONS:** Not virtual memory-compatible; expensive; works only with the Mac IIX; installation requires shipping system board to vendor or paying $2000 deposit. **COMPANY:** Fusion Data Systems (512/338-5326).

**REQUIRES:** Mac IIX, System 6.0.7. **LIST PRICE:** $3995.

---

The 33MHz 68040 ACCELERATOR boards reviewed here are all capable of outrunning the fastest 68030-based accelerator and, due to the software vendors' efforts to make their applications compatible with Apple's 040 models, most programs run without trouble on these boards.

If you have a IIX, IICX, IIx, or II and crave some speed improvement, the 33MHz Radius Rocket accelerator is for you. The Rocket board performed well in Macworld Lab tests, except for video and Disk I/O, compared with the Quadra 950.

For performance on a par with the Macintosh Quadra 950, you need a video accelerator like the Spectrum/8 24 PDQ and the forthcoming SCSI accelerator piggyback board for the Radius Rocket (a $299 option that will use the same SCSI chip as the Quadra 950). I recommended getting the Rocket board and the SCSI option when it becomes available. (Radius promises Quadra, IIXx, and IIsi support with version 2.0 of its software for the board.)

The Radius Rocket 33 is my board of choice, although it requires at least 4MB of its own RAM (you pop on the chips before installing the board). It has 8 SIMM slots for 16MB 80-nanosecond SIMMs, giving it space for up to 128MB of memory.

The Rocketware control panel is loaded with features such as a screen saver, screen capture, and large-type menu titles. Unfortunately, the software defaults to the board's slower write-through mode. I wish users could set the faster 68040-compatible copy-back mode as the default instead of having to set each application to 040 mode manually.

Radius is putting the finishing touches on an optional software add-on called RocketShare (under $500) that divides processing tasks among two or more boards—the Rocket board, the system board, and any other Rockets you have installed. Radius says the speedy multiprocessing should work with any program that can work in the background under System 7, but its real advantage of multiprocessing is for high-resolution 32-bit color rendering and other high-end graphics tasks.

The 33MHz Rocket board had no software-compatibility problems with the Macworld Lab test suite, although the board is still incompatible with A/UX and virtual memory. But before you place your order, make sure you read Radius's compatibility guide. Some hardware, like the older RasterOps color boards and Macromedia MacRecorder, don't work with the Radius Rocket 33.

Similar to the Radius Rocket, the Impulse Performance/040 is also a NuBus-based accelerator that requires its own memory—8MB of RAM is recommended. The board comes with software that lets you choose cache settings. The 33MHz Performance/040, with new software and firmware, fixes most of the bugs and incompatibilities that I encountered when testing the 25MHz version a while back. (The 33MHz version still has some trouble with ACtUS's 4D, but a forthcoming software upgrade addresses that problem.) The performance of the board, however, is not up to par with the Rocket.

Even though the price was recently cut from $3499 to $2399, I do not recommend the Performance/040. It ran a lot slower than the other boards in most of the tests. It's even slower than the native CPU in disk-intensive tasks because it uses the system board as an intermediary for all I/O activity—now you know why Impulse ships the board with a RAM disk utility. (The utility can use the on-board RAM, but not the RAM on the system board.)

There's a hardware/software upgrade in the wings that impulse claims will speed up the board considerably. I tried the beta software and noticed only minor improvement in most benchmarks. Until I have a chance to try the new hardware upgrade, I can't recommend this board. Besides the performance improvement, the product could use a better manual.

Installation of both the Performance/040 and the Rocket is very easy; you just load up the board with the RAM and then plug it into a NuBus slot. (Radius's clear instructions make it particularly simple.)

The Fusion Data Systems TokaMac II FX 33, which works only with the Mac IIX, is a completely new design. The board plugs into two slots at once on the Mac IIX—the PDS, or Processor Direct Slot (which provides faster access to the CPU's processor), and a nearby NuBus slot (for efficient NuBus data transfer). The TokaMac also sports a fast 128KB memory cache that speeds processing by minimizing the number of times the system caches data.

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**ACCELERATOR PERFORMANCE**

<table>
<thead>
<tr>
<th>Board</th>
<th>System</th>
<th>FPU Math</th>
<th>Processor</th>
<th>Disk I/O</th>
<th>Video</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadra 950</td>
<td>-</td>
<td>0.88</td>
<td>0.82</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>TokaMac II FX 33</td>
<td>IIX</td>
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<td>1.00</td>
<td>0.85</td>
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<td>Performance/040</td>
<td>IIX</td>
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<td>0.65</td>
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<td>0.28</td>
<td>0.28</td>
<td>0.53</td>
<td>0.40</td>
</tr>
</tbody>
</table>

This table compares the performance of three 33MHz 68040 accelerator boards. Macworld Lab conducted several tests in each category. The results have been combined and indexed to that each product's performance is equally weighted. As you can see, the TokaMac and Radius boards are the best at speeding up processor tasks, while the Quadra 950 excels in disk I/O and video performance. Higher numbers are better.
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system board memory must be accessed. Unlike the two other boards, the Toka-Mac takes full advantage of system board memory—the TokaMac doesn’t require any memory of its own. (The board handles older software that has trouble running in 640 copy-back mode with a control panel that lets you switch to write-through mode.)

The test results show that the board was faster than the Quadra 950 in most CPU and FPU tasks. The Quadra 950 edged out the TokaMac in both video and disk-intensive tasks because it has a built-in video accelerator and support for faster SCSI I/O. But you should be able to exceed video performance on the Quadra 950 by coupling the TokaMac with a video accelerator board that supports block-transfer mode. The TokaMac board has custom chips designed to speed up data transfer to other NuBus slots and free up the 040 processor as quickly as possible. (Fusion Data is still trying to fine-tune the board’s software to work efficiently with SCSI accelerator boards such as the PLX QuickSCSI.

To accommodate the TokaMac’s unique design, the system board must be fitted with a new chip, which is why you have to send the system board to Fusion Data Systems (the company promises a one-day turnaround) or pay a $2000 deposit for a new system board (you get the $2000 back when you turn in your original system board). Installation is straightforward, with one thing to watch for: you must very carefully align the board with both the NuBus and PDS slots before seating the board, unless you want a chance to practice your needle-nose pliers technique.

The only problem I encountered with the TokaMac was an occasional divided-by-zero error during restart. Fusion Data Systems acknowledges the problem and says the company is working on a fix.

With a price tag of $3995, the TokaMac board is the most expensive accelerator board available today. If I owned a Macintosh IIx with a plain video board and desperately needed the performance and functionality of a Quadra 950, I would first consider selling the IIx to trade up to a 950, which has built-in video acceleration and much faster SCSI performance—not to mention the fact that it has Ethernet, a hefty power supply, and room for additional internal hard drives; has conventional SIMMs; and when necessary, runs virtual memory. If you already have a loaded Mac II or IIx with a fast video board and more than enough memory, however, the TokaMac II PX FX 33 might make good sense as a route to speed.

---

**HP PaintJet XL300**

**PROS:** Prints tabloid-size images; high resolution (300 dpi); good Pantone color simulation.

**CONS:** Poor documentation; noisy.

**COMPANY:** Hewlett-Packard (800/752-0900, 800/387-3867 in Canada).

**REQUIREMENTS:** Mac Plus; System 6.0.5.

**LIST PRICE:** $3495.

---

**HEWLETT-PACKARD’S PAINTJET XL300**

The XL300 is a color ink-jet printer that prints at a resolution of 300 dots per inch. It handles letter, legal, and tabloid paper sizes. While the XL300’s output may not satisfy demanding graphic arts professionals looking for a color-proofing device, business users interested in punch-up their presentations with color should be quite happy with the printer.

The XL300 is based on an Intel 80960 RISC processor and comes with an AppleTalk network connection and a Centronics parallel port for DOS PCs. The printer switches automatically between the two ports, so it can be shared on a mixed Mac and DOS PC network. For PC users, the printer contains HP’s LaserJet-compatible PCL SC printer language. The HP PaintJet XL300 replaces the discontinued HP PaintJet XL as the tabloid-size unit in HP’s line of color printers.

The printer comes with 2MB of RAM. There are also two RAM slots, and you can add more RAM on SIMMs to bring the XL300 to a maximum of 18MB of RAM. In my tests, the standard 2MB of RAM worked fine, handling all of the test documents with no “out of memory” messages. HP tech support indicated that the extra RAM capacity was chiefly useful for DOS PC users and for people who have the PostScript option board installed in the XL300.

Setup was easy. Installation of the four ink cartridges (cyan, magenta, yellow, and black) was fast and clean, with none of the drips and mess associated with loading some color ink-jets. HP provides a software installer, and the printer driver is available in the Chooser. The driver is based on QuickDraw, and is compatible with Adobe Type Manager (ATM).

After selecting the print driver, you print by selecting Print from any application. A Print dialog option allows you to adjust the colors printed in two main ways: by attempting to match printed colors to the screen, or by using Pantone color simulations. To attempt to match screen color, you first use a pop-up menu to tell the driver which monitor you’re using.
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then the printer goes completely silent for a few seconds, then it starts to print. These noises are a bit disconcerting, but I eventually got used to them.

The XL300 is a good printer, well worth considering if you're in the market for color in business presentations. It is also appropriate for desktop publishers using spot color. People who need to do process color for photographs are probably best served by a thermal-wax or dye-sublimation printer, however. Tabloid-paper capability is unusual in this printer's price range, and makes the XL300 a good value.—Tom Negriño

Like Insignia Solutions' $99.95 AccessPC, Dayna Communications' $89.95 DOS Mounter, and Outbound Systems' DOS.INI (bundled with its Mac-compatible notebooks), Macintosh PC Exchange lets you put DOS 720K or 1.4MB 3.5-inch disks into a SuperDriver and instructs the Mac on how to read and write to these disks and how to translate DOS directories into Mac folders, so Mac users can manipulate DOS files using a familiar metaphor. But Macintosh PC Exchange's main competitors—AccessPC and DOS Mounter—are better products that cost only a little more.

All these programs let you map DOS file extensions (the three letters after the period in a DOS file name, used to identify the file type) to Mac applications and file type. Thus, for Macintosh Microsoft Word 4.0 you can associate the .WDBN file type with DOS files that have the extension .DOC, and you can have the Mac launch Microsoft Word 4.0 when you double-click on such files. (On the Mac you see the Word icon for this file rather than the usual DOS text icon.) This feature is handy if you use applications that are file-compatible across Mac and DOS/Windows versions. (Such applications include Word, Microsoft Excel, Lotus 1-2-3, Frame Technology's FrameMaker, Aldus PageMaker, Ventura Publisher, Aldus FreeHand, Adobe Illustrator, and Intuit Quick.) Other file-transfer programs offer file-extension mapping, although the interface on Macintosh PC Exchange is slightly simpler.

But none of the three programs take the next logical step: giving (or prompting the user to give) DOS file names and adding the appropriate extension when copying Mac files to a DOS disk. The programs seem to treat file transfer as something that happens mainly from DOS to Mac, a bit of unhelpful Mac chauvinism. You end up with arcane names like 9&.9CO (for what had been called 9.9 Color Monitors) and WORKSHE* (for what had been called Worksheets). The program should automatically name the files something like "COLORS.DOC and WORKSHEET.XLS", respectively.

With Apple's aggressive positioning of its product line as corporate computers that support the DOS standards as well as the Macintosh approach to computing (for example, Apple markets its PowerBooks as DOS-capable computers), you might think that Apple's solution to Mac-DOS file sharing would be innovative, maybe even trend-setting. You'd be wrong. Apple's new Macintosh PC Exchange, a $79 control panel, is adequate but hardly the state of the art in cross-platform file sharing.

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Display type is one of the most demanding forms of typography. The type in product labels, magazine and poster headlines, logos, and the like not only must be precisely spaced, it is also often stretched, rotated, attached to a curving baseline, or otherwise contorted. The typographic features in a desktop publishing program can’t begin to meet those demands. Even illustration programs like Adobe Illustrator and Aldus FreeHand fall short—they don’t let you drag individual characters to control spacing, for example. For serious display-type work, there’s no substitute for a dedicated display-type program like LetraStudio.

LetraStudio 2.0

PROS: Compatible with all major font formats; faster than previous version, many new effects; new dialog boxes allow for precise positioning and resizing; reduced price. CONS: No built-in text-styling effects; text can’t have graduated fills; no publish-and-subscribe support. COMPANY: Letratype USA (201/845-6100). REQUIREMENTS: Mac Plus: 2MB of RAM; hard drive. Recommended: 4MB of RAM for Mac LC, Mac II, or Quadra.
LIST PRICE: $249.

LetraStudio has been around for several years, but early versions were flawed. With version 2.0, the program has hit its stride, although it still lacks some of the flashy features of its major competitor, Broderbund Software’s TypeStyler.

Version 2.0 supports all major outline-font formats—PostScript Type 1 (including Adobe Multiple Master), PostScript Type 3, and Apple’s TrueType. (In a related development, Letraset has recently converted its library of display typefaces into Type 1 and TrueType formats. Each Letraset Fontek package includes a given font in both formats.)

LetraStudio’s operating style has always been straightforward: click on the text tool, choose a font, and type the text. Unlike TypeStyler, LetraStudio lets you type and edit text directly in the drawing area—no separate dialog box.

Better still, LetraStudio lets you adjust character spacing by dickering and dragging individual characters. It’s the most logical way to adjust spacing, and a vast improvement over the tendon-taxing keyboard kerning commands that illustration and publishing programs provide. Similar techniques let you slant or resize characters and move them up and down relative to the baseline.

LetraStudio provides two basic mechanisms for stretching and reshaping a block of text: you can reshape the baseline, making it wavy or even circular; and you can apply an envelope—a shape that LetraStudio reshapes text to fit within. The program provides more than a dozen preset envelope shapes that simulate a fish-eye lens, create a perspective effect, and more. You can reshape a baseline or an envelope using selection handles; with version 2.0, you can also use Bézier controls. Another new feature: you can copy effects that have been applied to one element and apply them to another.

Its mouse-oriented style has always been one of LetraStudio’s strengths, but 2.0 adds commands that let you type precise values. The Object Specs command lets you specify an object’s location and size. (Oddly, though, the dialog box’s Cancel button is the default—the one chosen when you press the return key.)

You can save completed display type in encapsulated PostScript, PICT, and Adobe Illustrator 1.1 formats. Unlike its predecessors, LetraStudio 2.0 can also import Illustrator 1.1 and Illustrator 88 line art. LetraStudio 2.0 also lets you convert text into a graphic. Convert a single character to a graphic and then choose Ungroup, and you can reshape the character by dragging its Bézier control points.

No matter how you contort text, all of LetraStudio’s text-editing and spacing controls are still available. (One exception: you can’t edit text that you’ve converted to a graphic.)

It can also be slow. LetraStudio 2.0 is faster than earlier versions, and it has a variety of display preferences that let you speed up screen redraws at the expense of on-screen text quality. Still, complex documents demand a fast Mac with at least 5MB of RAM. Even then, this program isn’t going to get any speeding tickets.

How does LetraStudio 2.0 compare with TypeStyler 2.0 in other areas? LetraStudio lets you assign colors using the industry-standard Pantone Matching System; TypeStyler 2.0 doesn’t. LetraStudio can have numerous documents open simultaneously; TypeStyler supports just one. But TypeStyler provides a wonderful selection of canned (and customizable) text effects—gradient fills, drop shadows, and so on—that LetraStudio lacks. Indeed, LetraStudio can’t apply a gradient fill to characters at all. TypeStyler also provides a tool for creating commonly used graphic shapes such as starbursts and diamonds; in LetraStudio, creating shapes other than rectangles and circles requires extra effort. And TypeStyler supports System 7’s publish and subscribe features; LetraStudio 2.0 doesn’t, although it does run fine under System 7.

In the end, LetraStudio provides superior features for manipulating characters, while TypeStyler provides a larger gallery of flashy effects. The program you choose may depend on the kinds of display type you create. If you’re after precise, intuitive control over character spacing and shape, LetraStudio is the better program.—JIM HEID
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Network Management System
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MacTRAC 2.0 (ADB)
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Comes with MicroSpeed Control Panel software. Up to 8 command key assignments for menu shortcuts. Use the Edit feature to create custom key assignments. Adjust tracking speed and double-click speed. Three-button flexibility accommodates right- or left-hand use.

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Leader Technologies
Finally, a simple and automatic way to keep track of the latest version of your files when you use a PowerBook and a desktop Mac. Select an unlimited number of files, folders, or disks to be maintained and synchronized. Conflict notification if changes have been made to files on both Macs since updating.

Shortlist
Brainchild
Combines the features of multiple productivity tools into one remarkably easy-to-use program! Time-management, phone dialing, mail-merging, and much more. Your data becomes more useful and accessible. Power-saving features allow 50% longer battery life – perfect for all Macs, including PowerBooks!

Effects Specialist/Layouts
Postcraft
Effects Specialist transforms bitmapped and PostScript fonts into sparkling headlines or eye-catching logos. Offers kerning and 120 different effects. Two different Layouts packages (PageMaker or XPress) each offer over 200 DTP sample templates for ready-made solutions to typical business publishing problems.

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Integrated Project Planning Software

Fair Witness 1.1

PROS: Coherent combination of outlining, project info, scheduling, and voting; stores multiple versions of ideas; different views of same data can be stored and accessed via menu selection; links between views simplify navigation.
CONS: Displays only one window at a time.
COMPANY: Chena Software (215/770-1210).
REQUIRES: Mac Plus; System 6.0.2.
LIST PRICE: Version 1.2 $295.

Planning a project usually requires project-management software. While Fair Witness isn’t a substitute for the typical project-management programs, it makes project planning easier by integrating the following actions in one program: outlining, information charts, time charts (scheduling), and voting.

When you start a project, enter your ideas in Fair Witness’s outline mode. As with other outliners, ideas can be in any order, since you can always reorganize them. Setting up subtopics and other outline hierarchy is important because Fair Witness depends on the outline’s contents to create other views (or layouts) of the project. In outline mode, you can expand any subtopic and display it independently. If you need to get back to another topic or another part of the outline, Fair Witness provides a pop-up menu that lists the outline’s topics.

When you’re ready to add more details to your project’s outline, you can create an information chart and define the columns you want to add, such as start and finish dates, notes, and the person in charge of a project. These columns can contain text, numbers, dates (including time), icons, or pictures. If you create date columns (say for the start and finish dates of project stages), Fair Witness can display a Gantt chart. To alter dates in the chart you click on one end of the bar and drag it to a new date—new dates are displayed as you drag, and the information chart is updated accordingly.

While an outline can be a good way to organize a project, project priorities also have to be set. Fair Witness allows you to rank ideas in sequential order and have team members vote for ideas; you can then score the ideas on a predefined scale, or compare each idea against all other ideas. Each member of the team can cast a vote, and Fair Witness tabulates the results. (Fair Witness is not multiuser software; project leaders create a voting table or matrix and enter the votes.) Fair Witness can also create pie charts or bar charts to display the results.

Fair Witness lets you save formatted views and review them at any time. You can assign a name to each view. These tagged views simplify moving between charts or outline views as you review your project. You can create any number of separate views—for project members, major project milestones, project resources, and so on. All the views are stored in the project’s file.

Fair Witness lets you create links between items in different views of the same project. Thus, if you want to refer back to a particular chart from a major subtopic in another view of your outline, you can create a link and easily move between the two items. With Fair Witness you can also fine-tune previous ideas without replacing them—the program uses a flip-page symbol with a number to show that a series of ideas is being stored (each idea in the series is time-stamped).

If you don’t want to use the structured layouts. Fair Witness’s free-form text mode allows you to place text anywhere on the screen, making it easy to group ideas or show links between groups of ideas.

Fair Witness can be a valuable tool for planning any project, but it’s not a total solution for project management. I suggest using Fair Witness to plan your project and prioritize items within the project, then use more traditional project-management software (like MacProject II or Micro Manager) to create PERT charts and allocate project resources.—Dave Kosior

Ergonomic Keypad

The Bat

PROS: Best ergonomic input device I’ve seen.
CONS: You have to learn to type all over again.
COMPANY: Infogrip (504/766-8082).
REQUIRES: Any Mac with ADB port; MultiFinder or System 7.
LIST PRICE: Single keypad $295; two keypads $495.

If your keyboard isn’t causing you pain, count your blessings. I joined the ranks of the computer-injured six years ago, thus qualifying to review The Bat, a new keyboard—or keypad, as the manufacturer calls it. It’s the best ergonomic computer device I’ve seen, but let me hasten to add that this judgment is based on my own symptoms—pain and spasm in the right shoulder and neck. Though I now use a trackball with my left hand instead of a mouse with my right, the cramped arm and shoulder position enforced by the typical QWERTY keyboard still hurts. If you don’t know what I mean by “cramped arm and shoulder position,” put your hands on a keyboard and observe. If you’re human, your arms are now hugging your sides and your shoulders are scrunching inward because your hands are together on the keys and parallel to the ground. I try to counteract these constraints, thinking “chest up, shoulders back,” as physical therapists instruct, but I can’t fight the scrunch for long.

With the Bat I have no need to scrunch. Its right- and left-hand keypads slant the little fingers down and the thumbs up, opening the shoulders. Better yet, I can spread the keypads apart, or use only one of them—one unit can replace the entire keyboard. And since maintaining any position too long causes me pain, I’m delighted that The Bat allows me to change positions. (Though I’m focusing on ergonomics, I should add that The Bat is an excellent choice if you have use of only one hand, or if you need to type with one hand while using the other.)

I don’t suffer from wrist or hand pain, so I can’t say whether The Bat will help those who do. However, the built-in wrist rests keep wrist and hand aligned, preventing an injurious angle. Infogrip hopes that The Bat will cut down on repetitive-motion strain in the hands and wrists because only the thumbs move about on the keypads.

On the downside, to use The Bat you must learn to type all over again. Each keypad uses only 7 keys to replace the 60 or more on typical keyboards. You usually have to press several keys at once to type one character, “chording,” much as you would on a piano. Your fingers rest on 5 gray keys, except when you shift a thumb to a red or blue key to switch between letters, caps, numbers, symbols, screen movement, and cursor control. If you’re in chronic pain and The Bat really helps you, its ergonomic relief is worth the retraining.

Bat advocates claim that chording increases input speed once you’re used to it, but I can’t say yet. After practicing during the evening news for a month, I can chord 25 words per minute, instead of my usual 80 on a standard keyboard. I still wish someone would manufacture a split, angled QWERTY keyboard like the one Tony Hodges designed (see The Innocent, Macworld, February 1990). In the meantime, I’ll keep practicing on The Bat. If you want to try it, buy it direct from Infogrip, which offers a money-back guarantee, or from a vendor who offers one.—Ann Garrison
Until recently, 300 dots-per-inch dye-sublimation printers cost in the neighborhood of $20,000 to $30,000. The RasterOps CorrectPrint 300 brings high-quality, photo-realistic printing to half that price. The CorrectPrint itself costs $899, but the printer needs a minimum of 12MB of RAM, plus a dedicated hard drive for font storage. RasterOps will sell you 12MB of RAM for $1719 (you still need to buy a hard drive), or you can buy a fully configured printer system—with 36MB of RAM and no need for a hard drive—for approximately $12,000 total.

Dye-sublimation printers can produce near-photographic images because they use a completely different imaging technique from that used by most Mac printers. Instead of printing cyan, magenta, yellow, and black dots next to one another and relying on the viewer’s eye to mix the colors, dye-sublimation printers lay translucent process-color dots one on top of another. Dye-sublimation printers can also vary the size of the printer dot itself. Most Mac laser printers build different-size halftone dots from a limited range of small printer dots; dye-sublimation printers can produce printer dots in a wide range of sizes. The CorrectPrint can lay down 256 sizes of printer dots. Because of this, it can build a wider range of halftone dots and thus can produce a wider range of colors. Theoretically, in fact, the CorrectPrint can represent every color a 32-bit file might contain. It can lay dots down at a rate of 300 per inch—fine enough to be visible only with a strong loupe. The disadvantage of these printers is that they require special media; four-color prints from the CorrectPrint cost $3.94 apiece for letter size and $4.09 for legal size, according to RasterOps.

The CorrectPrint has many features to recommend it besides price. It comes with a PostScript interpreter (a RIPS clone), so it can print files from programs like Aldus FreeHand. The CorrectPrint’s ROMs include routines for JPEG decompression, which makes life easier if you use large bitmap files because you don’t have to decompress them before sending them over a network to the printer. The device has built-in AppleTalk, Ethernet, SCSI, and RS-232C ports, plus a one-year warranty.

When they watch the TV commercials for The Miracle Piano Teaching system, music teachers nationwide must shiver. Has it come to this, then? Do we have to sucker kids into learning music just to sell a few more Macs? Not to worry. The Miracle may be a computer program, but it’s no game. Instead, it’s a painstakingly crafted, patient, and encouraging music and piano instructor designed to appeal to both kids and adults.

There are two parts to The Miracle kit: a four-octave stereo synthesizer that plugs into a Mac, and the software. The keyboard is no Steinway, but its full-size keys play louder when you strike them harder. (Even non-tracking keyboards in this price range don’t have touch-sensitive keys.) It’s also a real MIDI keyboard (it works with other Mac music programs; see The Desktop Critic in this issue). If you want to hear what it sounds like, I’ve posted some samples in the Macworld forum of America Online.

Once the keyboard is plugged into the Mac’s modern port, and you’ve turned off Suitcase II and Adobe Type Manager, you’re ready. The Mac plays a song for you. (No music is ever played without the sheet music on the screen, reinforcing the association of written to played notes.) You try just the right hand, as slowly as you want. The program encourages you, and suggests that you try it with the metronome. If you mess up, you try again, more slowly. Bit by bit, you’re gradually prodded into picking up the tempo, adding the left hand, and piecing the song together. At lesson’s end, The Miracle accompanies you with a synthesized orchestra. I may be a grizzled, cynical old reviewer, but, here’s quibble #1: Since you always work with the metronome, you cultivate a firm sense of rhythm. Fine. But you also never learn phrasing, rubato, feeling, or pedaling. Quibble #2: For some inexplicable reason, the right hand always plays single-note melodies, and the left plays three-note chords. Not only are such pieces atypical of piano music in general, but left-hand triads often sound muddy. Quibble #3: In some of the arrangements the musical interest has been stripped away. (In the Surprise Symphony, the surprise chord itself is missing!) There are a few errors in the musical notation (“My Country, ‘Tis of Thee” in 6/4 time). Last quibble: The program is slow to change screens, especially in color, and there are a lot of screens.

Because dynamics and expression are almost completely ignored, relying on The Miracle as your sole instructional source could be dangerous. (The absolutely black-buster piano method, of course, would be to use The Miracle under the supervision of a real teacher.) Even so, we can applaud The Miracle system for its breakthrough idea: to harness the popularity of the video age for the forces of education, self-improvement, and music. That may be no miracle, but it’s a pretty good trick.—David Pogue
**Super Tetris 1.0**

**PROS:** Better than Tetris; network and two-player options. **CONS:** Tiles are tiny; no DA. **COMPANY:** Spectrum Holobyte (510/522-1164). **REQUIRES:** Mac Plus; System 6.0.5; Mac II and 2MB of RAM for color. **LIST PRICE:** $49.95.

**REVIEWS**

There's one of those rare instances where a new version of a game truly improves on the original. Super Tetris (ST) is more varied, more challenging, and more forgiving than regular Tetris, and I predict it will easily outdo its predecessor's widespread, cross-platform popularity. The basic setup and controls are similar to those of Tetris. The pit, and there are the falling pieces. Each piece is composed of four squares, arranged in one of seven configurations. As the pieces fall one by one, you maneuver them (using the keyboard or an Advanced Gravis Mouse-Stick), trying to form horizontal lines. When you form a line, it disappears and you get points; when the pile of pieces reaches the top, the game is over. So far so familiar. But ST adds treasures and bombs, which provide strategic opportunities as well as a few ways to prolong a cliff-hanging game. ST also offers two-player modes (competitive or cooperative on one Mac, or head-to-head on a network).

The pit in ST has a waterline halfway down; the underwater part has a black background and contains rubble—assorted squares—interspersed with spaces that you can sometimes fit pieces into. Nine kinds of treasure squares are scattered among the rubble; you get rewards when you blow them up with bombs. As you complete lines, the pit scrolls upward, and you can see on a little map not only how far you are, but also a hidden picture revealed in the rubble you have eliminated.

My favorite new feature is the bombs. When you make a line, 2 bombs fall; if you make 3, 3 or 4 lines at a time, you get 4, 8, or 12 bombs, respectively. Bombs—which detonate on impact—can blow up one square each; you can use them to pare off the top of a too-tall tower or remove obstructions. With practice you can scoot the bombs about as they fall, taking out a square here, a square there, and carving a space for your next piece to fit into. When you blow up treasures, you get extra space, extra bombs, or extra pieces (unlike Tetris, ST starts you out with a finite number of pieces). You'd think all this extra stuff would be distracting, but everything works together just fine.

It's hard to find things to criticize in ST. The tiles have shrunk; presbyopes (like me) may need reading glasses to play in black-and-white. Much of the screen is taken up with gorgeous Moscow Circus scenes; I'd happily give up a bear or two for slightly bigger tiles. And if you try to play in two-player mode on an SE or a Plus, the game slows way down. Oh, and there's no DA version, as there was with the original Tetris.

But what a great game! I'm giving it four stars (instead of five) only because of the teeny tiles.

—FELICITY O'MEARA

**Education Game**

Where in the World Is Carmen Sandiego? Deluxe Edition suffers a bit from the problems that plague geography texts in the 1990s. In the game, Moscow is still the capital of the Soviet Union, and while Burma has become Myanmar, and its capital is Yangon, the first information I read about Myanmar told of a city called Rangoon. My Myanmar told of a city called Yangon, the first information I read about Myanmar told of a city called Yangon. The window shows various scenes, including pictures of the locations (lovely, but static and eventually repetitive) and brief animated sequences with clever, sometimes slapstick humor. The sound effects, from the rumble of the planes to the whistles, shouts, and crashes of the arrests in process, are truly wonderful.

Where in the World Is Carmen Sandiego? Deluxe Edition is available. Unfortunately, the red light is not all that noticeable, sometimes causing confusion. Clues from the crime net and information on the countries are shown as text in the central box of the Dataminder. The window shows various scenes, including pictures of the locations (lovely, but static and eventually repetitive) and brief animated sequences with clever, sometimes slapstick humor. The sound effects, from the rumble of the planes to the whistles, shouts, and crashes of the arrests in process, are truly wonderful.

Where in the World Is Carmen Sandiego? Deluxe Edition suffers a bit from the problems that plague geography texts in the 1990s. In the game, Moscow is still the capital of the Soviet Union, and while Burma has become Myanmar, and its capital is Yangon, the first information I read about Myanmar told of a city called Rangoon. Still, without almost daily updating, geography source can be perfect these days.

This deluxe version has 45 countries to visit, with 20 villains to capture, and 5 levels of difficulty—all a substantial increase over the original. More than 2500 clues ensure plenty of opportunity to learn lots of facts about the world.

This is education that’s fun for kids and adults. I learned a tremendous amount by playing it, and enjoyed myself as well. Yes, Broderbund’s done it again.

—WENDY SHARP
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**easyPrint 1.0**

**PROS:** Switches output devices quickly and easily; inexpensive. **CONS:** Documentation on disk.

**COMPANY:** SF/0 (415/328-9906). **REQUIRES:** Mac Plus; printer; System 6.0.5. **LIST PRICE:** $29.95; 10 copies $99.95; 50 copies $399.95.

**BACK IN 1989, APPLE COMPUTER promised that System 7 would contain a new print architecture allowing users to, among other things, print by dragging documents onto icons of printers on the desktop. Last May at the Apple Worldwide Developers Conference, that promise was renewed, but the release date was pushed back to “sometime in ’93.” If you’re as sick of the Chooser as I am, wait no more. Instead, pick up a copy of easyPrint, a nifty utility that lets you switch output devices without using the Chooser desk accessory.

The easyPrint utility itself doesn’t switch printers; you use it to create small applications (about 50K each) that do the actual job. When you launch easyPrint, a dialog box appears with a pop-up menu listing each device for which a Chooser driver exists in the System Folder, including laser printers, imagesetters, plotters, label printers, fax modems, slide makers, and more.

Choose the output device from the printer-type pop-up menu. If it’s a networked printer, you must specify the name and zone. Under System 7, easyPrint lets you pick from a dialog box that shows the available zones and devices. But under System 6, you must obtain this information using the Chooser, write it down, and then type it into easyPrint.

After selecting an output device, you’re prompted to enter a name and location on disk for the application that easyPrint will create. Since you needn’t use the same name as that which appears in the Chooser, call the printer whatever you want, whether it’s by location, printer type, or nickname. The applications also bear the same icons as the printers they represent.

To switch printers, launch an easyPrint application either by double-clicking on its icon on the desktop or by using a launching utility such as Icon Simulations’ On Cue. Under System 7, you can place easyPrint applications in the Apple menu for quick access, or drag documents onto a printer icon to select that device and print the document, too. You can configure the Mac to launch an easyPrint application on start-up so that a particular printer is always the default output device. In addition, there’s much less chance of compatibility problems than if easyPrint were a system extension.

On my Mac IIci it takes three seconds to switch printers using an easyPrint application, during which time an alert box appears informing you of the change. That’s faster than it usually takes just to open the Chooser, not to mention make a selection and then dismiss that annoying “You have changed your current printer” dialog box. SF/0’s package is recycled cardboard, and it forgets the traditional printed manual. Instead, the documentation comes on disk with a HyperCard-like browser. Unfortunately, the directions are riddled with typos and deviations from the Apple Publications Style Guide & Glossary. SF/0 puts itself on the back claiming “our ‘electronicDoc’ doesn’t use 32,000 pieces of 8.5 x 11 paper.” That’s true, but printing the documentation requires 100 full pages, with 75 percent of each sheet wasted on white space.

At only $29.95, easyPrint is a bargain for users who frequently switch between several output devices. But the real beneficiaries are network users. easyPrint greatly simplifies this task, but it doesn’t replace the Chooser altogether; you need the Chooser to mount file servers and to toggle background printing. Still, the program is so simple, it’s doubtful you’ll ever need SF/0’s technical support, which is available via a toll call, America Online, AppleLink, the Internet, and U.S. mail.—Owen W. Linzmayer

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Numerical Mathematics Software

**HiQ 1.0**

**PROS:** Amazingly fast at pure crunching; follows the Mac interface; thorough manual; champion at matrix and boundary value problems. **CONS:** A bit formidable for beginners. **COMPANY:** Bimillennium Corporation (408/866-2010). **REQUIRES:** Mac SE/30; math coprocessor; hard drive; System 6.0.5. **LIST PRICE:** $995.

**HiQ IS ADVERTISED AS “POWER Computing Software”: and for the tasks it addresses, it is, in fact, the most powerful numerical software for the Mac. This is not a symbolic computation program, as are Theorist, Maple, and Mathematica. It’s strictly numerical, strongly engineering-oriented, and it’s designed to push the limits of desktop numerical computing. HiQ can do, quickly, matrix problems that make MATLAB (longtime industry-standard matrix software) hang up and report system errors; HiQ can solve, using simple settings in dialog boxes, boundary-value problems for ordinary differential equations that need a lot of code-writing in Mathematica.

Bimillennium gets high marks for designing one of the few math software packages that isn’t obviously derived from a Unix-machine command-line-based ancestor. There’s a tool palette for defining objects (data, methods, graphs) on project worksheets, and the worksheets themselves are modeled on standard engineering notebooks. To solve a problem, you first define your symbols (HiQ-speak for scalars, vectors, matrices, graphs, and solvers) and then open one of the solvers to start computation.

A typical solver dialog box gives you an editing window for defining variables and equations and a list with a choice of numerical methods, where appropriate.

These numerical methods in the solvers are the heart of HiQ. I am at a loss to explain why HiQ doesn’t blow up on problems involving ill-conditioned 100-by-100 matrices. The references for each function detail the sources of the algorithms used, and these algorithms are in many cases the same ones used by other software. Yet no other math software for the Mac can get through such computations. The solvers—for expressions, polynomial and general roots, nonlinear equations, integration, statistics, optimization, and initial-value and boundary-value problems in differential equations—report not only timing and numerical accuracy or results, but generate code for the statement and solution of the problem in a HiQ script window. HiQ script is a simple language with program control commands like those in C or Pascal but displays an enduring nonchalance about data structures and variable typing, and you can easily customize computations since all the mouse-clicks generate script.

This software is not the first choice for freshman calculus classes, but it’s the right choice for serious engineering work, or as a replacement for other packages when severe numerical challenges cause the Mac to crash, take forever, or generate nonsense. HiQ can overpower mainframe-grade calculations and has dazzling graphics, an intelligent interface, and a useful script language you can learn in an afternoon.—Charles Seiter
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Notebooks use genuine Apple ROM and System Software and are equipped with all of the ports you'd expect in a Mac®.

### The specs speak for themselves:

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Notebook prices based on Outbound direct sales. PowerBook prices reflect published Apple retail pricing. Technical specifications and prices subject to change without notice.

### Enjoy Mac compatibility

The Macintosh ROM is pre-installed with memory conscious System 6.0.7, but Outbounds are fully compatible with System 7 and thousands of Macintosh applications. All models include an internal SuperDrive equivalent floppy disk drive for working with high and low density Mac and MS-DOS diskettes.
The experts love it too!

"Outbound offers top-notch portable Mac."  
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*Portable Office Magazine*

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*1991 BYTE Award of Merit*  
*BYTE Magazine*

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*MacUser Magazine*

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**and mobile Mac accessories**

Like our Notebook, you can count on Outbound peripherals and accessories for innovation and 100% compatibility with Macintosh and Outbound computers.

### The Outbound Outrigger monitor

Our Outrigger Intelligent portrait monitor for instance, eliminates the expensive SCSI interface normally required to hook a computer to a full-size monitor. A simple SCSI cable will connect the Outrigger to your Outbound Notebook, Apple PowerBook or any Macintosh. It sports a lightning fast, built-in 20 MHz 68000 processor and an extra SCSI port for even more versatility. The Outrigger increases your screen area up to 200% and helps turn your notebook into a true desktop station.

---

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**OUTBOUND NOTEBOOK**

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Construction and Remodeling Software

ConstructionMac 1.2

PROS: Flexible; comprehensive toll-free phone support; extensive list of materials. CONS: Complicated; slow; high memory needs; disorganized, incomplete documentation. COMPANY: Reveler Corporation (801/485-3291). REQUIRES: Mac Plus; 2MB of RAM (4MB with System 7); hard drive; System 6.0.5. Recommended: Color monitor.

LIST PRICE: $99.

MAKING FIVE TRIPS A DAY FOR supplies is remodeling or new construction at its worst. ConstructionMac aims to organize your project so you know in advance what you will need, about how much it will cost, and realistically when the project will be finished. The program achieves those goals to a limited extent—and with much work from you.

A project summary window contains a table of estimated and actual cost subtotals for 15 phases of a project. Of these, 11 phases have separate estimator windows for calculating and listing detailed costs. You can type detailed items or copy and paste many items at a time from a comprehensive materials window. ConstructionMac intelligently narrows its list of 1200 materials to items relevant in one estimator window at a time, helping ameliorate the program's overall slow scrolling.

Nine of the estimator windows calculate costs for some detail items but not others. In the drywall estimator window, for example, ConstructionMac calculates the cost of drywall and its installation, and calculates the quantity of joint compound and joint tape. You can transcribe the calculated costs into the drywall-cost table, but you must multiply (with a pocket calculator or maybe your brain) the calculated quantities by their unit costs before you can enter the total costs of those items.

You may have to break a project phase into multiple sections. For example, you might separately calculate the cost of ordinary drywall, waterproof drywall, and fire-resistant drywall. Subdividing like this gets complicated, and the documentation doesn't give enough guidance. Also, you must somehow divine numerous detail items, perhaps by scanning the materials window. In the rough carpentry estimator window, for example, you should include nails of various types, framing connectors, joint hangers, and other hardware. You have to speculate on quantities for the miscellaneous items you need and calculate their costs.

ConstructionMac doesn't recalculate whenever you change an input. Instead, clicking a button in an estimator window updates calculations in that window and posts the total costs of the window's detail items to the project summary window. Buttons at the bottom of each estimator window conveniently lead to the other estimator windows.

Other windows compute square footage, wallpaper quantities, heaped feet of lumber, and quantities of plywood or other sheathing. Using one of these four windows sometimes scrambles the display of the estimator window beneath it, but closing and reopening the estimator window restores it.

ConstructionMac includes a simple project-scheduling application. It lacks graphic input or output, so you enter a start date, task durations, and optional task costs in a table. Nonstandard keyboard navigation complicates this entry; you press arrow keys (not tab) to move among table cells. To see which cell you've selected you must press the enter key. You can also tediously select cells with the mouse. Clicking a button calculates the start date, end date, and several other statistics for each task.

Reveler is extensively revising ConstructionMac to fix many of version 1.2's shortcomings. For now I can't recommend the program to people who have never done remodeling or construction work, but those with some experience may find it helps organize their next projects.—LON POOLE

Fax Modem with Voice Mail

Ultima Home Office

PROS: Easy-to-use fax and voice software. CONS: Voice software is buggy; poor response from technical support. COMPANY: Prometheus Products (503/692-9600). REQUIRES: Mac Plus; 2MB of RAM; hard drive; System 6.0.4 (System 6.0.7 or System 7 for voice features). LIST PRICE: $649.

THE ULTIMA HOME OFFICE IS A 14,400-bits-per-second data modem, a send/receive fax modem, and a voice-mail system. The fax-modem component operates well, but the data modem and the voice-mail system need work to be acceptable.

In my tests, faxing worked well. I was able to send and receive faxed items from a variety of stand-alone fax machines, and between two other fax modems. To send a fax, you select the fax driver in the Chooser and choose Print from within whatever application you're using. Alternatively, you can use Maxfax to install a Fax menu in any application's menu bar.

Data transfer was disappointing. The modem worked fine at 2400 bps connecting to America Online and other services, but it disconnected randomly and unexpectedly at 9600 bps and 14,400 bps when used with a variety of telecommunications software.

The voice-mail system makes this product different from the other V.32bis modems on the market. You use the Maxfax software to set up, on the computer connected to the modem, a separate voice mailbox for each user; users can then call in, play back messages, and delete them remotely. To receive voice messages, the Maxfax application must be open; when a call comes in, Maxfax switches to the foreground and the voice-mail feature takes over the Mac until the call ends.

When you want to retrieve messages, the software has a nifty TollSaver feature, so that if you call in long distance and have no messages waiting, the modem doesn't pick up for a user-defined number of rings. When you have messages waiting, the modem answers on the first ring (also user-configurable). So, if you hear more than one ring, you know there are no messages and you can simply hang up.

You record your greetings for the voice mailbox using the Mac's built-in sound input; with an external sound digitizer such as Macromedia's MacRecorder, or with a telephone plugged into the modem. Voice quality recorded through the modem was only fair; one friend who left a message complained that the outgoing messages sounded as though they had been recorded undervalue.

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Kid Pix Companion 1.0

**PROS:** Adds clever new features to Kid Pix; includes the world's easiest-to-use QuickTime movie and presentation modules.

**CONS:** More complicated than the original program; sluggish; requires lots of Mac horsepower.

**COMPANY:** Broderbund Software (415/382-4400). **REQUIRES:** Mac Plus; hard drive; System 6.0, Kid Pix, for color: Mac II; 2MB of RAM. For System 7: 2MB of RAM; 4MB of RAM for color. For QuickTime: 4MB of RAM; System 6.0.7. **LIST PRICE:** $39.95.

My worry was that once the Big Bad Marketing People started messing with Kid Pix, they'd disturb the delicate blend of whimsy and simplicity. The description of Companion sure makes it sound that way. It comes on four disks; the author of Kid Pix wasn't involved in the sequel; and the manual says that the program "was designed so that kids... can have fun with multimedia technology." Yikes.

Companion is indeed more complex than its predecessor, but not overwhelmingly so. Some of it merely supplements Kid Pix features—for example, it provides 112 new images for the rubber-stamp tool. Alas, many of them are either weird (a heavy emphasis on Middle Eastern culture), a bit intense (gravelstone, skull), or so complex that you can't even identify the subject matter. (The figure at right shows three old stamps, on the left, and three of the new ones.)

The new features work much better. If you choose Color Me from the Companion menu, a dialog box appears (do three-year-olds know about dialog boxes?), from which you can choose any of 17 excellent line drawings to color in with the painting tools. Even better is the Draw Me command, where the program suggests something for you to draw, by both displaying a sentence on screen and having a gang of goofy voices read it out loud: "I'm a hummingbird fetus/with a hundred toes and a pickle in my nose/and I rock the house. Draw me!" The company says that there are "literally thousands" of possible sentences, but in fact you start hearing recycled clauses after only a few times.

The Wacky TV is a QuickTime movie player (the rest of Kid Pix goes away while the TV is open). It's fun to play the 15 included cinemovies (an average of about two seconds long), which you can play forward or backward, speed up, stop, and start. You paste a movie into your Kid Pix painting, where it plays whenever you choose Play Movie from the menu.

The final piece of the Companion kit is a separate program called SlideShow: a presentation program for prepubescents. You assemble up to 99 "slides" (Kid Pix paintings or QuickTime movies) using a storyboard interface. Then you specify a sound, timing, and transition effect (dissolve, cross-fade, and so on) for each.

It's all perfectly charming, but Companion lacks the goof-proof personality of the original Kid Pix; think of it as Preteen Pix. If that's not a problem—to you or your resident graphic artists—then by all means, convert your offspring into movie-making multimedia moguls.
**DateBook 1.0**

**PROS:** Easy to use; well designed; flexible views of events; integrates with TouchBase. **CONS:** Printing is buggy and incomplete; not multitimer.

**COMPANY:** After Hours Software (818/780-2220). **REQUIRES:** Mac Plus; 2MB of RAM; hard drive; System 6.0.5; System 7.0 for integration; TouchBase 2.0. **LIST PRICE:** $125.

**DATEBOOK OFFERS A FLEXIBLE APPROACH TO EVENT SCHEDULING AND TO-DO LIST MANAGEMENT. ANY ITEM ASSOCIATED WITH A TIME IS AN EVENT. TO-DO ITEMS CAN BE PRIORITIZED AND CAN BE CHECKED OFF WHEN COMPLETED. UNCHECKED ITEMS CAN BE AUTOMATICALLY forwarded TO THE NEXT DAY. DATEBOOK HAS YEAR, MONTH, WEEK, DAY, AND CUSTOMIZABLE LIST VIEWS OF YOUR ACTIVITIES; YOU CAN ENTER DATA IN ANY VIEW. THE MONTH VIEW AND YEAR VIEW SHOW THE CALENDAR AND A RESIZABLE DAY-AT-A-GLANCE AREA LISTING EVENTS AND TO-DO ITEMS. THE WEEK VIEW SHOWS ONLY EVENTS. DATEBOOK ALSO HAS A SMALL FLOATING WINDOW SHOWING THE CURRENT DAY AND TIME, ALONG WITH AN ALARM BUTTON AND A NEW BUTTON. YOU CAN ENLARGE THE WINDOW TO VIEW THE DATE, TODAY’S EVENTS, AND TO-DO’S. YOU CAN PAGE THROUGH TO PAST AND FUTURE DATES AND CLICK ON TO-DO’S TO MARK THEM AS COMPLETE.

Using System 7.0, DateBook has a two-way link via Apple events with After Hours’ TouchBase address-book manager. Data from the TouchBase file is copied into the Description field in the DateBook entry screen. You can also make changes to data in DateBook, and post those changes back to TouchBase.

DateBook has some innovative and unique user-interface features. Clicking on the month name in any view pops up the Date Selector menu. From this menu, you can move to any past or future date with one click. As you enter events, the program shades the appropriate segments of the day.

DateBook also has a small floating window showing the current day and time, along with an Alarm button and a New button. You can enlarge the window to view the date, today’s events, and to-do’s. You can page through to past and future dates and click on to-do’s to mark them as complete.

Although the manual refers to multiuser operation on a network, DateBook 1.0 works only in single-user mode. Due to last-minute problems, the company decided to release a single-user version; the package includes a note to that effect.

DateBook’s printing problems and recurring-events awkwardness prevent a higher rating for now. But if After Hours delivers the promised goods with its maintenance release, DateBook will deserve a second look.—TOM NEGRINO

**File-Share Monitoring Utility**

**Nok Nok 1.0**

**PROS:** Maintains log of attempted and successful connections to File Sharing; can determine identity of guest users; can set maximum connection time. **CONS:** Expensive for large number of network users. **COMPANY:** Trik (617/933-8810). **REQUIRES:** System 7. **LIST PRICE:** $49.95; five users $199; ten users $349.

**WHILE SYSTEM 7’S FILE SHARING FEATURE HAS ADDED NEW FUNCTIONALITY TO NETWORKED MACS, IT HAS ALSO INTRODUCED NEW SECURITY RISKS. NOK NOK HAS FOUR BASIC FUNCTIONS: ALERTING YOU WHEN ANYONE CONNECTS TO YOUR MAC THROUGH THE FILE SHARING FEATURE; LOGGING ALL ATTEMPTS AT CONNECTING TO YOUR MAC; SETTING TIME LIMITS FOR FILE SHARING USERS; AND DETERMINING A GUEST’S IDENTITY. IN MY TESTS, NOK NOK PERFORMED ALL THESE FUNCTIONS WELL.**

If you want to keep track of all users who connect to your Mac, you can configure Nok Nok to alert you on every connection. The notification can be a dialog box showing the name of the user and the name of the user’s Mac; a sound played from your System file; an icon flashing in the menu bar; or System 7’s File Sharing Monitor log.

The File Sharing Monitor is particularly useful if you want to disconnect the user immediately (if you’re getting ready to turn off your Mac, for example). Nok Nok can also be configured to maintain a log file of all attempts to use File Sharing. This plain-text file stores the name of the user attempting to connect as well as the time and date of each attempt.

It’s a common occurrence that once a user connects to a file server, that user often stays connected to the server until it’s time to shut down. With System 7’s File Sharing, a user might stay connected to your Mac (which acts as a server) all day even if he or she is not using any of the files on your Mac. That presents a security problem when the user is not in front of the Mac, since another, unauthorized user could use that Mac to access your files, possibly changing or deleting them. To guard against that situation, Nok Nok lets you set a maximum idle time for any File Sharing connection.

Nok Nok lets you restrict the amount of time File Sharing users can stay connected to your Mac. A connected user is notified two minutes before the maximum time is reached, which is usually enough time to complete the current task and disconnect from File Sharing. If the user is still connected when the maximum time is reached, he or she is disconnected from your Mac. In System 7’s File Sharing, you can authorize access to registered users who have access to many files on your Mac, as well as guest users, who have restricted privileges. Nok Nok allows you to set a different maximum connect time for registered users and for guests.

When a guest user logs on to your Mac using File Sharing under System 7, you know only that a guest is logged on; you have no idea who that user is. With Nok Nok, you get the name of the user and the name of the user’s Mac. If the user’s Mac is running System 6, you only get the Mac’s Chooser name. Either way, the information is usually sufficient to determine who’s using a guest account to access your Mac’s files.

Nok Nok does a good job of plugging the security holes that File Sharing created in System 7. I’d recommend Nok Nok to anyone using the File Sharing feature of System 7.—DAVE KOSIUR
NueX aims to marry artificial neural networks (ANNs) and knowledge-based expert systems (KBs) to let you create “intelligent” applications. Rule-driven KBs use preprogrammed true/false tests to analyze input data and arrive at one or more preordained conclusions. Data-driven ANNs use pattern recognition and weighted probabilities to analyze input data and “learn” to classify that data into categories. Combining the two makes possible sophisticated expert systems that can adapt to varying input data while still analyzing that data using a set of deterministic rules.

NueX is a HyperCard-based shell that provides both ANN and KB functions. The package includes the NueX main stack, a number of simple examples, and a rather thin user guide. Inside the main NueX stack are several components. The neural-network editor lets you create ANNs that are modeled by a C-based ANN simulator built into the NueX stack. A data editor (Apple's TeachText) lets you enter training data in the form of expected inputs and outputs. The ANN Monitor passes the training data through the network iteratively so the ANN can learn the input patterns and expected results. A logarithmic graph displays the effectiveness of each training cycle, letting you monitor how reliably the ANN produces correct output. The other side of NueX—its KB expert-system component—consists of a rule/fact editor and an inference engine.

NueX's rule language uses HyperTalk syntax, although you don't need to understand HyperTalk to use the KB. You use the rule/fact editor to enter KB rules and general facts; you then run the inference engine to analyze input data using those rules and facts, yielding a predicted output.

While NueX is certainly complex, and even educational, it's not ready for prime time as a serious production tool. First, its HyperCard foundation limits its speed—even on an accelerated Mac IIci, NueX is painfully slow. Second, the two sides of NueX—neural network and expert system—are woefully unbalanced. The ANNs tools are fairly complete and easy to use, although relying on TeachText as a data-input editor is a definite cop-out. The KB tools, though, seem to be an afterthought: they're far less sophisticated than those in competing, but much cheaper, expert-system products. The documentation, too, is uneven and incomplete—delving into neural-network theory to the point of discussing differential equations, while glossing over such issues as how to handle symbolic input. Tutorials are simplistic and don't adequately explain various NueX components, such as the ANN training graph. Finally, all of the examples provided are trivial; users of a professional-level product require usable templates.

As a lightweight intro to neural networks and expert systems, NueX has some merit, although its price makes it unattractive for educational purposes. But for practical use, it's impractical.

—MEL BECKMAN

Network Calendar Program

Now Up-to-Date 1.0.1

PROS: Fast; easy to learn; colorful displays; surprisingly bug-free for an initial release; good variety of printing options. CONS: Lacks to-do list feature; no word wrap in monthly calendar. COMPANY: Now Software (503) 274-2800. REQUIRES: Mac Plus; hard drive. LIST PRICE: $99; five-user pack $399; ten-user pack $599.

Tough less than a year old, Now Up-to-Date has become one of the most popular calendar programs for the Mac. It's not hard to see why. Now Up-to-Date's swift performance and logical structure make it exceedingly easy to use. And while networked users may find setting up the program's public, or shared, calendars a bit complicated at first, solo users probably won't even have to touch the manual.

Up-to-Date has terrific graphic appeal—especially on a color screen. Upon start-up, a spacious monthly calendar appears in a resizable window. You can also open weekly or daily views of your schedule and consult the two views simultaneously. In all the views, you can customize the calendar's fonts, styles, lines, and colors to suit your preference.

Entering data is fast and hassle-free, thanks to keyboard shortcuts. You can add new events or appointments to the calendar in any view. Double-clicking on the name of an event opens an Event Info window, in which you can set the duration of the event and assign it either to your own personal calendar or to a shared network calendar. There are options for setting alarms, creating recurring events, and adding detailed comments of up to 255 characters.

To mark longer stretches of time on your calendar—several days, or even a week—you can create banners, which can be resized and stretched across your monthly calendar. For general reminders, you can add notes to the calendar.

Over a network, Up-to-Date users can post events, banners, and notes to any number of public calendars, which are stored on the calendar server Mac and shared by other users. Users can assign unique colors and text styles to their views of a shared calendar to make identifying events easier.

Up-to-Date's Appointment Book program provides an outstanding variety of printing options. Daily, monthly, and weekly schedules can be printed out in three different appointment book sizes. You can print calendar views containing up to four months on each page, or you can create tiled wall calendars up to 3½ by 3 feet.

Up-to-Date has a few deficiencies: there's no word wrapping of event text displayed on the monthly calendar, so appointment listings are always cut off abruptly after the first few words. Events shorter than 30 minutes are unreadable in the daily view because they're scrunched into slivers on the time line. And events in Up-to-Date must always be rounded off to quarter-hour intervals; events can't begin or end at, say, 2:20 or 3:55.

Finally, there's one glaring omission. There's no way to list and prioritize general to-do items—an indispensable part of any comprehensive daily planner. Though Up-to-Date lets you save events without displaying a specific time in the monthly view, it always assigns a default time to them in the daily view. Likewise, when you export Up-to-Date data as a text file, all events are assigned a time, even if you've checked No Time in the Event Info dialog box.

Still, this is an outstanding calendar. And for a 1.0.1 version, it's polished and bug-free. According to the company, version 2.0, due out in the fall, will include a to-do function and a list view that will display to-do items alongside the daily schedule. The company also says that in version 2.0 each date cell on the monthly calendar will have word wrap and be scrollable.

—JOSEPH SCHORR
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Network-Administration Utility

**RouterCheck 2.0**

**PROS:** SNMP checking; excellent user interface; continuous network polling.  **CONS:** Expensive for small networks.  **COMPANY:** Neon Software  
(510/283-9771).  **REQUIRES:** Mac Plus; System 6.0.  **LIST PRICE:** $895.

**GATORS BOXES AND ETHER ROUTES**

and FastPaths, oh my! So goes the lament of the network administrator who must daily face the challenge of monitoring a busy multiple-network system, or internet. Those electronic beasts known as routers break up a large network, into an internet of zones that then use the routers to communicate with one another. This speeds up network processes such as printing, E-mail, and server access by creating a smaller area for data to travel. Routers can also provide translation services between different network protocols (AppleTalk to Ethernet, for example). But keeping track of routers and the traffic they process—especially if the mechanisms come from different manufacturers—can drive you round the bend.

RouterCheck 2.0 is compatible with any Phase 2 AppleTalk router, both hardware and software. For RouterCheck to collect detailed information (beyond simply the zone list), the router must support SNMP protocol. It provides cross-vendor router accessibility with a much improved user interface over that of its previous version. It also provides real-time monitoring of the network via SNMP (Simple Network Monitoring Protocol), constantly polling the routers to ensure that network traffic stays at an optimal pace. If bottleneck or other zone problems do occur, you can correct them either by resetting the router via the RouterCheck application or, for more intricate operations, by using the router's native configuration software.

RouterCheck begins by scanning the internet for routers and collecting some basic information such as the internet and zone numbers, and the brand name of each router. It then displays a router list from which you can obtain additional detailed information by double-clicking on the names of listed routers. This information includes vendor-specific data such as software version and PROM numbers, and network-specific information such as zone location, net and node identities, and the routing table (a list of all the networks it sees). This first search can take a few minutes or a few hours, depending on the number of routers in the internet. You can save this router list to track changes to the network.

**Version 2.0 adds two excellent polling and monitoring features. You can now set RouterCheck to poll routers to see which ones are working and which ones are down, and to watch for changes in network traffic speed and zone lists. RouterCheck keeps a log of this traffic information, and when suspicious activity occurs (such as a new zone appearing or traffic slowing down), the software can notify you in a number of ways, including an on-screen message, an alert sound, or a pager via Ex Machina's Notify software. Dialog boxes suggesting possible reasons for suspicious activity are another excellent new feature.**

At $895, RouterCheck is too pricey for most tiny internets (one to four routers). That's unfortunate, because the wealth of information RouterCheck provides would be useful for managers of small internets and for newcomers to network management. A lower-price version with an upgrade path would be a great addition. On the other hand, the only limitation to the number of routers that RouterCheck can monitor is the capacity of the administrator's Mac. Larger internets require more memory and disk space to compile and save reports. For mid-size to larger internets, RouterCheck is a must. It keeps your finger on the pulse of your router configurations and internet traffic—and keeps your pulse in check.

—MATTHEW R. CLARK

**Foreign-Language Reader**

**Transparent Language 1.04M**

**PROS:** Simple to use; inexpensive; minimal system requirements; single program reads multiple languages.  **CONS:** No word-count feature; no print feature.  **COMPANY:** Transparent Language  
(603/465-2230).  **REQUIRES:** Mac 512K; System 6.0.  **LIST PRICE:** Three stories in French, German, or Spanish $139; three stories in Latin $129.

**ANY FACTORS ARE INVOLVED IN learning and retaining a foreign language—first acquiring the accent, vocabulary, and grammar, and then practicing those elements through conversing, listening, and reading. Transparent Language addresses just one part of that process—reinforcing foreign-language skills through reading. This is a program without an iota of glitz or glamour. And though I'm as charmed as the next person by the Mac interface, I am completely undisturbed by Transparent Language's lack of sound, graphics, color, or even buttons. For a 128K application that enables me to read stories in French, Spanish, German, Latin, and Italian—one program—I'll do without.**

If you install stories in several languages, all are available from a single Open New Title command, although you can open only one story at a time. The main screen is simply a scrolling text window containing the story. It is surrounded by five smaller windows giving the meaning of each highlighted word, the phrase in which it appears, the whole sentence or clause, plus any comments or notes the translator chooses to include. For example, the German phrase *die Katze im Sack zu kaufen* (underlined to indicate that it's idiomatic) translates literally to "to buy the cat in the sack," but it correlates with the English expression "to buy a pig in a poke," meaning to accept something sight unseen. In another story the interpreter explains that the Spanish verb *se bahía turbar* is in the pluperfect tense, formed from the past participle of *turbarse* (to become upset) and the auxiliary verb *haber* (to have). Using the Root Search command, you could look for all verb tenses formed with *haber*, or use Word Search to locate other pluperfects formed with *había*. For help working through long or complicated sentence structures, you can choose Underline Segment. You can also place and find bookmarks, helpful for studying lengthy works.

You can move and resize any window, change its font and point size, and close or open it via the pull-down Show menu or keyboard commands. Most of the #-key combinations deviate from Macintosh standards and are instead mnemonic—#t-W is the toggle for the Word Meaning window, for example, and #t-P is for Phrase Meaning. But since most of the normal Mac commands don't apply (you can't print stories or windows, for instance), this poses no real problem. The commands for Open, Quit, and Help are standard.

The technology underlying Transparent Language works with any Latin character-based language; availability of translated works is the only limitation. The company continues to build its catalog and expects to add new languages in the future. For now, its offerings include works in French by Balzac and Baudelaire, in German by Kafka and E.T.A. Hoffmann, in Spanish by Cervantes, in Latin by Cicero and Catullus, and one short Italian story by Manzoni. Most full-length titles run roughly 25 to 50 printed pages and cost from $12.95 to $29.95. Optional audiotapes are also available (from $5.95 to $9.95).

The program has no facility to test a student's vocabulary or comprehension, which some may regret. I would have liked a word-count feature to help gauge progress. But these are minor quibbles and not really part of Transparent Language's simple, clear-cut mission. This is a superb tool for bolstering language skills through reading.  
—MARJORIE BAER

212 October 1992 MACWORLD
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The Department of Music Education

BY DAVID POGUE

YEAH, YEAH. THE MAC IS THE
musician’s computer. We all
know that every jingle is re­corded, and every Broadway
show tune published, and ev­ery
movie sound track assembled, by Macintoshes. The
music pros are in heaven. Good for them.

But what about the wannabes? What about the
11-year-olds coming home from school and having to choose be­tween practicing piano and Super Mario Bros. on the Nintendo? Or the 60-year-olds coming home from work and want­ing to pick up where high-school band left off? Or the in-between-year-olds who just
want to learn a little music without mak­ing it a big expensive federal case?

Due to the tragic perception that mu­sic on the Mac is a niche market (read: not
profitable), most music-instruction pro­ducts have a decidedly homemade feel.
Most are created and marketed by one person. Fortunately for the future of America’s choirs, bands, and symphonies, there are still some standouts.

The Miracle Piano Teaching System
IF YOU HAVE SEEN THE ADS ON TV,
you already know that this product is
not put out by any one-man operation (Software Toolworks, $499.95). It has
its faults and foibles, but it’s thoroughly modern, assumes no prior knowledge, and has enough lessons to keep you busy for a year.

The Miracle is an electronic MIDI
keyboard that connects to the Mac. The software listens to what you play, gives
feedback, points your mistakes. (MIDI comes up in every discussion of the
Mac and music, including this one. MIDI, pronounced middy, is the electronic
language—and the physical connector—that a Mac and a synthesizer use to com­municate. Like PostScript, only musical.
A MIDI file is a generic music docu­ment, like a word processor’s text file.)
For more on The Miracle system, see
Reviews in this issue.

Compose Yourself
THIS ECCECTRIC COLLECTION OF FOUR
tools—a manual, two cassettes, some
HyperCard stacks, and a sequencer (a
program that records anything you play
on a MIDI synthesizer)—is dedicated
to teaching what’s unteachable: how to
compose music.

The cornerstone is the manual, a
lovingly prepared unveiling of the author’s
personal observations and secrets for com­posing (MacBeat, $99). The beginning
chapters make a cursory attempt at teach­ing music theory, appreciation, and nota­tion—but don’t be fooled; it’s way over
the heads of nonmusicians. If you are a
musician, you will indeed find some inspira­tional nuggets, and I can imagine one or
another of the 66 composing ideas de­scribed in the Strategies stack bumping
even a seasoned pro out of a rut. Bag the
 crude sequencer, though, and don’t
bother with the dozens of recorded mu­sical examples on disk—they’re improvi­satory noodlings, wrong notes and all,
more desultory than illustrative.

Jazz Through MIDI 3.5
AT FIRST, YOU MIGHT THINK THAT THIS
typewriter-produced, unproofread, cut­and-pasted book is an ordinary Jazz­for-Klutzes textbook, complete with
opaque sentences like “To find the ‘Tri­tone substitution for any chord count
three whole steps from any dominant sev­enth.’” But then you listen to some of
the musical examples—two disks full of
absolutely sizzling jazz, blues, and Latin
MIDI files—and your jaw begins to drop.
Using a sequencer program like EZ
Vision, Pro 4, or Performer, you can slow
down these exquisitely recorded pieces
(piano, bass, drums, and vibes are
on separate tracks), and follow the included sheet mu­sic, until you understand how
the jazz greats do it. It’s as­sumed that you have a good
MIDI synthesizer and a se­quencer program, and that you
already play the piano. If you
want to learn jazz, you may get
a lot out of this crude but ef­fective Music Minus One for the cellular-phone set (New
Sound Music, $49.95).

The Book of MIDI
IT IS A WHOPPING 3-MEG,
310-card HyperCard stack
that introduces you to MIDI (Opcode
Systems, $39.95). Some of it makes in­credibly clever use of HyperCard. For
example, in the excellent chapter on clas­sic old synthesizers, you get to hear a two­second snippet of each keyboard being
played. And the how-to-wire-your-home­studio section is perfect: animated cables
snake through the diagram one at a time,
leading you through that hairy process blow by blow.

Ironically, I doubt you’ll learn much
about MIDI. It’s one of those irritating
texts that regurgitates technically correct sentences without making them mean­ingful: “The first bit of a byte defines the byte as either a status or data byte, and is called the Most Significant Bit (MSB).” Um, yeah. I was gonna say that.

There’s a little bit of hypertexy stuff—you know, where you click on a boldfaced term and a definition pops up. Trouble is, definitions in this book don’t actually pop; instead, when you click on a term, you’re taken to another card in the stack, where the definition contains other obscure terms. By the time you have a decent understanding of the original term, you’ve traversed cards all over the stack, and you’ve long since lost your place.

MidiSchool
NEVER HAVE THE TECHNICAL BAFFLE­
ments of MIDI been so lushly illus­trated—both musically (if you have a
synthesizer connected) and graphically
(thousands of drawings and car­toons)—as in this gorgeous
219-card HyperCard stack (EduActive, $119). Unfortu­nately, the text doesn’t live up to
the graphics’ high stan­dards; while difficult concepts are somet­imes cleverly ex­plained (“MIDI has channels, just like your television”), an
equal number are tossed out
without regard for the begin­ner (“Use a MIDI cable rather
than a 5-pin DIN, or it is likely to
cause a ground loop”). And
the fact that two of the three main section titles feature
AWOL apostrophes foreshad­ows the punctuation problems that occasionally follow.

CONTINUES
Still, writer/illustrator/programmer/marketing department Paul Keeffe has put enough polish into this stack to win it a spot on any music teacher’s desk. The program can track the individual progress of many students; there are two interesting (but somewhat lame) built-in MIDI programs, including a sequencer; and the electronic Administrator’s Notebook gives the instructor a degree of control over the proceedings. Best of all, it’s impossible to get lost in this stack; the navigational controls are crystal-clear.

**An Intro to MIDI 1.1**

The last in the stack of stacks is this 88-card shareware offering ($15 requested; I found it on America Online). It’s not nearly as complete as the commercial MIDI stacks; it has no illustrations, sounds, or MIDI features; and this text, too, is afflicted by CRAMPS (careless-random-apostrophe-mistakes-by-programmers syndrome).

Even if tough MIDI concepts aren’t much better explained for the beginner, the writing tone is fanlier than in the other stacks. And this stack costs next to nothing to download (transfer) to your Mac; you may as well peruse it to see if HyperCard MIDI training is your cup of techno-tea.

**Adventures in MusicLand 2.0**

This package contains four cute, colorful guessing games that involve music and sound (Dr. T’s Music Software, $79). Two of them are like the old “Concentration” TV show; you have to remember the locations of face-down musical cards. In Picture Perfect, you’re shown one small section of a composer’s face (or an instrument, or a musical symbol) at a time, and you’re supposed to identify it by typing. And Melody Mixup is like that cumulative-memory game for long car rides: “I’m going on a trip and I’m taking an Armadillo, a Bongo, and a Cucumber... your turn!”, except that you have to play back increasingly long sequences of musical notes.

Two problems. First, the novelty wears off fast. In Sound Concentration, for example, there are only eight sounds (dog barks, glass breaking...), no matter how many times you play. Second, I couldn’t figure out whom these things are for. Adults? Then there needs to be a gazillion times more variety. Kids? Give it up—no ten-year-old I know could come up with answers like Mendelssohn and Mondelez. Oh, sure, some of the games, using certain program settings, might be educational and fun for anyone. But the 20-second credit sequence plays, unstoppable, every time you change games. The program is as easy to use as it is to lose. It shows a piano keyboard and a single note of a chord. The program supplies the rhythms you paint (or rhythms) onto the keyboard (or fingerboard). You can use either the built-in Mac speaker (and select from dozens of instrument sounds), an attached MIDI keyboard (incredibly useful), or both. This is the only drill program you can control by pressing various on-screen buttons by remote control—so that you’re not continually scooting back and forth from desk to synth.

Every kind of drill is included (intervals, chords, melodies, scales), and everything is customizable (what range of notes to use, whether or not you want a timer, how many notes in a chord, and so on). Too bad there’s no rhythm training and not much in the way of note-reading drills. An un-copy-protected version (2.1.3) is supposed to be available by the time you read this.

**Listen 2.1.2**

The LISTEN PROGRAM, says its manual, “is not intended to replace a full course in melody and harmony.” Precisely so; but if you have a book or a teacher to spell out the basics for you, I can’t imagine any better way to practice sight-reading, ear training, and note recognition (Imaja, $99). As Listen plays each note, you get triple sensory reinforcement: how it sounds, how it looks on paper, and where it is on the keyboard (or fingerboard). You can use either the built-in Mac speaker (and select from dozens of instrument sounds), an attached MIDI keyboard (incredibly useful), or both. This is the only drill program you can control by pressing various on-screen buttons by remote control—so that you’re not continually scooting back and forth from desk to synth.

The program uses either built-in Mac sounds or a MIDI instrument. Unlike Listen, Practica Musica emphasizes reading music, and its ear-training examples use actual melodies instead of computer-generated note strings. The pitch and rhythm training drills are particularly cooperative: you paint pitches (or rhythms) onto a staff, and the program supplies the rhythms (or pitches) automatically. The program doesn’t look as good as it works, though; it has crudely-drawn musical notation, nonstandard scroll bars, and a few other clunky interface elements. (The author says that version 3.0, now in development, will be gorgeous.)

**MIBAC Music Lessons 1.1**

In another era, on another computer, this might have been a great drill program (MIBAC Music Software, $119). It shows a piano keyboard and a single staff. The program plays exercises using either the Mac speaker (no choice of sounds) or MIDI. It has 11 drills, from key-signature recognition to scale-naming. It’s an easy-to-use, absolutely literal, electronic edition of the ear-training and theory drills you took in college.

But Music Lessons left me disappointed. There’s no melody ear training, no chord drills, no inversion tests. When you play answers on the MIDI keyboard, the program marks as incorrect any notes you play that fall outside of a limited keyboard range. The whole thing feels a little leaden, partly because it takes so long for the program to cough up the answers (and the next drill), and partly because there’s so little spark or variety.

**The Upshot**

There’s no question that computerized music lessons are superior (levelier, more illustrative) to the ones in self-study books. They even have certain advantages over classes: you control the pace and the difficulty, for example, and the feedback on drills is instantaneous. But without a teacher, the mighty burden of motivation falls back into your lap. If you think you’re self-disciplined enough to stick with it, here’s what I’d tell you.

To learn piano, get The Miracle. To learn to read music, get The Miracle or Practica Musica. To cultivate your ear and reinforce your music theory, it’s Practica Musica or Listen. To learn MIDI, start with Intro to MIDI; buy MidiSchool if you’re still curious. And then remember what the New York City cop told the tourist who asked how to get to Carnegie Hall: “Practice.”

Contributing editor DAVID POGUE is the author of *Macs for Dummies* (IDG Books Worldwide, 1992). He has been the MIDI guru, conductor, or music copyist for several Broadway musicals.
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That's Automatic.

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WITHOUT EVER
HAVING TO THINK TWICE.
MacTools® 2.0 is the first automatic data protection program
with integrated virus protection, backup and data
recovery.
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into tomorrow's disasters, MacTools is the only
data protection package that offers scheduled
disk analysis and repair.
New MacTools automatically detects and removes known viruses
and protects your computer from unknown viruses.

When it's time for you to
backup, MacTools can use tape
or network drives at the times
you schedule. And it will even
remind you to back up to disks.

MACTOOLS 2.0 HELPS
MAKE EVERY MANAGER'S
JOB A LITTLE EASIER.
Just configure MacTools once for
your entire group, then customize
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AsanteHub 1012
An intelligent 10BaseT hub with an RS-232C port that allows for out-of-band network management via modem using included AsanteView software. The product also has an RS-485 port and LED status displays for network monitoring and troubleshooting. It is equipped with 12 RJ-45 ports, a 50-pin RJ-21 connector, and a 3-1/2 port that includes BNC, RJ-45, and AUI connectors. With out-of-band management $1499; with in-band and out-of-band management $1999. Asante, 408/734-4844, 800/662-9686; fax 408/752-8372.

Cirrus Optical
A 128MB magneto-optical disk drive that takes 3.5-inch cartridges and uses a Panasonic mechanism. La Cie says the drive has a 38ms average seek time and a throughput of 600K per second. It has external termination and SCSI ID switches, and includes the necessary cabling, Silverlining hard drive management software, and $480 of public domain software. $1699. Additional cartridges are $99 each. La Cie, 503/520-9000, 800/999-0143; fax 503/520-9100.

ColorWorks
A family of LCD projection panels that let users show images from a computer using an overhead projector. The devices are available with a 9-inch or an 11-inch panel and can project up to 24,389 different colors with a contrast ratio of 20:1. Panels weigh 6 pounds each and are compatible with the company's Cycolps pointer system. 9-inch panel $3599; 11-inch panel $4995. Proxima, 619/457-5600; fax 619/475-9647.

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CP-503
A plain-paper laser plotter that plots A- and B-size pages and has a 400-by-400dpi resolution. The company claims the plotting speed is 8 ppm for A-size media and 4 ppm for B-size. An auto- scale feature lets users reduce D- and E-size drawings to A- and B-size without having to reconfigure the software driver. The plotter is compatible with HP-GL and has 6MB of RAM and RS-232C and Centronics interfaces; it uses a TI9000 controller with a clock speed of 50MHz. $8895. Mutoh America, 708/952-8880; fax 708/952-8808.

DigILINK
A high-speed, 128K-per-second digital bridge that can link any number of remote ethernet networks to each other via ISDN telephone lines. The device has an ethernet adapter and an ISDN terminal adapter built in and supports 10BaseT and 10Base2 connections for Ethernet, and RJ-45 cables for ISDN connections (an NT1 network terminator is required). The DigILINK can transmit Ethernet data over one or both 8 channels of an ISDN line and can be configured via the serial port of a Macintosh; administration software that supports Apple events is included. $3495. Sonic Systems, 408/736-1900; fax 408/736-7228.

Floptika 20/M
A SCSI floppy disk drive that offers 31MB of data storage on a 3.5-inch floppy disk. The drive can also read from and write to 1.44MB Macintosh-formatted disks and 720K and 440KB DOS-formatted disks. It has an external termination switch and SCSI ID selector, and it ships with formatting software. The company says the drive has an access time of 80ms and a sustained data-transfer rate of 200K per second when working in the 20MB Floptika mode. $985. Procom Technology, 714/852-1000, 800/800-8690; fax 714/852-1221.

GatorLink
A multiuser device that extends an AppleTalk ethernet network across dial-up telephone lines and provides access control in the form of zone lists, allowing administrators to select which AppleTalk zones will be visible to users. The device uses a Motorola 68332 processor, which provides three dedicated RISC engines to handle I/O duties, leaving the MC68000 free to provide AppleTalk Remote Access services. The GatorLink also supports Security Dynamics' ACE/Server security system and does not operate as a router. $1899. Cayman Systems, 617/494-1999; fax 617/494-9270.

Ilsi Ethernet Card
An Ethernet board for the Ilsi that uses Direct Memory Access to transfer data directly into system memory; is available in thick, thin, and 10BaseT configurations; and has two LEDs that indicate network status and link integrity. The board also has a pass-through slot for future options and can be configured with a 20MHz floating-point unit for an additional $100. The board is based on National Semiconductor's SONIC chip set and proprietary software driver. 10BaseT thin and thick $319; 10BaseT thick $279. TechWorks, 512/794-6533, 800/688-7466; fax 512/794-8520.

Kingfisher
A video-capture board that has composite, S-Video, RGB, and YUV inputs; captures still or video images in 8-bit color or gray-scale. The included software allows users to control brightness, contrast, saturation, and hue; also includes gamma correction, flicker, and noise-reduction filters. $1985. Graphics Unlimited, 1A Norwich St., Cambridge CB2 1ND, United Kingdom.

MirrorImage 309
A 300-dpi, 9-pages-per-minute laser printer that uses a Western RISC processor and includes Adobe PostScript Level 2 software and 35 Adobe typefaces. The B+/B II-11-inch printer has a SCSI port and a parallel port; comes with 2MB of RAM, upgradable to 10MB. $1699. Mirror Technologies, 617/433-4450; 800/654-5294; fax 617/633-3136.

MT30
A 4mm DAT tape drive that provides up to 8GB of storage and ships with the company's Memory Tape Manager software that provides automatic, unattended backup for an unlimited number of Macs. The software has a feature called Tape Rolllover that allows a backup to automatically continue to another drive when the capacity of the first tape device is exceeded. Tape Shadowing automatically creates a second backup tape whenever a backup is performed. $2600. Memorybank, 313/761-2783, 800/562-7593; fax 313/761-3263.

Phase III FXI
A plain-paper color printer based on phase-change ink-jet technology that now includes Tektronix proprietary TekColor Finepoint technology, which allows the printer to print with line detail. TekColor Previewer—software that is built into the printer's driver—has also been added and gives users the ability to preview output before it goes to the printer.
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**Toll-Free Tech Support**

Yes No Yes Yes

**Uses Claris’® XTND to Read/Write MS.® Word**

Yes Yes

**POWERBOOK FEATURES:**

- Battery Status & Clock Display: No Yes No Yes
- Sleep Command Within Program: Yes Yes Yes Yes
- Battery Conservation: No Yes No Yes
- Thick Cursor & Insertion Point Preference: No Yes No Yes
- Custom Keyboard Equivalents: Yes No Yes No

**EDITING FEATURES:**

- Headen/Footers: Yes Yes Yes Yes
- Paragraph Style: Yes Yes Yes Yes
- Footnotes: Yes Yes Yes Yes
- Custom Keyboard Equivalents: Yes No Yes No
- Unlimited Undo: Yes No Yes No
- Noncontiguous Selection: No Yes No Yes
- Rectangular (Vertical) Selection: Yes No Yes No
- File Management & Retrieval System: Yes No Yes No
- Graphics Layer: Yes No Yes No

**SPELL CHECKER:**

- Words: 135,000 135,000
- User Dictionary: Yes Yes Yes Yes
- Skip All: Yes Yes Yes Yes
- Replace All: Yes Yes Yes Yes
- Auto Hyphenation: Yes No Yes No
- Thesaurus Words: 1.4 Million 1.4 Million

**FIND/REPLACE FEATURES:**

- Find All: Yes No Yes No
- Wild Cards: S T
- Font, Size, Style, Color Sensitive: Yes No Yes No
- Phonetic Find: Yes Yes Yes Yes

**OTHER FEATURES:**

- Editable Clipboard: Yes Yes Yes Yes
- Electronic Bookmarks: Yes Yes Yes Yes
- Swap Paste: Yes Yes Yes Yes
- Appened Copy: Yes No Yes No
- 32 Bit Addressing: Yes Yes Yes Yes
- Virtual Memory: Yes Yes Yes Yes
- System 7 Compatible: Yes Yes Yes Yes

"...best new PowerBook product I’ve seen.”

Steven Bobker, MacUser 6/92

PowerPortrait

**QuadraLink DMA**

A board for NuBus Macintoshes that provides four serial ports running at 960Kbps. The board includes AE Shadow software that enables programs that do not use

Apple’s Communications Toolbox to recognize and use the four extra ports. Optional ShadowLAN software allows users to share any of the four ports—as well as a Mac’s built-in serial ports—across an AppleTalk network.

**PMO-650**

A 650MB rewritable optical drive that incorporates the company’s Optical Hard Drive mechanism, offering speeds the company says are faster than most hard drives. The drive also features an 80188 processor running at 20MHz for strategic data mapping and data queuing on reads and writes. $3995. Pinnacle Micro, 714/727-3300, 800/553-7070; fax 714/727-1913.

**PowerPortrait**

A SCSI-based, 15-inch display for compact Macintoshes, PowerBooks, and Mac-compatible portable computers that has built-in QuickDraw acceleration and supports resolutions of 72 dpi, 80 dpi, and 88 dpi; the refresh rate is 79Hz. The monitor does not require a graphics board and has a built-in hardware pan mode that allows users to work on a virtual two-page desktop at up to 1024 by 1024 pixels. An optional antiglare, antistatic coating is $50. Platinum model with DB-25-to-DB-25 cable $595; granite model with HDI-30-to-DB-25 cable $1059. Sigma Designs, 510/770-0100; fax 510/770-2640.

**SB-TMO-1000**

A 1GB external 3'/4-inch rewritable optical disk drive that uses a Maxoptix Tahiti II drive mechanism; is backward compatible with ANSI/ISO-standard 525MB 3'/4-inch cartridges; and comes with partitioning, mounting, and password-protection software. MicroNet says the drive has an access time of 35ms and sustained data-transfer rates of greater than 900K per second. $5345. MicroNet Technology, 714/637-6033; fax 714/637-1164.

**TowerFeed 444**

A device that can be configured with up to five paper drawers (each with a sheet-capacity of 500 sheets) for use with Apple LaserWriter IIF, IIFX, and IIG. A coding system can be set in each drawer that identifies the size and type of paper that can be loaded in each drawer so that it can be configured without reconfiguring printer or device. The TowerFeed’s driver software allows users to choose a paper type from any print dialog box. $1995 to $3455, depending on the number of trays installed.

**UltraDrive 120MO**

A 120MB, 3'/4-inch magneto-optical drive that GCC claims has an average access time of 35ms. The drive comes with one 120MB cartridge, the company’s DriveManager disk-management software, and MacTools Deluxe from Central Point Software. $1899. Additional cartridges $69 each; three-pack $1777. GCC Technologies, 617/890-0880; fax 617/890-0882.

**VISIT Video**

A desktop video-conferencing application that uses switched 56K digital and ISDN lines and allows users to see real-time video images of each other on a Macintosh screen while sharing documents, graphics, and other information. The system includes software, a video circuit board, camera, and communications hardware to access public and private telephone networks. The product also supports a full range of Northern Telecom’s digital PBXs priced as low as $5000 depending on network configuration. Northern Telecom, 408/988-5550, 800/667-8437; fax 408/764-2659.

**SOFTWARE**

**Bankruptcy Mac 2.0**

A set of FileMaker Pro templates that generate bankruptcy forms for Chapter 7 and 13 filings. The program was designed to produce the new Official Bankruptcy...
Forms and contains all forms necessary for filing with the clerk of any U.S. District Bankruptcy Court; additional practitioner forms are also included. The package automatically calculates a summary of schedules as well as computations for the debtor's current income and expenditures. 2MB min. memory. $119. comp law, 419/695-8480.

Battle of Britain 2
A color, simulation game that re-creates the Battle of Britain using a plotting map, tote-board system, and other information. The player tracks radar and ground observer reports, analyzes the size and potential threats of enemy forces, based on incoming information, and interprets daily intercepts. The player must also cope with changing weather patterns, dwindling resources, and the Luftwaffe's seeming ability to outfox the Allied pilots at every turn. 1MB min. memory. $54.95. Deadly Games, 212/475-2377; fax 212/475-2377.

Blackjack Tutor
A blackjack simulation and tutorial package that features extensive game-summary reporting, in SYLK file format, card-counting drills, and many different game configurations. The program supports up to seven players and can be set up to compare each play decision against a particular blackjack strategy and also to compare wagers against a wager strategy. Animated graphics show card dealing and collecting players can save strategy files that contain game decisions. 2MB min. memory. $59.50. InSite Systems, 919/954-4736.

ClienTrac
An office- and contact-management package that keeps a personal scheduler by day, week, or month; has a to-do list; and can create an unlimited number of project and check lists. The program puts an icon bar at the top of the screen for navigation and also serves as a word processor. For managing contacts the program can dial phone numbers, has a call-back alert, and stores a variety of client information. It also does mail merges and prints reports, phone books, and large and small mail labels. 2MB min. memory. $135. Whiskey Hill Software, 415/851-8702.

EIS Toolkit
A spreadsheet-based tool for developing information systems; allows users to create custom executive information systems without programmers. The systems users create feature graphical user interfaces, access to Excel and Lotus 1-2-3 spreadsheets and mainframe databases, password protection, and presentation-quality graphics. Customizable model packages enable users to track, analyze, and understand marketplace dynamics. 2MB min. memory. $89.95; with Wingz $995; run-time version for one user $299.95; run-time version for ten users $400. Micro-Strategy, 302/427-8800; fax 302/427-8810.

ImageAccess
A relational database that provides data entry, searching, sorting, and organizational functions for images; works directly with Nikon's LS-3510AP film scanner and auto-feeder allowing unattended scanning and cataloging of up to 300 slides at a time. When an image is acquired the program records the file name, date of acquisition, location, size, dimensions, creator, and image type; other data fields can be defined by the user. File formats supported include TIFF, PICT, BBM, and JPEG; the program also creates thumbnails for each image imported, and can display a scrollable grid of thumbnails. 8MB min. memory. $495. Nikon, 516/547-4355, 800/695-6687; fax 516/547-0905.

KidDesk
A menuing and desk accessory program that protects data on a hard drive while providing children with a personalized workspace of their own. The program hides the menu bar, gives kids easy access to applications through icons, and requires a code to exit. Users can choose from six desktop themes, including Dinosaur and Executive Desk; each desktop has several desk accessories that can be accessed by clicking on icons. The accessories include a talking clock, a calculator, a calendar, and a voice-mail system that uses the built-in microphone on Macs that have one. 1MB min. memory. $39.95. Edmark, 206/861-8200, 800/426-0856; fax 206/861-8998.

Leisure Suit Larry 5
A color, animated adventure game that stars Larry, who, in this episode is the Chief VCR Rewinder for *America's Sexiest Home Videos,* a mob-controlled垄断ering of earlier optical drives. And because DataPak MO/128 incorporates high-technology noncontact laser design, loss of data is virtually eliminated, keeping your precious data where you want it when you want it.

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as a free-form database and autodialer; QuickElo is a single-envelope-addressing desk accessory with type autosizing, centering, and printing; PrintDex is an application that prints information from QuickDex II in multiple address book forms. 1MB min. memory; $89.95. Casady & Greene, 408/484-9228, 800/359-4920; fax 408/484-9218.

CD ROMS

Darwin
A collection of the works of Charles Darwin that includes the complete text and illustrations from The Voyage of the Beagle, Origin of Species, and The Descent of Man, as well as Michael T. Ghiselin's book Triumph of the Darwinian Method. The text from the five-volume set Zoology of the Voyage of the Beagle is also included. The CD contains a bibliography of over 1000 primary and secondary references, a timeline detailing significant events in Darwin's life, and more than 650 color and black-and-white images. $99.95. Lightbenders, 415/621-5746, 800/432-3766; fax 415/621-5898.

PrimeTime
A collection of media clips that includes over 1000 pages of animated actors, background props, and sound clips for use with the company's Promotion and Addmotion II animation processors. The CD ROM also contains buttons for use in the programs and in QuickTime movies. The clips can also be used in a variety of animation and presentation packages from other vendors. 4MB min. memory. $99.95. Motion Works, 604/685-9975; fax 604/685-6105.

Resource Library Volume I
A collection of public-domain color pictures and QuickTime movies taken from sources such as NASA and the U.S. Department of Agriculture. Subjects include animals, people, plants, space, weather, farms, and ranches. 2MB min. memory. $49.95. Bliss Interactive Technologies, 405/439-2247.

Total Baseball
A multimedia-based history of baseball that includes more than 2600 pages of statistics and articles dating back as far as 1871; more than 500 images of players, teams, and ballparks; and sound clips of some of the game's memorable moments. The product has over 120 years of detailed statistics, standings, and images. Includes batting, pitching, and fielding registers for major league players; the top 100 all-time, lifetime, and single-season leaders in a variety of categories; and full team rosters. 2MB min. memory. $69.95. Creative Multimedia Corp., 503/241-4311, 800/776-9277; fax 503/452-9930.

ACCESSORIES
Macky Sac
A 5-inch neoprene-and-cotton beanbag for use as a wrist rest to provide support to desk top users. $69.95. Action Laser Products, 714/491-1983, 800/289-1983; fax 714/491-0501.

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Questions and Tips from Macworld Readers

BY LON POOLE

IN THE APRIL ISSUE A READER inquired whether she'd be better off taking her U.S. system overseas (specifically, Germany) or buying a replacement system there. My response included a table of electrical power requirements collected from various Apple documents, John O'Toole of Benton Harbor, Michigan, spotted an error in the table, and I found a couple more. The Mac Plus works with any voltage from 100 to 240 (not just 120 volts); The AppleCD SC requires 100V to 120V power (the AppleCD SC Plus works with 100V to 240V); and the StyleWriter is not recommended for use with 50Hz power.

D. Smith of Aachen, Germany, was surprised my response didn't address the reader's "fiscal and mental Gesundheit." Smith says compared with the price and service benefits of the super-competitive U.S. market, the cost of European Macs are appalling. In Germany, the price you pay for most hardware is between 50 and 100 percent higher than the list price in the United States (and you rarely pay full list price in the U.S.). A 10 to 15 percent import duty and a 15 percent value-added tax explain part of the higher prices. You can forget trying to negotiate a better deal; dealers' reactions range from surprise to offense. And the concepts of service, products in stock, trade-ins, courtesy, and free delivery (indeed, free anything) haven't yet been translated into the European Apple desktop lexicon. Software costs are similarly outrageous—try $210 to upgrade from Word 4 to Word 5, or $300 to go from More 3.0 to 3.1! Fortunately, most well-known U.S. mail-order companies ship to Europe, and savings are usually significant even after freight and duty are paid. Smith's advice for Macintosh fanatics moving overseas is to take your Mac with you.

Control Panels, DAs, and Memory

Under System 7, do control panels and desk accessories use RAM when they're not open?

Mitchell Rose
Los Angeles, California

A. DAs use memory only when you open them. Under System 7, each open DA gets 20K of memory. If a DA needs more memory than that, it increases the system software's memory size by 10K and 200K (depending on its individual memory needs). You can observe this in System 7 by checking the system software size with the Finder's About This Macintosh command before and after opening a DA. When you open DAs under System 6 with MultiFinder, they get all their memory by increasing the system software size; without MultiFinder they steal memory from the open application program.

A control panel uses memory when it is not open if it includes a system extension (also known as an INIT or start-up document). The Mac loads the system extension portion of the control panel into memory during start-up, increasing the system software size by 10K to 300K per control panel. Many control panels display icons during start-up if they contain built-in system extensions, but not all do. Two of the standard control panels contain system extensions and increase the system software's memory size—Easy Access (about 12K) and Memory when it's used on a PowerBook (about 38K). To find out which of your control panels contain system extensions and how much of them increase the system software size, you can use the Profiler module of Now Utilities from Now Software (503/274-2800). Profiler reports the increase in system software size only if you have installed the Startup Manager module of Now Utilities. You can use Now's Startup Manager or the free program Extensions Manager 1.6 by Ricardo Batista (available from user groups and online services) to determine which control panels load. You can also prevent a control panel from loading by dragging its icon to the desktop or to a folder other than the System Folder, Extensions folder, or Control Panels folder. To temporarily suspend loading of all extensions and block opening of items in the Startup Items folder, press the shift key while starting up or restarting the Mac. If you want to press shift until you see the Finder's menu, then all extensions will load, but the items in the Startup Items folder will not be opened.

Control panels do not get their own slices of memory when you open them. When you open any System 7 control panel, it uses part of the Finder's memory. With System 6, you open one control panel device at a time inside the Control Panel desk accessory.

TrueType and LaserWriter Incompatibility

Q. I can't print TrueType fonts on my original LaserWriter. Apparently TrueType fonts are converted to PostScript Type I format before being downloaded to an original LaserWriter, but that model has insufficient memory to image those downloaded fonts. Do you know if upgrading to a LaserWriter Plus will let me print TrueType fonts? My Apple dealer can't tell me if a Plus has more RAM or just more ROM to supply additional fonts. Is the RAM in a LaserWriter Plus expandable?

H. Edwin Simmers
Bellingham, Washington

A. Both the original LaserWriter and the LaserWriter Plus came with 1.5MB of RAM. The Plus's 1MB ROM has more PostScript fonts and better memory management than the LaserWriter's 0.5MB ROM. The original LaserWriter's memory-management methods (in the printer's ROM) can't make space in the printer's RAM during a print job to allow automatic downloading of TrueType fonts (actually the PostScript derivatives created by the Laser-
HOW TO/QUICK TIPS

Writer driver. My best information is that neither model uses SIMM chips, so increasing RAM wouldn't be practical.

Apple claims you can use the LaserWriter Utility program that comes with System 7 to manually download a TrueType font to an original LaserWriter, enabling you to print documents containing that font. Because the LaserWriter Utility program downloads the font to the printer before the print job begins, the LaserWriter's limited memory management doesn't have to cope with a change during the print job. However, you will probably be able to manually download only one TrueType font at a time.

Like the original LaserWriter, the Plus can't print TrueType fonts directly, but its improved memory management can make sense in RAM for a font automatically downloaded during a print job. So the Plus should be able to work with the automatically downloaded PostScript Type 1 fonts that the LaserWriter driver software on the Mac derives automatically from the TrueType font.

Performance is slow, particularly when converting and downloading multiple TrueType fonts for one document.

Don't get swept away by TrueType hype. If you've got an original LaserWriter or LaserWriter Plus, you're better off sticking with PostScript fonts. You can replace TrueType fonts by converting them to PostScript format with the FontMonger program from Ares Software (415/578-9090), and you can use Adobe Type Manager (ATM) to see smooth PostScript fonts at any size on screen. You can get a copy of ATM and four Adobe Garamond fonts for $7.50 by calling 800/521-1976, ext. 4400. Outside the United States and Canada you can get an International English version of ATM for $30 by calling 303/799-4000, ext. 4600.

Upgrade or Not

Q. Three years ago I bought a Mac Plus with a 20MB hard drive and am considering upgrading it from 1MB to 4MB of RAM so I can use software that requires large amounts of memory. With so many new Mac models coming out, is the Plus worth upgrading? I don't want to invest in something useless.

Andrea McCurdy
Randolph A.F.B., Texas

A. A Mac Plus with 4MB of RAM is no speed demon but is far from useless. In fact you can accomplish quite a lot with a 2.5MB Plus and one of the newer integrated software products such as ClarisWorks or Symantec's GreatWorks. A 2.5MB or 4MB Mac Plus is also adequate for word processing, accounting, telecommunications, basic drawing, uncomplicated spreadsheet calculation, and modest data management tasks. With 4MB you can keep at least two application programs open concurrently using System 7 or System 6 with MultiFinder. With 2.5MB you can count on having only one application program and the Finder open at the same time. Use System 7 if you need one of its special capabilities such as file sharing; otherwise stick with System 6 for its faster Finder, whose extra speed is especially noticeable on a Plus.

You should move up to a Classic II, LC II, or faster model when you start thinking about doing page layout, extensive graphics, slide presentations, complicated spreadsheets, database management, or other demanding work. To figure out where you are on the continuum between basic and complex graphics, spreadsheet, or database work—and consequently whether or not to get a faster Macintosh—take stock of how much time you use your Mac and how much of that time you spend waiting for it. The more you use it and the more

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You can probably install RAM, internal hard drives, and internal expansion boards without any formal training. Most of these products come with complete installation instructions (RAM and internal hard drives from Apple being notable exceptions). One author, Larry Pina, has written several books about repairing and servicing Macs. *The Dead Mac Scrolls* (Peachpit Press, 1992; 510/548-4393 or 800/283-9444) helps you diagnose common problems in Macs up to the II and SE/30. ImageWriters, and LaserWriters up to the IINTX. The book suggests general repair procedures but includes no detailed instructions. Pina's other books tell you how to fix the problems. *Macintosh Repair and Upgrade Secrets* (Howard W. Sam's, 1990; 317/573-2500 or 800/545-5914) covers Macs through the SE. *Macintosh II Repair and Upgrade Secrets* (Brady Books, 1991; 317/573-2500 or 800/428-5331) covers all Mac II models and Apple's 12-inch monochrome and 13-inch color monitors.

You can become authorized to service your own equipment through Apple's Dealer Sponsored Servicing Owner (DSSO) program. An Apple dealer sponsors your enrollment in mandatory Apple-certified training classes, sells you service modules and parts, and answers your technical-service questions. For more information, ask your dealer for a copy of the DSSO Product Sheet, which the dealer can get from his or her local Apple customer service manager. If you own or manage more than 100 Macs, you can apply for the DSSO program at a local Apple sales office (call 800/767-2275 for the location of the office nearest you).

**Custom Folder Icons**

**TIP** If you have too many look-alike folders cluttering your desktop and you use System 7, you can liven them up by superimposing a relevant application icon (see "Look Lively"). First copy a folder icon from its info window, which you view with the Finder's Get Info command, and paste it into a paint program. Then open the folder that contains the application whose icon you want to use, set the window view to By Small Icon, and take a screen snapshot (press # shift-3). Open the screen snapshot file (named Picture 1, Picture 2, or something similar on your start-up disk) with the paint program or with TechText, copy the small application icon from the snapshot, and paste it over the previously pasted

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Look Lively

If you use System 7, you can replace plain folder icons with livelier composite icons. Copy a small application icon from a screen shot, paste it onto a plain folder icon in a color paint program, copy the composite, and paste it into the folder's info window.

Icon Store

System 7 users can store hundreds of icons on a floppy for later use as custom icons. Howard Wright of Grand Rapids, Michigan, makes aliases of files with icons he wants to save and copies the aliases to a floppy named Custom Icons. Whenever he wants to customize a file, he copies the icon from the alias's info window and pastes it into the file's info window.

PAL (programmable array logic) chips. In addition, the Mac II cannot be upgarded to more than 20MB with 4MB SIMMs because the bank-A SIMM sockets work only with 1MB SIMMs.

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SIMM Compatibility

TIP

I read in the January issue about some SIMM incompatibilities [1MB SIMMs that have only two chips instead of eight chips may not work on a Mac Plus, an SE, a Classic, a Mac II, or a III; and some third-party 2MB SIMMs do not work on a Mac LC or IIIi.—L.P.] I recently discovered another memory problem, much to my chagrin. The Mac II and III are not compatible with standard 4MB SIMMs, but require special SIMMs with PALs, those SIMMs are compatible with the SE/30, Classic II, LC, III, III, and Quadras (but not the IIx, which has unique SIMMs).

Tech Note 176 also explains that the special PAL chips prevent the Mac II and III from unwittingly activating a test mode built into the RAM chips used on 4MB SIMMs. These chips came into being after Apple designed the Mac II and III; the previous generation of memory chips, which are used in 1MB SIMMs, do not have the problem—riddled test mode. Although only the II and III require the 4MB SIMMs with PALs, those SIMMs are compatible with the SE/30, Classic II, LC, III, III, and Quadras (but not the IIx, which has unique SIMMs).

Tech Notes are available from some user groups and online information services. You can also order a complete set of notes and a year's update subscription on disk for $65 or on paper for $100 from APDA (408/562-3910 or 800/282-2732, 800/637-0029 in Canada).—L.P.

Lunatic Fringe Mania

TIP

Just when I thought it was safe to re-boot—I spent most of last year at the Betty Ford Center trying to extricate little Lode Runner men from my nightmares—I happened upon my roommate firing at little purple bubbles on his new Mac. Five months, many one-upped high scores (don't ask, but it's Level 67), and innumerable games later, I have decided to come clean on my tricks and tactics for that sneaky little option in Berkeley Systems' After Dark screen-saver program, Lunatic Fringe by Ben Haller.

1. The faster you kill, the faster you advance levels. It takes four levels to get to the first real threat, the puffer, and two more to reach the deep threat, the slicer, at level 6. This may take 15 minutes. So kill fast, making use of the special weapons (they reappear somewhere in the grid as soon as you use them up). An option is to set the starting level as high as you can, for example, to level 10.

2. The hammerhead is easier to kill after it has released its mace and, as is true for each alien except the slicer, after it has bumped into an asteroid. Aim for the nose of the alien's ship. If you're a puffer- phobe, circle it and shoot repeatedly at its backend.

3. You can use the turbo thrust to kill. If you are near death but still have a turbo thrust, aim your ship at the pursuing alien and hit the turbo thrust button. This works most satisfyingly with the slicer. You are invulnerable while you are thrusting, and can bump the alien to death. Although turbo—thrust—killing (like killing with the power shield) brings only half the normal number of points, it's almost always a more attractive option than dying.

4. With the triple gun, get as close to the alien as possible and blast it to smithereens in one shot.

5. If your turn jets are damaged and you are spinning wildly through space, hold down both the Turn Left and Turn Right buttons. This stops you from rotating and allows you to pilot yourself, albeit in fits and starts, in a specific direction.

6. Long sweeping passes through the entire grid often turn up hiding places of special weapons, turbo threats, power shields, and so forth.

7. In the high levels, avoid the hammerhead if you haven't any special weapons. Be content with killing sludgers and slicers instead.

Alex Pugsley

Toronto, Canada
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Font-Customizing Techniques

BY JIM HEID

The Mac's ability to set type in a variety of fonts, sizes, and styles has always been the cornerstone of its personality. The Mac's typographic features have improved dramatically in recent years, as outline fonts have become the dominant font technology in the Macintosh world. In an outline font, characters are described by mathematical equations; by processing these equations, the Mac can create characters of virtually any size—as if characters were created using rubber bands that can be stretched and resized.

The other major approach to describing fonts—the bitmap approach— isn't nearly as efficient or flexible. In a bitmap, or fixed-size, font, characters are described by an arrangement of bits. A separate arrangement is needed for each size; most bitmap fonts include descriptions for the common type sizes: 10, 12, 14, 18, and 24-point. (A point is a printer's unit of measurement; there are 72 points in an inch.) If you specify a point size for which no arrangement exists, the Mac scales an existing size to fit, resulting in misshapen, chunky-looking characters.

Instead of restricting you to specific sizes, outline fonts enable you to format text in any size—29-point, 17.5-point, 589-point. This makes it easy to fit headlines into a particular width, and it simplifies copyfitting—choosing the point size that enables a certain amount of text to fit in a certain amount of space.

Two outline font technologies are prevalent in the Macintosh world today: PostScript fonts are the veterans (and by far the most popular), and TrueType fonts are relative newcomers. PostScript printers such as Apple's LaserWriter II and IIg contain a selection of PostScript fonts; you can supplement these resident fonts with downloadable fonts, which live on the Mac's hard drive and are transferred to the printer's memory during a print job. The most common and preferable format for PostScript downloadable fonts is Type 1; Type 3 is a less common format that generally delivers inferior results on laser printers. If you use the Adobe Type Manager (ATM) utility, you can print Type 1 PostScript fonts on non-PostScript printers such as Apple's StyleWriter or Personal LaserWriter LS.

Because of their flexibility, outline fonts are naturals for special typographic effects. Stretching a font more vertically than horizontally creates a skinnier, condensed version of the original typeface. Stretching it more horizontally than vertically gets a wider, expanded font. Attach an outline font to a curved line to create wavy-looking text, or stretch it to fit an irregular shape. You can even alter the characters themselves to create logos, special symbols, and fractions.

Numerous programs are available that let you perform these and many other font-customizing jobs. Altsys's Fontographer and Letraset's FontStudio let you alter fonts and create new ones from scratch. Arial Software's FontMonger, Type Solutions' Incubator, Design Science's ParaFont, and Altsys's Metamorphosis Professional are best suited to modifying existing fonts—converting them from one outline format to another, expanding or condensing them, or creating fractions.

Type-effects programs such as Letraset's LetraStudio and Broderbund Software's TypeWriter let you twist, stretch, squeeze, mold, mirror, and otherwise modify type. Both excel at display—fancy headlines, product labels, logos. They let you do with a mouse what was used to require hours of labor over a layout table or in a darkroom.

This month, I show how to perform several font-customizing jobs using these and other programs. You need to know how to install fonts in your system; instructions are in your Mac manual.

Expand and Condense

Expanding or condensing, or horizontally scaling, a typeface can give it a new, distinctive personality. A condensed font looks more delicate and allows more text to fit on a page; an expanded font has a weightier look (see "Expanding and Condensing").

The Aldus PageMaker and QuarkXPress publishing programs let you expand or condense text formatted in existing fonts; drawing programs such as Aldus FreeHand and Adobe Illustrator do too. But wouldn't it be more convenient to have fonts that are expanded or condensed to begin with? That way, you could use them in programs that don't have horizontal-scaling commands, such as word processors. You can scale fonts in advanced programs such as Fontographer, but it is often easier in the basic (and more economical) font-customizing programs.

How to: Parafont

Choose New from the File menu, and then choose the font you want to scale from the Base Font popup menu. Select the Bold and Italic check boxes if you want to scale those styles, too. Choose FontAttributes from the File menu and type a name for the new PostScript font—for example, TimesCondensed or TimesFat. (A PostScript font name can't have a space in it.) From the Edit menu choose Select All and then Transform. Type the desired scaling percentage in the Horizontal Scale text box. Finally, use the File menu's Make Screen Fonts and Make PostScript Font commands to generate the bitmap and PostScript outline fonts to install in your system.

How to: Incubator

Choose the TrueType font you want to modify from the Font menu. (Incubator works only with TrueType fonts.) Use the Width scrollbar to condense or expand the font, watching Incubator's sample-text display and preview window until you get the desired results. Finally, create the new font: click on Create, type a name for the font, click on OK, and then on Save. Install the resulting font file.

Because horizontal scaling distorts the proportions of a typeface, it compromises the original type design. Avoid scaling by more than 25 percent or so in just one direction unless you're after a particularly dramatic or gaudy effect.

Adobe's new Multiple Master font technology enables you to horizontally scale fonts without compromising the original type design. Besides being able to expand or condense a font, you can also continue...
create any font weight, from extra light to extra bold. For details on this breakthrough font technology, see "Understanding Multiple Masters," *Macworld*, September 1992.

Let's Get Fractional

If I had a dime for each time I saw a phony fraction such as 1/2 in an otherwise good-looking publication, I'd be rich enough to run for president. You can create your own fractions the hard way by reducing the type size of the numbers and then, if your word processor or publishing program allows, shifting the numerator up by a few points. Some fonts contain ready-made fractions; best of all are the expert sets some font vendors sell, whose true-cut fractions match a specific typeface, with the small numerals tweaked for better legibility.

You can also customize an existing font to create your own fractions—even oddball ones like 15/28. It's easiest in FontMonger and ParaFont.

How to: FontMonger

Use the Open command to open the font for which you want to create a fraction. When the keyboard display appears, select the key to which you'll assign the fraction. (To use an option-key or shift-option-key sequence, click the appropriate modifier keys[s] in the keyboard display.) After selecting a spot for the flecking fraction, choose Alter Character from the Keyboard menu. When the Alter Character dialog box opens, select the kind of fraction you want and then type the numerator and denominator in the appropriate text boxes (see "Making Fractions"). Click on OK, and then save the new, customized font using a different name to avoid replacing the original.

How to: ParaFont

From the Base Font pop-up menu, choose the font for which you want to create fractions. Choose Fractions Only from the Key Layout pop-up menu, and then click on OK. ParaFont creates a font containing common fractions. You can double-click on a fraction in the keyboard display to specify your own numerator and denominator. Use the File menu's Make Fonts and Make PostScript Font commands to generate the bitmap and PostScript outline fonts you'll install.

When creating a fraction, ParaFont extends numerals slightly to make them more legible—a nice touch. The results still don't quite compare to the true-cut fractions of expert font sets, but they're close. ParaFont's other customizing options use similar techniques; for example, the program can simulate old-style figures—numerals with ascenders and descenders, usually available only in expert sets—by condensing certain characters and moving them up or down.

Turning Text into Pictures

Many company logos consist of text that has been stylized, reshaped, shaded, or otherwise modified. Using Altsys's Metamorphosis Professional (Meta Pro, for short), you can convert a passage of text into an object-oriented PICT graphic you can paste into a graphics program and polish as you please.

How to: Metamorphosis Professional

In Meta Pro's main window, click on the Convert Text button and choose the PICT to Clipboard option from the Format pop-up menu and the Type Your Own option from the Text pop-up menu. Choose the desired font, style, and size from their respective menus (a large size such as 100-point gives the best results—you can scale it down later). Type the text you want to convert in the text box and then click on Convert (see "Prose to Picture"). After the conversion is complete, switch to a graphics program and paste. If you paste into Claris MacDraw II or MacDraw Pro, you can reshape an individual character by selecting it and then choosing Reshape from the Edit menu. Keep in mind you won't be able to edit or reformat the text once it's a graphic. If changes are required, you'll have to return to Meta Pro and start over.

Meta Pro can also save converted text in a PICT or encapsulated PostScript (EPS) file that you can open using an object-oriented drawing program or import into a publishing program. Meta Pro can also convert fonts themselves from one format to another. If you have Type 1 PostScript fonts, for example, you can convert them to Type 1 format for use with Adobe Type Manager. Meta Pro can even convert fonts for or from an IBM PC or Next computer. If you have a Mac and a PC, you can convert Mac fonts into ones usable by Microsoft Windows.

Turning Pictures into Text

Another customizing task involves adding graphics, such as a scanned image or an image from a clip art collection, to an existing font.

You might start by scanning an original—your signature or company logo, perhaps—and then saving the resulting image. Scan a large original if possible (if you're scanning your signature, write big); you'll get more detail in the resulting font. Import the scan into Fontographer or FontStudio and use the autotrace feature to trace the image. If you've worked with PostScript illustration programs such as FreeHand or Illustrator, you might prefer to trace the image by hand. In either case, the result is an outline character of the art you scanned.

How to: FontMonger

First, put the scanned image on the Mac's Clipboard using a graphics program or your scanner software, select the image and choose Copy from the Edit menu. Then start or switch to Fontographer and open the font you want to modify. Select the character position for the new character and double-click on it to open the character-editing window. To remove the character already in that position, choose Select All and then Clear from the Edit menu. Choose Paste from the Edit menu—the image appears in gray. Choose Trace Background from the Path menu and click on OK. Fine-tune the resulting outline if desired. Use the File menu's Generate Fonts command to make the font you'll install in your system.

How to: FontStudio

FontStudio does not accept scans from the Clipboard; you need to save an image in TIFF, PICT, or
MacPaint format and then open the image in FontStudio as a template. Use the File menu’s Unpack Suitcase command to open the font you want to modify. Double-click on the appropriate bitmap or outline-font icon in the Family window, and then double-click on the character you want to replace. To remove the character already in that position, choose Select All and then Clear from the Edit menu. Now choose Open Template from the Character menu and double-click on the name of the previously saved original image. Select the autotrace tool and then click within the character-editing window. Fine-tune the resulting outline if you like, then generate the font.

This scan-and-trace process is how font developers work: a designer hand-draws large masters for each character, scans them, and then traces them. You can apply these techniques yourself to create an entirely new font. Create a font of your own hand-printed letters (great for architects; not recommended for physicians). Or make a font from a sample in an old type-specimen book—many books containing old display type and a variety of ornamental dingbats are available from Dover Books. To get good results, you need to do a great deal of fine-tuning and print a ream or two of test output to check spacing in all sizes and character combinations. When done, you’ll have a new appreciation for the skill and patience of a professional type designer.

**Type on Display**

The font-customizing programs I have covered so far let you create and modify fonts that you then install in your system to use with other programs. Letraset’s LetraStudio and Broderbund’s TypeStyler are designed to let you create special typographic effects using fonts already in your system. (Both programs also provide their own proprietary outline fonts.) The result is typically a PICT or EPS file that you import into a publishing or illustration program.

With either program, start by typing text and then formatting it in the desired font. Next, you might fine-tune the character spacing; instead of requiring you to use awkward **-** key sequences to adjust spacing (as do publishing programs), both programs let you simply drag characters left or right—a more efficient and direct technique. After you tweak the spacing, you might draw a shape and resize the type to fit within it (see “Styling Type”). Nothing illustrates the flexibility of outline fonts like watching characters recast themselves to fit a shape you draw.

Both TypeStyler and LetraStudio work with PostScript and TrueType fonts and also include a few display typefaces. If you work with display type frequently, investigate Letraset’s Fontek library of over 100 display typefaces. Each Fontek package includes both TrueType and Type 1 PostScript versions of the first-rate display type that Letraset has been selling for years.

A similar effects program is PostCraft International’s Effects Specialist, which lets you apply 120 special effects to text you type. Effects Specialist doesn’t let you fit type to irregular shapes or manually kern by clicking and dragging characters. But it does provide more special effects than TypeStyler and LetraStudio do, and you can modify those effects in a dizzying number of ways.

For those who think big, there’s Broderbund’s BannerMania. This fun program lets you create, yes, banners—choose one of the 50 built-in designs, type your text in any of 19 built-in fonts (or use any Type 1 PostScript font), apply one of the 34 built-in special type effects and 134 built-in color schemes, print, and then assemble the resulting pages. You can also customize designs, type effects, and color schemes. It’s a sign maker’s playground.

**Font Futures**

There are enough options out there to keep a font customizer busy for years, but there are even more on the horizon. Apple has announced enhancements to the Mac’s system software that will simplify the creation of three-dimensional fonts and give TrueType technology features similar to those of Adobe’s Multiple Master fonts.

If you want to create stunning three-dimensional type, investigate Pixar’s Typistry, which should be shipping by the time you read this. Typistry lets you create 3-D text from existing fonts. After typing some text, you can apply a variety of surfaces—from wood grain to marble to chrome—to it as well as simulate various lighting effects. You can also animate the text and create QuickTime movies of the results (see last month’s column for an introduction to QuickTime).

Note that there are some legal issues behind font customizing. Specifically, you can’t legally modify a copyrighted, commercial font (or use it to create fractions) and then distribute the resulting font or post it on an online information service—even if you change the font’s name. Doing so is as much a form of software piracy as copying a word processor for a friend.

You should note that some font-customizing tasks—for example, fitting text to a shape, stretching and condensing a font, applying special PostScript effects and gradients—lengthen printing times, especially to a PostScript-based image-setter. If you’re creating a document laden with effects, prepare to wait—and to pay more if you use a service bureau that charges by the hour.

If your patience and budget don’t restrain you from going overboard, let your sense of good taste do so. Don’t go crazy with glitzy effects. Good font customizers work like jazz musicians—they improvise and customize, but they also preserve the essence of the original.

See Where to Buy for contact information.
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**Tips to Power Up Your Presentations**

People use everything from HyperCard to MacDraw for creating presentations on a Mac, but Aldus Persuasion has been one of the most popular presentation tools since it first appeared. It’s a mature, stable product and is available directly from Aldus (206/628-2320, 800/685-3540; fax 206/343-3360). The most notable improvements in its latest revision, version 2.1, include System 7 capabilities such as publish and subscribe and the ability to play QuickTime movies. Some of the tips that follow come from Tim Davensport in Aldus technical support by way of Jill Miller in Aldus public relations. Ravi Khalsa, who runs the video service bureau Khalisa Productions in Phoenix, provided most of the information about printing presentations to videotape.

**Reshaping Free-Form Graphics**

Few humans can devote the long hours of study and practice required to master drawing free-form graphic objects correctly. Persuasion 2.1 offers a crutch that earlier versions lack—the editing of free-form shapes. Select a free-form shape and choose Reshape Poly from the Draw menu. A handle appears at each vertex of the shape, and you can drag a handle or a line to change the shape. To add a handle, click anywhere on a line. To delete a handle, drag it on top of another handle. To finish editing the shape, click somewhere away from it in the window.

**Chart Spacing**

Persuasion has no commands for adjusting the spacing of bars in a bar chart or columns in a column chart, but you can spread out bars or columns (see “Spread Out”). Just insert rows or columns in the data sheet as though you were inserting additional categories between the existing categories. Do not leave the values of the new categories blank; Persuasion will plot the blanks as zero values. Instead, type a blank space in each empty cell of the new categories. Click the Toggle box to reselect all the chart’s cells, and then click the Replot button to have Persuasion interleave blank bars or columns among the nonblank bars or columns.

If your chart includes a legend, Persuasion adds a key for each new blank category. To remove bogus keys from the legend, ungroup the chart, select and delete the extra keys, adjust the position of the remaining legend parts, and regroup the chart. Do this only as a final step. If you later must repplot the chart, you’ll have to remove the extra keys again.

**Embossing Text and Graphics**

You can create the effect of raised or embossed text and graphics by forsaking Persuasion’s Shadow command and adding a highlight and a shadow of your own (see “Raised Text”). Working at full size, add the highlight by duplicating the original, changing its color to a lighter shade of the original’s color, dragging it to a position 1 pixel above and to the left of the original, and sending it to the back. Then add the shadow by duplicating the original, changing its color to a darker shade of the original color, dragging it to a position 1 pixel below and to the right of the original, and sending it to the back. For text larger than 30-point and large graphic objects, you may prefer the look of a shadow offset 2 points below and to the right of the original. The embossing effect is most convincing if the original object is a color similar to that of its background, the highlight is two or three steps lighter in Persuasion’s color grid, and the shadow is two or three steps darker. If the original...
nal color is light, you can make the highlight white. If the original color is dark, you can make the shadow black.

**Selecting Overlapping Objects**

Avoid insanity when you're selecting an object that lies behind another object, such as the highlight or shadow of an object you embossed according to the previous tip, by holding down the option key and clicking through the stack of objects. Each time you option-click, you select the next object back. To move a buried object, option-click till you select the object immediately in front of the object you want to move and then hold down the option key, press the mouse button, and drag away. Click once without pressing the option key if you want to select the frontmost object.

**Merging Presentations**

Sometimes you want to tailor a presentation for a new audience by merging parts of several finished presentations. You can select slides in the slide sorter of one presentation, cut or copy them, and paste them into the slide sorter of another presentation. You can also copy and paste single or multiple objects between the outlines of different presentations, but working in the slide sorters is easier. When you paste slides, Persuasion maintains all outline and data-sheet links. To select multiple slides, you either drag a selection rectangle (a marque) around them or press the shift key while clicking each one in turn.

**Don't Plot Zero**

A line chart, area chart, scatter chart, or high-low chart normally shows all the values in the range of cells you have selected on the data sheet. If you have missing data or want a discontinuous plot, enter a space or dash in the cell of each point you want Persuasion to skip when it plots the chart. If you leave a cell empty, Persuasion plots it as a zero. In a line chart, for example, the line would zig down to zero and zag back up to the next data value.

**Printing to Video**

Slides, overhead transparencies, and projection monitors are not the only presentation media available. You can also record your presentation on videotape or even use Persuasion to make titles for a video production. You can't simply plug a video recorder or television into the Mac because the Mac's video signal isn't compatible with television equipment. You need an encoder like the $195 TV Encoder from Computer Video (617/937-0888; fax 617/937-0893) to transform the Mac's video signal into a standard NTSC composite or S-video television signal. The TV Encoder is compatible with video boards from RasterOps, SuperMac, and others, but works particularly well with the Apple 8*24 and 8*24GC video boards or with the built-in video of a Quadra. The Apple video sources, when set for 256 colors in the Monitor control panel, automatically filter out the flickering you would otherwise see in thin lines when they appear on television. To filter flicker with other video sources, you must use an expensive scan converter instead of an encoder. You cannot correct flicker with the tools in Persuasion.

When creating presentations for video, set the slide size to be the size of the screen. To do this, you choose the Page Setup command and dismiss the first dialog box by clicking OK. In the second dialog box, named Presentation Set-up, you select the Slide Shape option to Screen and click OK. In the third dialog box, Adjust Graphics, you select the options according to how you want Persuasion to adjust the slides in your presentation, and click OK. This creates a slide that fills the screen when you view the presentation with the Slide Show command.

Televisions over scan their picture tubes, enlarging the picture so it does not all fit on the screen. You must fit your presentation inside the NTSC safe zone, or objects near the edge may be cut off when they appear on television. To be safe, keep everything about ¼ inch from the edges of the Mac's screen.

Bigger is better; that's the general design rule for television. Make text 24-point or larger and use sans serif fonts. Small text and the detail in serifs become blurry on television. The same goes for thin lines in graphics, so use lines at least 2 pixels thick and avoid detailed line and fill patterns.

Saturated colors, especially red and orange, bloom on television—beyond their boundaries. Use subdued colors, preferably from the top three rows of Persuasion's color grid, and keep the contrast low between adjacent colors.

Put enough black slides at the beginning and end of your presentation to provide 10 seconds of leader and trailer. You can use this time to operate the video recorder. To record a presentation, start it with the Slide Show command (set the Slide Advance option to Automatic and the slide-timing options to durations suitable for your presentation). When the black leader appears on screen, press the record button on the video recorder. Stop the video recorder during the black leader at the end of your presentation.

**Contributing Your Tips**

Do you have a technique or shortcut not mentioned here? Share it with Macworld readers by sending it to Quick Tips, Macworld, 501 Second St., San Francisco, CA 94107.

Contributing editor LON POOLE answers readers' questions and selects their tips for the Quick Tips column each month.
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Half the fun of planting a tree is imagining what it will be like in a few years. Our tree will branch out to shade us from the summer sun, help cool our home and the neighborhood, and conserve energy in the process. It will provide a home for songbirds, and will remind us of the special times we share together.

You can cool and beautify your home, too. Join me and plant a tree. For your free booklet, write: Conservation Trees, The National Arbor Day Foundation, Nebraska City, NE 68410.
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Macworld

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"In terms of price per megabyte, this is the best deal. You also get good, fast service and technical support." —MACWORLD, August 1992

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<td>1.6G</td>
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<td>2699</td>
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</tbody>
</table>

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300 dpi

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The DGR Technologies 128 Turbo Optical Drive.
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Thick to 10T adapter
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228.00
528.00
298.00
98.00

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Dayna EtherGui Plus
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for LC Ethernet
20MHz 882 option
for IDE Ethernet
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345.00
605.00
49.00
69.00

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### Compare our DAT drives to theirs.

<table>
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<th>Third Wave DATdrives</th>
<th>The Other Guys</th>
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### Removable Media

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### Disk Drives

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<tr>
<td>1700</td>
<td>CALL</td>
<td>CALL</td>
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### Memory Upgrades

Third Wave manufactures a complete line of memory products for all Macs — 1, 2, 4, and 16 MB SIMMs, including low profile 16 MB SIMMs for the Quadra 700.

We also manufacture pseudo-static PowerBook modules to 8 MB and VRAM for the LC and Quadra.

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A total of 120MB storage and 6MB pseudo-static RAM! Send us your PowerBook and we'll install it free!

*Includes trade in of Apple 2MB module and drive, Models 140 and 170 only.

Also available — 8/60 for only $64.00

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Only $449!
TWO Year Warranty. Includes SyQuest.

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- MTBF of 100,000 - 250,000 hours
- TWO Year Warranty
- Low Profile design to meet the requirements of battery-powered notebook computers
- 5 volt AC Adapter $19

Quantum Drives feature:
- MTBF of 100,000 - 250,000 hours
- TWO Year Warranty
- Low Profile design to meet the requirements of battery-powered notebook computers
- 5 volt AC Adapter $19

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- Includes SyQuest cartridges
- Fully embedded SCSI interface
- As fast as 14.5 ms positioning time
- Up to 4.8 MB/sec SCSI data transfer rate

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Maxtor

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- Adobe PostScript Level 2
- 300 dpi • 6 ppm • 35 fonts
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- MultiSync 5FG $1359
- MultiSync 6FG $2475
- Mac FG BX Interface Card $719
- Mac FG 24X Interface Card $1519

**NEC CD-ROMs**
- 2MB RAM $159
- 2nd Paper Tray $299

---

**ClubMac Color Pivot/LE Bundle**

- The ClubMac Bundle combines the low cost, 15" COLOR full pg display and the Color Pivot Interface. Provides 624 X 832 pixel resolution at 78 dpi. Available with NuBus, IIsi, LC, SE/30 or PowerView.

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- Rocket 25i $1219
- Rocket $1629
- Rocket 33 $2029

**PrecisionColor**
- PrecisionColor 8 $449
- PrecisionColor 8X $729
- PrecisionColor 8XJ $515
- PrecisionColor 24X $1629
- PrecisionColor 24XP $515
- PrecisionColor 24XX $569
- Color Pivot $429
- B/W Pivot $249
- Color Pivot/LE $879
- TPD $385

**PowerView**
- Full Page Display $579

**Graphic Displays**
- SuperMatch 20T Multimode Trinitron $2769
- SuperMatch 20 Dual Mode Trinitron $2519
- SuperMatch 20 Color $1679
- SuperMatch 17 Multimode Color $999

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- Spectrum 24 Series III $1179
- Spectrum 8 and 24 PDD / PDD si $382
- Spectrum 8 Series III $499
- Monochrome Card $339

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- Video Spigot (NuBus / Mac IIsi or Mac LC) $499 / 415
- Video Spigot Pro (NuBus / Mac IIsi) $1389 / 1299

**Monitors**
- 20" Trinitron (2075M) $2715
- 20" Color Hitachi (2085H) $1939
- ClearVue/SD 21 (with Cable) $1389
- 21" Monol/Gray Scale $999
- 16" Color Monitor $1165

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For Data Compression

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Besides data compression, the DataPress enables you to expand the capabilities of your SCSI bus. It is a gateway to another complete SCSI chain of seven additional devices.

And there's more. At the core of the DataPress is ETC's SmartPeripheral™ Engine, an innovation that brings dumb peripherals to life. Empowering them to do things they've never done before. In this engine we've used a Flash EPROM that allows you to add future SPE Options by 'double-clicking' on an auto-installing icon.

What are SPE Options? These are programs that run on the DataPress to add features like: disk mirroring, super volumes, RAID, encryption, and continuous off-line storage of removable magnetic media.

So how do you choose the best data compression solution around? It's a lot less intimidating than choosing a good wine. Call 1-800-876-4ETC.
America's Macintosh Hardware Specialists

Quantum

All MacLand Drives are pre-tested, pre-formatted, and come complete with our own installation and reference manual, DiskMaster Plus™ formatting and utility software, cables and two-year warranty. Internal hard drives also include bracket kits to fit your particular Mac.

<table>
<thead>
<tr>
<th>INTERNAL</th>
<th>EXTERNAL</th>
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<td>$699</td>
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<tr>
<td>425MB</td>
<td>$999</td>
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MacLand carries the full line of FWB quality hard disk drives. Please call for our latest pricing.

SyQuest

All MacLand Removable Hard Drives come with our own installation and reference manual, DiskMaster Plus™ formatting utility software, cables, and a one-year warranty. Cartridge not included.

<table>
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<tr>
<th>Cartridges:</th>
<th>44 Megabyte Hard Drives</th>
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<th>88 Megabyte Hard Drives</th>
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</table>

Testing, Testing 1-2-3...
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<td>Xceed 8 bit II or SE/30 .......... $249</td>
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<td>ColorServer PDS SE/30 17&quot; ..$399</td>
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<td>ColorServer PDS II 17&quot; .........$399</td>
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<td>Mac LC II 4/40</td>
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<td>Mac IIci - 5 meg</td>
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<td>Mac IIci - 5/105</td>
<td>2995</td>
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### MONITORS

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<td>Color Pivot Interface</td>
<td>II, LC, IIci, SE, SE/30</td>
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<td>Pivot Display for Built-in Video</td>
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<td>Two Page Display 19&quot;</td>
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<td>Two Page Display 21&quot;</td>
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<td>Two Page Display Interface SE, SE/30, II,iIi</td>
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<td>Precision 8 interface</td>
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<td>Rocket Accelerator 25 Mhz</td>
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### DRIVES

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<td>Quantum 105 Pro</td>
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<td>Quantum 210 Pro</td>
<td>835</td>
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<td>Road Runner 80 meg</td>
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<td>for Powerbook</td>
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<td>Fujitsu 425 meg yr. warranty</td>
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| Company               | Microsoft Word                | 289  |
|                       | Microsoft Excell              | 309  |
|                       | Aldus Pagemaker               | 497  |
|                       | Caire Omniphone               | 499  |
|                       | Adobe Photoshop 2.0           | 515  |
|                       | Quark Express 3.0             | 579  |

### PRINTERS

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<tr>
<th>Company</th>
<th>Model</th>
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<td>T1 Microlaser PS35</td>
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<td>T1 Microlaser PS17</td>
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<td>QMS PS410</td>
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<td>Apple Stylewriter</td>
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<td>Apple Laserwriter II</td>
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<td>Apple Laserwriter IIg</td>
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<td>HP Deskwriter</td>
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| Company               | HP Deskwriter Color            | 669   |
|                       | HP llp for Mac                 | 1538  |
|                       | HP llp for Mac                 | 1749  |
|                       | HP III for Mac                 | 2379  |
|                       | HP lllsi for Mac               | 4639  |
|                       | HP Deskwriter Ink Cartridge    | 1815  |
|                       | AppleTalk Connectors           | 2584  |
|                       | Color Printers                 | 4795  |
|                       | NEC PS 40                      | 1195  |

### MONITORS (cont.)

| Company               | Platinum Two-Page Display      | 1175  |
|                       | Super Match 19" Color          | 1929  |
|                       | Super Match 21" Two-Page Color Display | 2839 |
|                       | Dual-Mode Trinitron 19"        | 2599  |
|                       | Thunder/8                      | 1159  |
|                       | Thunder/24                     | 2699  |
|                       | Spectrum 8.24 PDC              | 899   |

### SCANNERS

| Company               | Logitech ScanMan 32            | 279   |
|                       | Microtek 600ZS w/Photoshop      | 1229  |
|                       | Microtek 1850S Slide Scanning  | 1495  |
|                       | Umax UC-630 w/Photoshop         | 1195  |
|                       | Caire Typist                   | 436   |

### MODEMS

| Company               | Zoom FX9624 Plus 2400 BPS      | 125   |
|                       | Modem MX 2400S w/SendFax       | 108   |
|                       | v.32 Turbo w/v.42bis w/MNP software | 445   |
|                       | Dove Fax Modem 9624            | 256   |
|                       | Dove Fax Modem 0624 Plus With Voicemail | 325   |
|                       | PSI for Powerbook 140 & 170 Internal 9600/2400 | 225   |

### ACCELERATORS

| Company               | Daystar 40 Mhz PowerCache      | 888   |
|                       | 50 Mhz PowerCache              | 1325  |
|                       | 50 Mhz PowerCache w/68882      | 1595  |
|                       | Radius Rocket                  | 1700  |

### MEMORY

| Company               | 1 meg for LC/CI/SI             | 37    |
|                       | 4 meg for LC/CI/SI             | 139   |
|                       | Powerbook 140 & 170 4 meg      | 299   |
|                       | Powerbook 140 & 170 6 meg      | 399   |
|                       | Envisio Powerbook Display      | 429   |
|                       | Adapter and memory             | 699   |

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<tr>
<td>NEW !!! RasterOps PaintBoard LI 24 bit video board with acceleration for 16&quot;</td>
<td>Universal PowerCache 33MHz</td>
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<tr>
<td>NEW !!! RasterOps PaintBoard 24 System 20&quot; RasterOps PaintBoard with 24 bit accelerated video board</td>
<td>Universal PowerCache 40MHz</td>
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<tr>
<td>NEW !!! RasterOps MediaTime 24 bit board with real time digital video and 16 bit audio</td>
<td>Universal PowerCache 40MHz w/68882</td>
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<tr>
<td>NEW !!! RasterOps 16&quot; Color Monitor</td>
<td>Universal PowerCache 50MHz</td>
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<td>RasterOps 24STV Board/accelerator</td>
<td>$129.</td>
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<td>RasterOps NEW 24XLI 2076 System</td>
<td>$CALL.</td>
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<td>RasterOps 8XLI 1960H System</td>
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<td>RasterOps 264 30/24SX</td>
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<td>RasterOps 21&quot; Mono System</td>
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<td>RasterOps Video Expander II</td>
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<tr>
<td>Spectrum 24 Series III/Trinitron System 24 bit accelerated card with SuperMac III/Trinitron</td>
<td>SE, SE/2 &amp; Mac II Display Cards</td>
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<tr>
<td>Spectrum 8/24 / 8/24 PTOsi</td>
<td>$2499.</td>
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<td>Spectrum 8CL</td>
<td>$1099.</td>
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<tr>
<td>All SuperMac products in stock. Call us about our special board trade-in program. Call for special education allowance.</td>
<td>$799.</td>
</tr>
<tr>
<td>NEC</td>
<td>$499.</td>
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<tr>
<td>NEW 4FG 15&quot; MultiSync Monitor</td>
<td>$CALL.</td>
</tr>
<tr>
<td>NEW 3FGX 15&quot; MultiSync Monitor</td>
<td>IN STOCK.</td>
</tr>
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<td>NEW 5FG 17&quot; MultiSync Monitor</td>
<td>IN STOCK.</td>
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<th><strong>NEC</strong></th>
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<td>NEW 4FG 15&quot; MultiSync Monitor</td>
<td>Pocket Hammer Transportable 50/100mb</td>
</tr>
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<td>NEW 3FGX 15&quot; MultiSync Monitor</td>
<td>$CALL.</td>
</tr>
<tr>
<td>NEW 5FG 17&quot; MultiSync Monitor</td>
<td>$CALL.</td>
</tr>
<tr>
<td>IN STOCK.</td>
<td>Hammer Disk 44mb Syquest removable</td>
</tr>
<tr>
<td>IN STOCK.</td>
<td>$CALL.</td>
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<tr>
<td>IN STOCK.</td>
<td>Magnavox Professional 14&quot; Color Monitor</td>
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<th><strong>Supra</strong></th>
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<tr>
<td>CM1445 8 Bit Color Bundle</td>
<td>Magnavox 14&quot; Color Monitor</td>
</tr>
<tr>
<td>CM1445 24 Bit Color Bundle</td>
<td>$1229.</td>
</tr>
<tr>
<td>14&quot; RGB monitor with RasterOps 24SX 14 bit board</td>
<td>$779.</td>
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**SPECIALS!!**

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<th><strong>TechWorks</strong></th>
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<tr>
<td>T-19 sx System $2395</td>
<td>NuBus 10 Base T, Ethernet Card</td>
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<tr>
<td>T-19 mx System $2895</td>
<td>$175.</td>
</tr>
<tr>
<td><strong>E-Machines</strong></td>
<td>NuBus 10 T, Thin, AATI Ethernet Card</td>
</tr>
<tr>
<td>E-Machines NEW T-16 II/SX-24 Terminal System</td>
<td>$199.</td>
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<tr>
<td>E-Machines NEW T-16 II/SX-8 Terminal System</td>
<td>GraceLAN Std. 50 User Version 2.0</td>
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<tr>
<td>E-Machines NEW T-16 II/DoubleColor Terminal System</td>
<td>$329.</td>
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<td>E-Machines NEW T-16 II/DoubleColor Terminal System</td>
<td>GraceLAN Asset Manager</td>
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<tr>
<td>CM1445 24 Bit Color Bundle</td>
<td>$559.</td>
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<td>CM1445 24 Bit Color Bundle</td>
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<tr>
<td>14&quot; RGB monitor with RasterOps 24SX 14 bit board</td>
<td>$779.</td>
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OMS 410 .. .. $1777
OMS PS 815 .. .. $2077
13" Apple Color .. .. $6277
14" Seiko Inst .. .. $547
15" NEC 4PC .. .. $747
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<tr>
<td>Mac Classic II</td>
<td>Call</td>
</tr>
<tr>
<td>Mac LC II 4/40mb with 14&quot; color monitor</td>
<td>$1245</td>
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<tr>
<td>Mac LC II 4/120mb with 14&quot; color monitor</td>
<td>$1440</td>
</tr>
<tr>
<td>Mac Illi 5/120mb with 14&quot; color monitor</td>
<td>$2899</td>
</tr>
<tr>
<td>MacPro keyboard</td>
<td>$2799</td>
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<tr>
<td>PowerBook 140 &amp; 170</td>
<td>Call</td>
</tr>
<tr>
<td>H.P. Deskwriter</td>
<td>$399</td>
</tr>
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<td>H.P. Deskwriter C</td>
<td>$699</td>
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<td>External 40mb drive</td>
<td>$225</td>
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## System Products

### Top Quality Products

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<tbody>
<tr>
<td>Mac II 4-40</td>
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<tr>
<td>LC II 4-40</td>
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<td>Quadra 950 In Stock</td>
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<td>Powerbook 140 4-40</td>
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<td>Powerbook 170 4-40</td>
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<td>Powerbook 170 2-80</td>
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<td>Radius 21&quot; Color</td>
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<td>Radius Precision 24xCard</td>
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<td>Gen-Sys 20&quot; Tril. +424 Bit</td>
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<tr>
<td>Gen-Sys 20&quot; Tril. +8 Bit</td>
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<tr>
<td>Sony Tril. 130/160</td>
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<tr>
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<tr>
<td>UMAX UC 630</td>
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<tr>
<td>Microtech 607/1805</td>
<td>$1369/1799</td>
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<tr>
<td>Iomega 352/732</td>
<td>$1399</td>
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<tr>
<td>HP Scanjet 11P/11C</td>
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<tr>
<td>Apple 13&quot; RGB</td>
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<td>Sigma-Design portrait</td>
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## Printers

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## Monitors

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## Scanners

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<td>Powerbook 140 4/80</td>
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<tr>
<td>Powerbook 170 4/80</td>
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<tr>
<td>Powerbook 170 2-80</td>
<td>$4299</td>
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CLEARANCE SPECIALS

Apple LaserWriter 12, 30, 32, 14, 12c/g
Mitsubishi 5373-105 Color 300dpi w/Express Harp Postscript driver $399.99
QMS ColorPage 300-10 DEMO $5500
QMS PS Plus RIP Postscript Laser $1799
SuperMac 19 Color New & Used $1999
E-Machines Color Page 15" w/ 120ppm $5199
Minolta 16" 1024 X 768 w/64 MB $4999
RazerOps Trinitron 19 & 21" From $2299
Sony 19 Industrial Trinitron NEW $2699
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Minolta 16" 1024 X 768 w/64 MB $4999
RazerOps Trinitron 19 & 21" From $2299
Sony 19 Industrial Trinitron NEW $2699
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PowerBook Mac llci SuperMac Apple Sony Asante
140 4/40 .... '1995 8MB/ 120HD .. '3 180 Spec 8 ser Ill 15 15 IOBaseT Hub .. '249
170 8/80 .... .. 12495 8MB/240HD .. '3445 Spec 8.24 pdq ' 828 64K Ether ........ 1
1219
Syl0Wri1er ... 1345 1320 Color ...... '385 140 8/ 120 ... .'2695 20MB/425 HD '4 195 Spec1rum 24 .'729 EN/SC 108T .... '249
170 4/40 ...... '3395 Quadra 700 Spec 24 ser 111• 1159 Laser NTR . '1679

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Continued...
CATALOG

SIMMs
- 1 Megabyte 70 ns: $34.00
- 1 Megabyte 80 ns: $31.00
- 1 Megabyte 100 ns: $30.00
- 2 Megabyte 80 ns: $59.00
- 4 Megabyte 80 ns: $185.00
- 8 Megabyte 80 ns: $319.00
- 16 Megabyte 80 ns: $549.00

Video RAM
- 4 Bit to 8 Bit Upgrade: $24.00
- 256K Quadra URAM: $30.00
- 512K Mac LC URAM: $59.00

PowerBook
- 140/170 6 MB Upgrade: $289.00

Quadra Memory
- 256K URAM Quadra 700/100: $335.00
- 256K URAM Quadra 950: $42.00
- 16 MB SIMMs Quadra 700: $575.00
- 16 MB SIMMs Quadra 900: $549.00

Cache Cards, Etc.
- II si 64K Cache Card: $130.00
- II ci 64K Cache Card: $129.00
- II si 2-slot Card and 6882: $119.00

PowerBook Memory
- 2 Megabyte Module: $109.00
- 4 Megabyte Module: $199.00
- 6 Megabyte Module: $289.00

68030 25Mhz Accelerators
- "Quick30" for Mac SE, Plus, and 512Ke: Runs at the speed of a Mac IICI
- System 7/Virtual compatible
- Add up to 16 Megabytes of RAM
- Includes 68862 Math CoProcessor
- Only $529.00

FPUs (chip only)
- 68082 16 Mhz: $69.00
- 68082 20 Mhz: $109.00
- 68082 25 Mhz: $135.00
- 68082 33 Mhz: $175.00
- 68082 50 Mhz: $49.00

Miscellaneous
- T.I. Microlaser 1 MB HYD for Mac LC: $139.00
- Mac Classic 1 MB Bd: $55.00
- Mac Classic 3 MB Bd: $119.00
- SyQuest Cartridges: $65.00
- 512Kb to Plus Upgrade: $255.00
- 68651 16 Mhz HYD: $79.00
- Mac Portable RAM: CRIL
- Next Memory: CRIL

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MACWORLD October 1992 289
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## Hard Drives

<table>
<thead>
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<th>Model</th>
<th>Internal</th>
<th>External</th>
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<td>$415</td>
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<td>Fujitsu</td>
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<td>Syquest Removable</td>
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## Quadra Specials

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## SIMMs

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## Notebook Memory

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## Maximum Memory Special

16 MEG SIMMS

- **$509**

## Syquest Cartridges

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<td>88 MEG</td>
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- Fax (714) 847-5043
- 7911 Professional, Huntington Beach, CA 92648

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<th><strong>OPTICAL DRIVES</strong></th>
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<td>Virtual 128 mb 3.5 Cartridge</td>
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<td>KOMAG 128 mb 3.5 Cartridge</td>
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<td>Video Spigot NuBus with Adobe</td>
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<td>Maccon+II Macll Thick 10Base T, 16K</td>
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<tr>
<td>Maccon Thick 10 Base T</td>
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<tr>
<td>SCSI Ethernet Thick 10 Base T</td>
</tr>
<tr>
<td>SCSI Ethernet for PB, 10 Base T</td>
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<tr>
<td>SCSI PB Ethernet 10 Base Tw/SCSI Cable</td>
</tr>
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<td>Kirby Xebra Send/Rec Fax Modem Q200</td>
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<td>AE Modem, 2/300 MNP5 Send Fax</td>
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<tr>
<td>Global Village Teleport Full Fax</td>
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<tr>
<td>Global Village Powerport Gold</td>
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<tr>
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<thead>
<tr>
<th><strong>ADDITIONAL PRODUCTS</strong></th>
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<tr>
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<td>AE Modem, 2/300 MNP5 Send Fax</td>
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<tr>
<td>Global Village Teleport Full Fax</td>
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<td>Global Village Powerport Gold</td>
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<td>Global Village Powerport Silver</td>
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<td>Global Village Powerport Bronze</td>
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<td>PSI Power Modem</td>
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<td>NEW! Supra 5014 SIR Fax Modem V.32 bis</td>
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<td>NEW! Supra 5024 2/60 bps moderm</td>
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<th><strong>COMPARABLE LOW SHIPPING PRICES:</strong></th>
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<td>$6 And up overnight shipping by Airborne Express.</td>
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<tr>
<th>Model</th>
<th>Storage</th>
<th>Size (MB)</th>
<th>Warranty</th>
<th>Price</th>
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<tr>
<td>PT 21</td>
<td>600MB</td>
<td>June</td>
<td>600MB</td>
<td>2.499</td>
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<tr>
<td>PT 65</td>
<td>600MB</td>
<td>June</td>
<td>600MB</td>
<td>1.799</td>
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<td>PT 85</td>
<td>600MB</td>
<td>June</td>
<td>600MB</td>
<td>1.199</td>
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Four System 7 compatible color games.

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1755 AmandaStories ......................49.95

1671 Anatomist learn anatomy ........29.95

2127 Creepy Crawlies ............99.95

1566 Lifesaver 2.0 ......................99.95

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2122 Virus Stompers ....................29.95

Contains the latest version of Disinfector.

5936 Color Startup Screens v.1 - NEW

Four System 7 compatible color games.

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German Edition, 4/92

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<table>
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<th>Model</th>
<th>Price</th>
<th>Fast Renegotiation</th>
<th>Remote Configuration</th>
<th>Call Back Security/With Password Protection</th>
<th>FAX V.17 14.4Kbps S/R</th>
<th>Caller ID</th>
<th>Distinctive Ring</th>
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Circle 107 on reader service card
## Business Software

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<td>Microsoft Word</td>
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## Entertainment Software

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<td>18</td>
<td>3</td>
<td>Crystal Quest</td>
<td>Casady &amp; Greene</td>
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## Utility Software

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## Network/Data Communications

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## Add-In Boards

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<td>Macintosh Display Card 8+24</td>
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## The AmCoEx Index of Used Macintosh Prices

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<th>Monthly Change</th>
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Source: Exclusive Audits & Surveys research from more than 250 Macintosh retailers and selected mail-order vendors. Covers sales during June 1992.
Mirror Introduces Desktop Performance For Your Powerbook...

With Mirror’s exciting new peripherals, your PowerBook can function just like a desktop machine, with a high resolution monitor and plenty of storage.

The Mirror PowerVision™, an internal video board for the PowerBook 140 or 170, works with a variety of standard monitors, including our NEW 14-inch Color Display and 15-inch Gray-scale Display. With 0, 2 or 4 MB of on-board RAM, the PowerVision’s pass-thru connector lets you use existing RAM, and our installation video makes setup a snap (professional installation also available).

The Mirror ViewPort™ is a 15-inch monochrome display with a built-in SCSI video controller and QuickDraw acceleration for performance rivaling internal video boards. Ideal for PowerBooks, the ViewPort brings big screen power to any Mac with a SCSI port. (continued)

---

The NEW Mirror 14-inch Color Display
$399

Mirror PowerDock™ battery powered base unit and charger.
$199

Mirror Pocket Hard Drives
40 MB $399
80 MB $599
120 MB $749
Includes SCSI cable for PowerBooks and standard Macs—a $100 value!

PowerVision internal video adapter board includes tools and a comprehensive installation video. from $549

Systems including PowerVision board and display from $948
Drive and DAT Tape Drives, Mirror offers the capacities, speed, features and prices you want.

Once you've used a Mirror high resolution display, you'll wonder how you ever lived without it. Our monochrome full-page and two-page displays deliver bright, sharp screen images for word processing, spreadsheets, database management and publishing.

For graphic design, illustration or pre-press, choose a Mirror color display. Available in 14-inch, 16-inch and 20-inch models, there's a Mirror color display that's right for every job.

The top-rated Mirror Color Scanner makes it easy to add sharp, vivid color images to your work at an unbeatable Mirror price; just $1199 including Adobe Photoshop.

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All Mirror products are backed by our famous 30-day, "love it or return it" policy, and the best customer support in the business. Call today to see for yourself.
...And Powerhouse Perip

The NEW Mirror 14-inch Color Display is the latest version of our best selling color monitor. Designed to work with the built-in video of your Mac LC, IIci, Iici, or Quadra--or with Mirror's PowerVision video board for PowerBooks; this display features razor-sharp focus and brilliant color and it's still only $399!

The Mirror Pocket Hard Drives and optional Mirror PowerDock redefine storage convenience. For moving data between machines, or to expand your PowerBook's capacity, these tiny drives fit anywhere. Slip the Pocket Drive into the PowerDock and use a standard PowerBook battery to power the drive while you travel. When you're back home, the PowerDock does double duty and charges your spare battery.

Whatever your need, whatever Macintosh model you use, Mirror has high performance peripherals to match.

Our complete line of storage systems can handle any task. From our critically acclaimed hard drives and CD-ROM, to our high performance 128 MB Optical

<table>
<thead>
<tr>
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20-inch ProView Trinitron Display, 8-bit w/ 24-bit video card $2,499
20-inch ProView V Color Display, 8-bit w/ 24-bit video card $2,199
16-inch Trinitron Display $1,199 w/ 8-bit video card $1,599 w/ 16-bit video card $1,699 w/ 24-bit video card $1,999
16-inch Color Display $899 w/ 8-bit video card $1,299 w/ 16-bit video card $1,399 w/ 24-bit video card $1,699
14-inch Color Display $399

NEW Lower Price!

Mirror 600 Color Scanner
with Adobe Photoshop $1,199

* You pay shipping costs (and consumables for printout). ** For built-in video. *** PowerDock available September 1992. Prices are F.O.B. origin. Prices are for US orders only; call for international pricing. All prices subject to change.
While the cursor may hop or skip with some trackballs, Turbo Mouse® has always been known for its ultrasmooth movement.

Now, the latest version of Turbo Mouse is known for something else—jumping. Our new Brilliant Cursor technology makes it possible.

With it, you can move the cursor instantly to predefined HotSpots on the screen, such as the File and Edit menus and the Trash icon.

First, you define your HotSpots. Then, click a button and move the ball in the direction you want to go. The cursor automatically jumps to the predefined HotSpot. You can even program in different HotSpots for different applications and for different users.

And Brilliant Cursor technology is not all that’s new with Turbo Mouse 4.0. Also new is advanced acceleration with three levels of control and Enhanced Mouse Buttons that let you execute one of seven programmable commands. For example, send a Print command with just one click using Send String. Or move the cursor with ultra precision using Slow Cursor. Even save different combinations of commands for each of your favorite programs.

Then there’s the award winning Turbo Mouse hardware. Hardware that has won more awards than any other input device. Hardware that has consistently been voted “Best Input Device” by Macintosh users worldwide. Features include a large comfortable ball, “easy-click” buttons, long-lasting precision stainless steel bearings, and two ADB ports for chaining other devices.

Turbo Mouse 4.0 is fully System 7.0 compatible. To receive information by fax, call 800-535-4242, dial 82 and request document 320. For general information, call 800-535-4242. Outside the US, 415-572-2700.