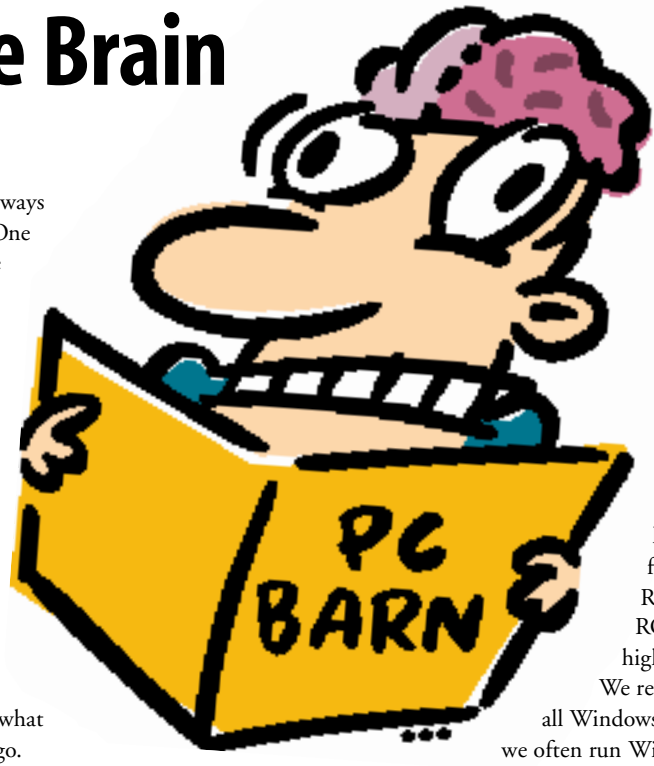
Hardware: **Buying a fast PC**

# Shopping on the Left Side of the Brain

By Tamis Nordling




Scott Matthews

**There are a couple of** major ways to approach a purchasing decision. One might be called the "right side of the brain" method, in which you make a quick, spontaneous decision based mostly on intuition. This is low on the stress scale, and can be a great way to buy a sandwich for lunch, or even a painting for your living room. But it's a bad way to buy a computer.

Another approach might be called "left side of the brain" decision-making—a rigorous intellectual process involving in-depth research and analysis. Don't use this method to select a spouse. But for major purchasing decisions, like what computer to buy, it's a good way to go.

This is especially true when buying a PC, because you aren't making just one decision but many, each involving a complicated piece of equipment. What CPU should you get? What kind of monitor? What video card? How much RAM? What kind of hard drive? The list goes on. It's easy to feel overwhelmed by the complexity of the decisions.

You may be tempted to skip the research stage. Every computer vendor in the market will happily make these decisions for you by selling you a package labeled for use as a "power" system, a "multimedia" system, a "home" system, and so on. Often these packages are a great deal if they really have all the components you need, but many vendors cut corners to keep prices down. If you're not sure what questions to ask and what to look for, you could end up with a system that won't really give you what you need. To avoid such pitfalls, do your research. Put that thinking cap on the left side of your brain and decide what you want to do with your new computer, figure out what components you'll need to do that work, and then start looking at prices.

At *Adobe Magazine*, we're mostly a Macintosh-based production shop, but we have a couple of PCs that are important shared resources: a fast 486 notebook with a monochrome monitor that we use for editing, business applications, and on-the-road work; a rather outdated 386 with a VGA display that we use for occasional testing purposes and light business tasks; and a fast 486 with 16 MB of RAM, a triple-speed CD-ROM drive, and a 14-inch, high-resolution monitor.

We rely heavily on our 486 to test all Windows-based Adobe applications; we often run Windows-based multimedia applications on it; we use it for a few DOS-based applications; and our art department uses it for scanning and some image-editing. Although Photoshop runs nicely on our 486 (faster than it does on several of our Macintosh Quadras), the 486 doesn't have quite enough RAM or hard-drive space, and its monitor isn't quite good enough, to use it for serious Photoshop image work.

We really needed another shared workstation for heavy-duty image-editing in Photoshop. We could have gotten another Macintosh, but we could get more bang for our buck by investing in a new PC instead. Plus, a new PC would be able to help offload some of the increasing demands we place on our 486. Once we'd decided on a PC instead of a Mac, we began defining what PC we wanted. First, it would have to run Photoshop and Adobe's other professional graphics applications at serious production speeds. Second, we wanted it to be up to speed for Windows 95. Third, we wanted to make sure the system would be easy to upgrade to a capable multimedia station.

What we needed in order to run Photoshop primarily deter-

mined how our system should be configured. Of all the Adobe professional graphics applications, Photoshop is the biggest system-resource user, so any system that could run Photoshop really well would run Premiere well, too, and make PageMaker and Illustrator scream.

We were confident the Photoshop workstation would be more than adequate for Windows 95, but did want to make sure the system we bought would support Windows 95's Plug-and-Play feature.

## the Box Score: A never-ending battle

All the major magazines that cover PC hardware include reviews of PCs with every issue. The top-scoring performers change frequently—competition among computer vendors is fierce, and new machines come out all the time. If you're in the market for a PC, check out as many current reviews as you can find. Here's what some magazines were saying when we went to press in May (and even then, some of the prices were already out of date by the time they appeared).

***PC World***
*June 1995: Top five "Power Desktops"*
Dell Dimensions XPS P120c, $4,689
Micron P120 Millenia, $3,799
HP Vectra VL3 5/120, $3,700
Dell Dimensions XPS P90, $3,233
Gateway 2000 P5-120, $4,299

***PC Magazine***
*May 30, 1995: "Editor's Choice" Pentiums*
Performance-oriented:
Gateway 2000 P5-120, $4,299
Micron P120 Millennia, $3,799
Mainstream:
Austin Power Plus 100, $3,499
Gateway 2000 P5-100XL, $3,340
Value-oriented:
Austin Power Plus 75, $2,699

***PC Computing***
*June 1995: "High-End Systems"*
Tagram Thunderbolt (100MHz), $3,945
Gateway 2000 P5-100XL, $3,699
Zeos Pantera 100, $3,795
IBM Personal Computer 750 (100MHz), $5,230

Plug-and-Play, if it works, will allow Windows 95 users to add peripherals to their systems quickly and easily (plug it in and it plays, with no need to mess with interrupt conflicts, the CONFIG.SYS and AUTOEXEC.BAT files, and so forth).

At this point, we started doing some serious left-brain research on what components we should get. It was a somewhat daunting task; we work mostly with Macintosh computers and we aren't hardware experts. We asked around Adobe for advice on what we should get, surfed the hardware-specific forums on CompuServe and the World-Wide Web, consulted several helpful publications (see "A buyer's library" on page 30), and eventually felt adequately prepared to start shopping. Here's an overview of what components we decided we wanted, roughly in their order of importance.

**Plug-and-Play, if it works, will allow Windows 95 users to add peripherals to their systems quickly and easily.**

**A really fast Pentium CPU.** The CPU is the most important component of any computer, and it's the last part you should skimp on. In the PC market today, the Pentiums are the fastest chips available. We decided to look for one that would run at 90 or 100 MHz. Since we were on a budget and didn't want to pay a high premium for the most cutting-edge chip available, we decided not to shop for the newly introduced, 120-MHz Pentiums (which were going for approximately $500 more than 100-MHz Pentiums in April).

**Lots of RAM.** Beside the CPU, how much RAM is available on a system has the greatest impact on Photoshop performance. For the best performance, Photoshop should have available for its exclusive use an amount of RAM that is 3–5 times the size of the graphic file being edited. That ensures Photoshop will have enough RAM to hold the entire graphic and other data it needs to perform calculations, without having to use hard-drive space as additional memory (which significantly reduces performance). According to all the serious Photoshop users we know, 32 MB is a good place to start.

**A big, fast hard drive.** The images we'd be editing would be big, often taking up from 1 to 20 MB each. Not only would our hard disk need to be big enough to accommodate them, it would also need to be big enough for us to reserve at least 32 MB (the same amount as our RAM) for a Windows permanent swapfile, with plenty of space left for Photoshop to use as a scratch disk (this is the area Photoshop uses as virtual memory when it runs out of RAM). We decided a 1GB (gigabyte) drive would meet our needs now and give us some room to grow.

We also wanted to make sure that the hard drive we got would be fast. The three factors that tend to influence hard-drive speed the most are platter rotation speed, on-board buffer or cache size, and interface type. Platter rotation speed is how fast the drive spins; 3,600 RPM used to be standard, now 4,500 RPM is common among fast hard drives, and some drives with speeds up to 7,200 RPM are available. A large on-board buffer or cache (look for one that's at least 256K) improves performance, too. Features like write caching (in which the buffer holds data the hard drive needs to write until there's a pause in operations) and read-ahead caching (in which the cache loads sectors following what's already been read, assuming those sectors will be read next) increase speed as well.

It's not quite as easy to say what type of hard-disk interface gives the best performance. The two standard, high-end choices available today are EIDE (enhanced integrated drive electronics) and SCSI-2 (small computer system interface). We decided to buy a SCSI-2 drive, for a variety of reasons—see the sidebar "SCSI-2 or EIDE?" on the facing page for more information about that decision.

**A high-end video system**. Having a fast, powerful Photoshop workstation only makes sense if the video system (monitor and video card) is good enough to support serious image-editing. We decided we wanted a 17-inch flat monitor that would support 24-bit color at a resolution of at least 1024 by 768. We also wanted the display to be as flicker-free as possible: specifically, we looked for a noninterlaced monitor (interlaced monitors redraw only every other line of pixels at a time, which contributes to flickering) with a redraw speed of at least 70 MHz at 1024 by

## SCSI-2 or EIDE?

**So which is faster, SCSI-2 or EIDE? Speed is quantifiable, so you'd think this would be an easy question. Think again.**

**Our first inclination was to buy a SCSI-2 drive, since they're supposed to be faster and offer better chaining capabilities. Most of the computer vendors we talked to said our decision to get SCSI made a lot of sense, but other vendors, some of whom don't even offer SCSI drives for their power stations, balked. One salesman told us his company didn't carry SCSI hard drives anymore because they aren't as fast as EIDE ones. When I asked why, the salesman mumbled something about "inferior design," but wouldn't—or couldn't—elaborate.**

**Here's a little background on EIDE and SCSI. IDE (integrated drive electronics) is a standard for device interfaces that was developed in the mid-1980s as a low-cost way to connect one or two hard drives to a computer. Its modern incarnation, EIDE (enhanced IDE), has transfer rates of 11 MB per second, and an emerging version of EIDE offers 16 MB per second. Developed in the early '80s, SCSI (small computer system interface) is a standard way to connect up to six peripheral devices to a computer. SCSI-2 (also called Fast SCSI) is the current version of this technology, and it offers transfer rates of 10 MB per second. A new SCSI standard, called Fast-Wide SCSI, offers rates of up to 20 MB per second.**

**So SCSI-2 offers 10 MB per second, close to EIDE's 11MB; but SCSI-2 offers some features, such as multitasking support, that should make it faster overall.**

**So that makes SCSI faster, right? That's what we thought, and we were partly correct. Actually, under Windows 3.x EIDE offers faster performance than SCSI-2, for a few reasons. Windows 3.x isn't a true multitasking environment, so it can't take advantage of SCSI-2's multitasking support. In addition, EIDE drives can take advantage of 32-bit disk access under Windows 3.1, but SCSI drives generally can't because most SCSI controllers in this environment handle their I/O at the BIOS level, not through Windows. However, under operating systems that offer 32-bit transfer—Windows for Workgroups and Windows NT, for instance—the results shift: SCSI-2 outperforms EIDE, sometimes quite significantly. SCSI-2 should see similar performance gains under Windows 95, which is a 32-bit operating system.**

**This made our decision to go with SCSI-2 fairly easy. We're already using Windows for Workgroups, and we'll be upgrading to Windows 95 as soon as possible. Besides, we wanted SCSI-2's better connectivity features—with SCSI you can chain up to six devices, including external ones, off one controller (EIDE can chain a maximum of four internal drives off two controllers). The other factor: we're a Macintosh-based production shop, and SCSI is ubiquitous on the Mac platform, since SCSI support is built into Macs. So sticking with SCSI would allow us to share peripherals more easily across platforms. The only disadvantage to the SCSI drive was that we had to spend about $200 extra for a SCSI controller, which doesn't come built into most systems. In our case, it was money well spent.**

768—the higher the redraw speed, the less flicker. For a video card, we looked for something that would offer fast performance displaying 24-bit color at 1024 by 768. To get the kind of performance we wanted, we would need at least 2 MB of VRAM (video RAM), a special, high-speed type of memory used to enhance video performance.

**A fast memory subsystem**. In addition to RAM, there are several components of the memory subsystem that significantly affect performance. One is the processor-to-memory bus, the highway that carries data between the memory system and the CPU. The wider the bus, the faster the flow. Pentium systems come standard with a PCI (peripheral component interconnect) 64-bit bus, the widest available.

Another important feature of the memory subsystem is the level-2 cache. This is a block of SRAM (static random access memory), which is placed between the regular memory and the CPU and acts as temporary storage for the processor. It holds the data most recently read from regular memory so that the processor can retrieve this data from the cache instead of from regular memory. Since processors tend to use the same chunks of data over and over again, a level-2 cache significantly reduces the number of times the processor must retrieve data from regular RAM (which is considerably slower than retrieving it from SRAM).

**Programs that work primarily with very large units of data don't benefit significantly from extra-large caches. Photoshop is one such program.**

Several features determine how good a level-2 cache is. Its size is important, certainly: most Pentiums come with 256K level-2 caches that can be upgraded to 512K. How much the size of the cache affects performance depends on what applications you're running—applications that frequently reuse the same instructions benefit the most from memory caching. Other cache features that improve performance include *write-back* designs (in which the cache holds data both read from and written to regular memory). For more information on level-2 cache features and how they affect performance, check out the resources listed in "A buyer's library" on page 30.

Programs that work primarily with very large units of data don't benefit significantly from extra-large caches. Photoshop is one such program. Because of this, we didn't worry too much about advanced level-2

caching features; instead, we decided just to look for a 256K, write-back cache to enhance performance in programs other than Photoshop.

**A flash (upgradable) BIOS that supports Plug-and-Play**. The BIOS (basic input/output system) is a mini-program that resides in read-only memory. It's the first thing your computer reads upon starting up, and it relays basic information such as what the peripherals are and what the computer should do with them.

Windows 95's Plug-and-Play feature will work if two things are in place: a BIOS that supports Microsoft's Plug-and-Play specification and peripherals that support the same specification. Those are big ifs; many peripherals on the market don't support this specification (none of the ones in our office do), and the specification itself probably hasn't finished evolving.

So we decided we'd look for a BIOS that supports Plug-and-Play but that also offers full support for the current "plug-and-*pray*" specification, including ESCD (extended system configuration data). Getting a "flash BIOS" would allow us to update the BIOS later if the Plug-and-Play specification changes or we need to update for any other reason.

**A fast, reliable CD-ROM drive.** Currently, we use our office's CD-ROM drives primarily to read Photo CDs, multimedia titles, archived copies of the magazine, and software on CD. We decided to look for a quad-speed CD-ROM drive with a SCSI-2 interface for portability and speed.

We declined to shop for any other multimedia peripherals like fancy sound cards and speakers, since we currently do very little with sound.

**A good price and good service**. We also wanted to make sure we bought our PC from a reputable manufacturer that would offer technical support and a decent warranty. And last, but not least, we needed to keep in mind budget constraints. We were determined to try to find a system that would meet our needs and come in under $4,000. We almost succeeded.

## A buyer's library

**The articles listed in "The Box Score" (page 28) helped us sort through the various packaged systems offered by the major vendors. But when it came to researching individual components and figuring out how to get the best deal, we turned to other sources. Here are a few of the articles and other resources we ran across that were particularly helpful.**

- **"Let's Make a Deal," by Daniel Tynan. *PC World*, March 1995. A great overview of different ways to buy a PC (mail order, local retailers, superstores, and so forth) and their relative merits.**
- **Intel's World-Wide Web site, at *http://www.intel.com/*. Includes lots of clear, helpful information on CPU, memory, and other component features.**
- **"Getting Win95 up to Speed," by Bill Machrone, Brian Livingston, Larry Seltzer, and Greg Smith. *Windows Sources*, April 1995. Helpful overview of what hardware will support Windows 95 best. Its focus isn't on what configuration will run high-end graphics products well in this environment (products like Photoshop require more RAM than typical business-oriented Windows applications), but the article is helpful nonetheless.**
- **"Take a Drive," by David W. Methvin and John Gatner. *Windows Magazine*, April 1995. The best overview of SCSI vs. EIDE drives we found.**

## Multitask shopping

Once we'd done so much tedious research, the shopping almost seemed easy. But one thing that's hard about comparison shopping in the computer world is that it's quite hard to find comparable systems; each vendor offers systems that are configured differently, and it can be difficult to get these companies to provide price quotes broken down by component. And, of course, not all components that sound the same really are the same. The process wasn't just about shopping for a single computer; it required several simultaneous shopping experiences (one for each specific type of component we wanted).

**We might live to regret not getting the Millennia, but we were already over budget. Besides—we were getting really sick of shopping.**

We began by harassing several pleasant, helpful salespeople at a variety of major PC vendors by asking a host of in-depth questions about their systems and components. Most of the salespeople endured the interrogation gracefully and competently; many were willing to fax us specification sheets on individual components like monitors and CD-ROM drives, and some forwarded us to their technical support departments if we had questions they couldn't answer.

After spending a week or so comparing custom-configured systems from several of the major vendors, and reading reviews of similar systems in various publications (see "The Box Score" on page 28), we selected a SCSI-based, 100-MHz Pentium system from Micron Electronics of Nampa, Idaho.

The Micron system we picked had almost everything we wanted. We made a few compromises to keep from exceeding our spending goals too much—the system we picked was already over budget at $4,537, including freight. Here's what we got for our money: a Micron PowerStation Plus Pentium 100-MHz system with a 256K write-back cache; 32 MB of RAM; a 1.06GB SCSI-2 hard drive with a fast, 32-bit PCI SCSI-2 controller; a Plextor quad-speed SCSI-2 CD-ROM drive; a 17-inch flat, non-interlaced monitor; a Diamond Stealth 64 video card with 2 MB of VRAM; and a 3-COM Ethernet card. The system also came with standard features such as a 101-key enhanced keyboard, a Microsoft mouse, and OEM versions of the Microsoft Office suite of business software. Micron also throws in a Creative Labs SoundBlaster 16 sound card and mini speakers—components we were going to delay purchasing for budget reasons, but were happy to get sooner.

Dealing with Micron was mostly reassuring. The salespeople were knowledgeable and helpful, as was the technical support staff. However, we also got the impression that they were a bit short-staffed at times, perhaps victims of their own recent success. We often had a hard time getting through on the phone, and quotes on the

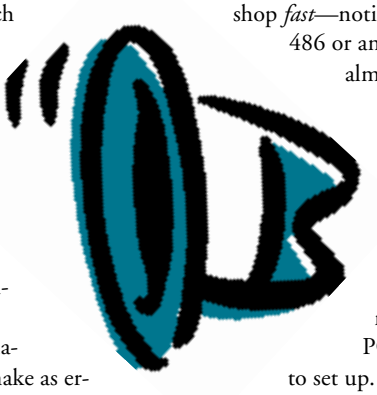
configurations we wanted didn't always arrive as promised. We also had to confess to being from *Adobe Magazine*—which we usually keep to ourselves when shopping for this section—in order to get our system sooner than the three weeks Micron originally quoted.

The only other difficult aspect of our encounter with Micron was that they were almost too helpful. After we'd nearly finalized our decision on system components, our sales rep pointed out that a different system—their new Millennia Pentium package—might suit our needs better. The Millennia system, if configured exactly like one of the PowerStation systems, goes for about $300 more but offers up to 20 percent better performance, at least in standard Windows benchmark tests. Its enhanced performance comes from sophisticated new memory-subsystem features that speed RAM caching and decrease delays caused by cache misses.

We might live to regret not getting the Millennia, but we were already over budget and we reasoned that Photoshop wouldn't fully benefit from cache enhancements since Photoshop works with such large units of data. Besides—we were getting really sick of shopping.

## Epilogue

About two weeks after we ordered it, our system arrived with all components intact. Except for some major hassles getting it to talk to our network (which is almost always a pain with PCs), it was extremely easy to set up.



The only real complaint we have with the system is the mouse. Micron, like many PC vendors, ships its systems with Microsoft's new standard mouse, the "IntelliPoint," which Microsoft labored long and hard to make as ergonomic as possible. It's longer than the old Microsoft standard mouse, and has a bump in the middle—presumably for cradling the middle of your hand. That may be just fine if you have an average-sized hand, but those of more diminutive stature may find the mouse too big. A few of us find it quite irritating because we have to bend our wrists in awkward ways and stretch to reach the buttons. Right now we're trying to dig up a smaller mouse to use with the system.

Despite this relatively minor problem, we love our new Pentium. It runs Photoshop *fast*—noticeably faster than our 486 or any of our Quadras. It's almost scary.

We're glad we did our research, even if it was rather arduous at times. But our adventure in left-brain shopping got us an incredibly fast, reasonably affordable PC that was pretty easy to set up. Now we can get down to what we bought the computer for in the first place: doing some right-brain design work in Photoshop. ◗

*Tamis Nordling is the technical editor of* Adobe Magazine.



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