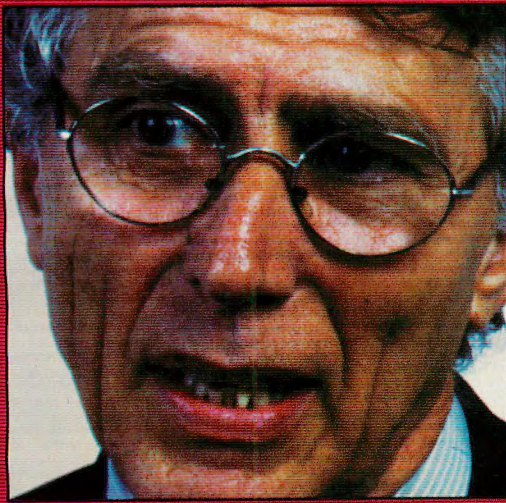# PARADISE LOST...

WhatWent Wrong?

Henrietta Emerson

Age: 64

Retired

DECEASED

Former charity worker and treasurer of the Wives of Foreign War Veterans. Killed tragically during anti-videogame violence protest rally.
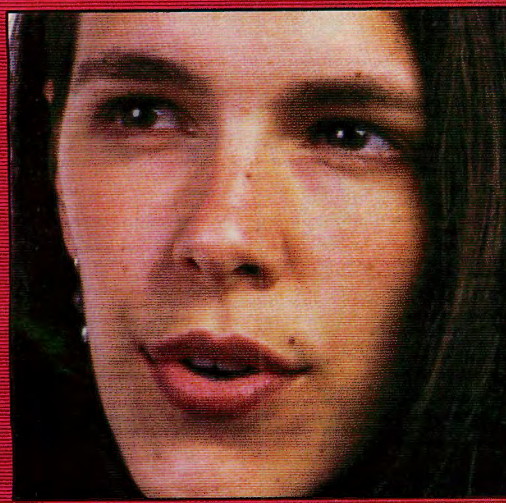
Ronald Wanker

DECEASED

Age: 52

Mental Health Technician

Employed at Paradise Psychiatric Center for 27 years. Fatally wounded by multiple bullet wounds.

Jennie Peters

DECEASED

Age: 17

Paradise High Senior

Majorette in local youth marching band. Death caused by 3rd degree burns inflicted by exploding napalm.

PARADISE LOST...

What Went Wrong?

"Antisocial, psychotic, and completely irresistible."
PC Games

"It's bloodier than Monolith's BLOOD, and more explosive than id's QUAKE!"
PC Multimedia & Entertainment Magazine

"One of the most powerful game editors we've ever seen in an action game."
Computer Gaming World

"Sure, senseless violence is fun. But it's even more fun when it's directed at marching bands."
Computer & Net Player Magazine

KPAR
• NEWS •

PARADISE,

Cut a Music CD in Your Own Mac Studio

By Steven Anzovin

The music business must be the last industry where you and a few friends can get together in a basement and create something that will bring happiness to the world—and make you all gazillionaires, to boot. Nowadays, however, the technical bar for music demos is a lot higher than it used to be. Squirrely sound recorded on a scratchy four-track just doesn't cut it with today's industry scouts (grunge being a passé, early-'90s kind of thing). Luckily, you've got the foundation for a first-class audio-CD recording studio right in your Mac.

In this article, we'll show you how to set up a basic Mac recording studio from sound equipment you can find in your local shopping mall. We'll explain how to get world-rocking sound into your Mac, then whip your tracks into shape for mastering onto an audio CD that will knock that A&R man's Air Madas off.

MIDI Primer

MIDI (Musical Instrument Digital Interface) is a communications protocol that allows electronic musical instruments to interact with each other and with computers. MIDI does not carry audio sounds or waveforms, just the instructions for making them. If you press a key on a MIDI keyboard, what comes out via the MIDI port is not the sound of a note but digital data about its signature, tempo, volume, and so on. This compact information can be passed quickly from device to device and read easily by a computer.

MIDI supports up to 16 tracks of note data. Each track can have its own instrument—piano, violin, fuzz bass, etc. However, unlike a digitized audio file such as an AIFF, which always sounds the same, MIDI data will sound somewhat different played on each MIDI instrument, because the sound you hear is dependent on that instrument's individual sound-producing qualities.

To hook a MIDI instrument to your Mac, you need a MIDI interface, which is a small device that connects to the five-pin MIDI ports on the MIDI instrument and the serial port on the Mac. You also need a sequencer, software that enables you to record, edit, and play back MIDI tracks one instrument at a time. (Steinberg's Cubase VST is a sequencer and also works as sound recording and editing software.) Sequences generally are saved as standard MIDI files, which can be played back on any MIDI instrument or sequencer.

How do you play MIDI files on your Mac? Cubase and most other full-featured music editing programs can do it. You can also use Apple's MoviePlayer utility (version 2.1 or later) to convert a standard MIDI file into a QuickTime music movie. In fact, double-clicking on a MIDI file will generally open MoviePlayer and automatically perform the conversion.
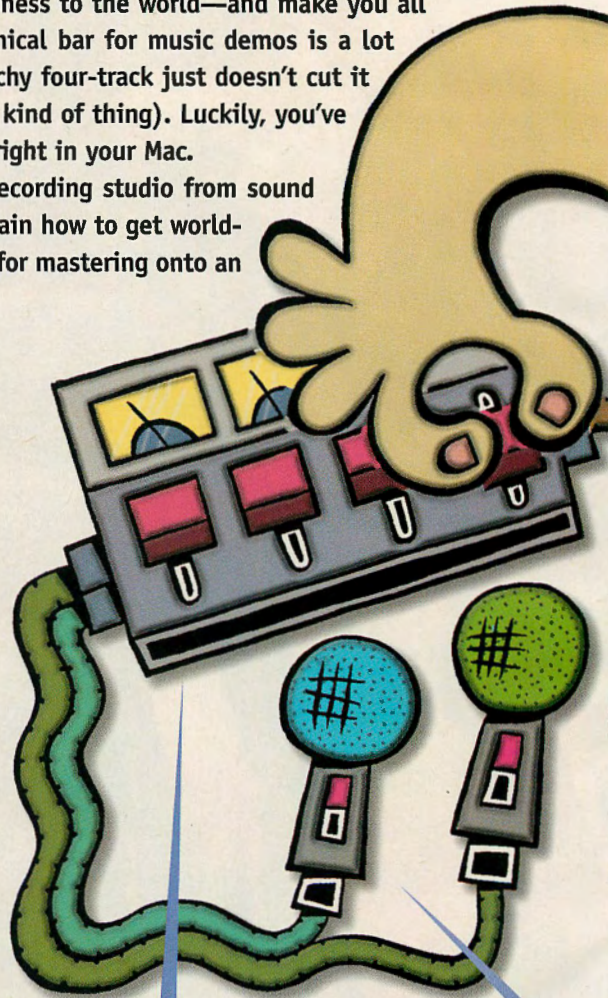
A microphone mixer to combine and set the sound levels of input from microphones and other sources. Yep, Radio Shack sells those: the cheapest is the 4-Channel Stereo Microphone Mixer (about $50, Cat. No. 32-1106).
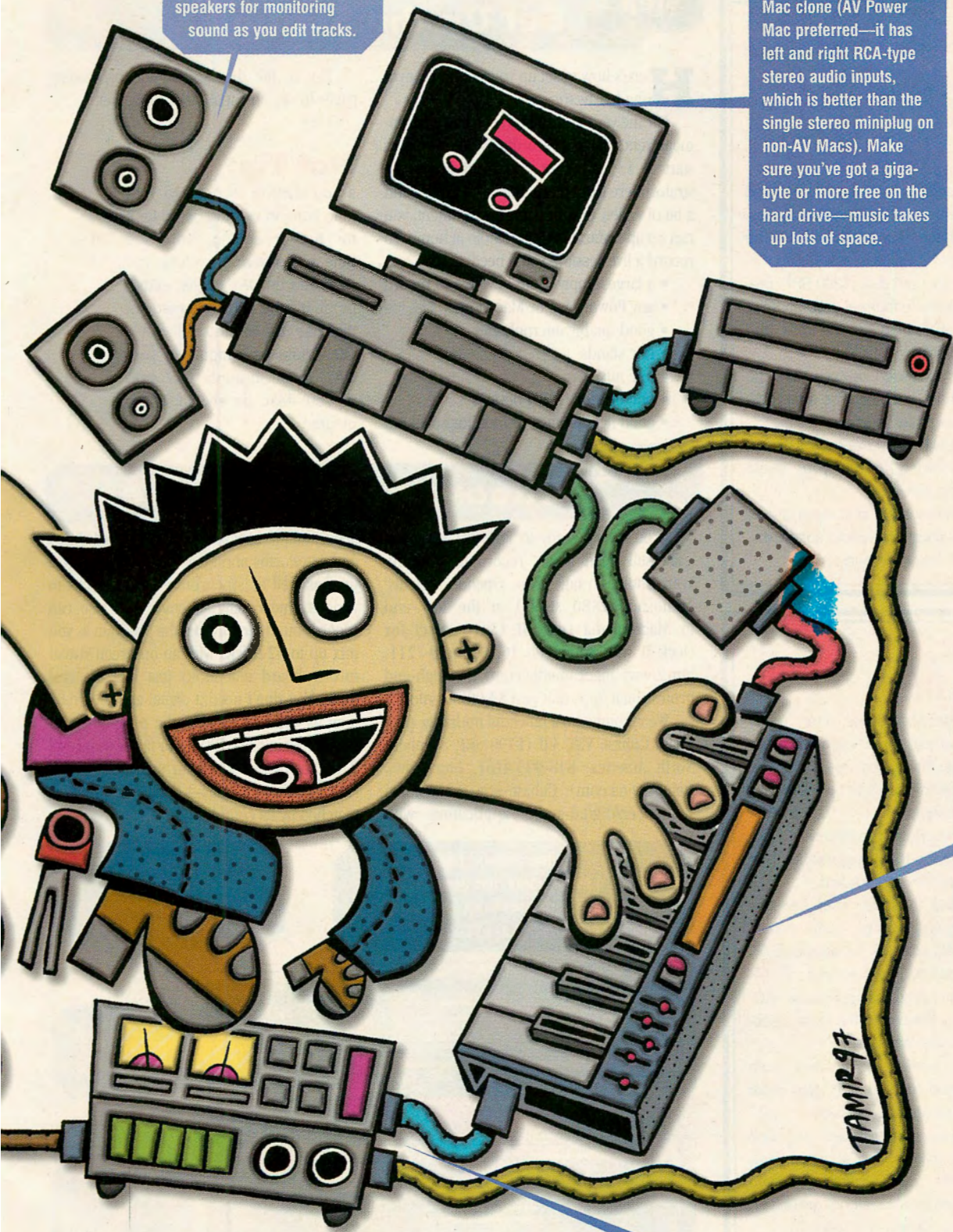
Good headphones or speakers for monitoring sound as you edit tracks.

Any Power Mac or Mac clone (AV Power Mac preferred—it has left and right RCA-type stereo audio inputs, which is better than the single stereo miniplug on non-AV Macs). Make sure you've got a giga-byte or more free on the hard drive—music takes up lots of space.

A MIDI music device, such as a keyboard or drum machine, jacked to your Mac's serial port via a MIDI interface box. (See "MIDI Primer," p44.) A good basic MIDI interface is the MIDI Translator Pro ($80 street, Opcode Systems, 415-856-3333, http://www.opcode.com).

TAMIR 97

Mics for recording vocals and acoustic instruments. Shure, Sony, and others make good basic models for around $50 or $60. The Radio Shack Highball Dynamic Microphone ($50, Cat. No. 33-984D), made by Shure, is widely available. Forget Apple's *PlainTalk* mic; it doesn't have the dynamic range to record music with decent fidelity. And don't plug a standard mic into your Mac; only Apple's mics work. Stands for each mic are necessary because if you hold a mic, you'll introduce noise by inadvertenetly moving. It's nearly impossible to hold a mic at exactly the same distance from your mouth during a whole session. Stands run about $25 each (try Radio Shack Cat. No. 33-320A).

An amplifier to power up the signal from the mixer for input into your Mac's mic jack (or audio inputs on an AV Mac). The Mac's mic jack accepts mic-level, amplified input; a mic or mixer doesn't generate a powerful enough signal to be recorded with Mac software. The receiver from a stereo system will work if it has a full complement of inputs and outputs.

Six Tips for Direct-to-Mac Audio Recording

Audio recording works best if your Mac is not distracted by other activities. Follow these suggestions for the best results:

—Use an AV hard disk (7200 RPM preferred) with no thermal calibration.

—Clean everything off the disk and defragment it.

—Detach unneeded devices from the SCSI chain, and keep the total SCSI cable length as short as possible.

—Turn off all System extensions except those needed to run your audio recording software.

—Turn off file sharing, and close all programs except your audio software.

—Turn off Virtual Memory.

Beating the Buzz

Homemade recordings often suffer from unwanted hums. Here are a few tips to keep the buzz at bay:

—Keep volume levels at no more than three quarters.

—Eliminate possible sources of feedback: Disconnect earphones and speakers during recording.

—If possible, run the mixer and any other analog units on battery power, not an AC adapter—unbalanced AC power can add a nasty hum.

—Turn off any unnecessary AC-powered devices in the area, especially fluorescent lights.

—Use the beefiest gold-plated audio cables you can find, and keep cable lengths as short as possible.

—Ground any analog equipment, such as the mixer, with a grounding connector (run a bare wire from the mixer to the phono grounding connector on the amplifier).

—Use an equalizer, analog or digital, to cut out any stubborn hum frequencies. Cubase has a built-in equalizer.

Step 1
Set Up the Studio

Here's how to set up your audio recording hardware.

For the very best audio recording environment, rent time in a recording studio—prices start at $35 an hour and head up to the stratosphere from there. But if you don't mind a bit of variety in your sonic environment, you can set up a Mac recording studio at home. To record a live session, you'll need:

- a large, empty room in which to record
- any Power Mac or Mac clone
- good-quality microphones
- mic stands
- mic mixer
- one or more MIDI devices
- good headphones or monitor speakers

Flip to the diagram on the preceeding pages to see how it all hooks together.

Hot Tip:

If you want to record into your Mac from an existing demo tape for further editing, your job gets a lot easier. Hopefully, you recorded on DAT (digital audio-tape). It's the only tape medium that has the sound quality of a CD. Route the outputs of your DAT deck through the amp to your Mac as shown in the diagram.

Step 2
Choose Your Software

You're not ready to jam just yet—you still need music recording software. Your choices range from Opcode Systems' Audioshop ($80 street) at the low end to Macromedia Deck II ($419 street for Deck II with SoundEdit 16, 800-470-7211, http://www.macromedia.com) to high-end professional apps that cost $3,000 or more.

We recommend a powerful midrange program, Cubase VST 3.0 ($799 SRP, Steinberg North America, 818-993-4161, http://www.steinberg-na.com). Cubase is a professional sequencer/digital-audio application with
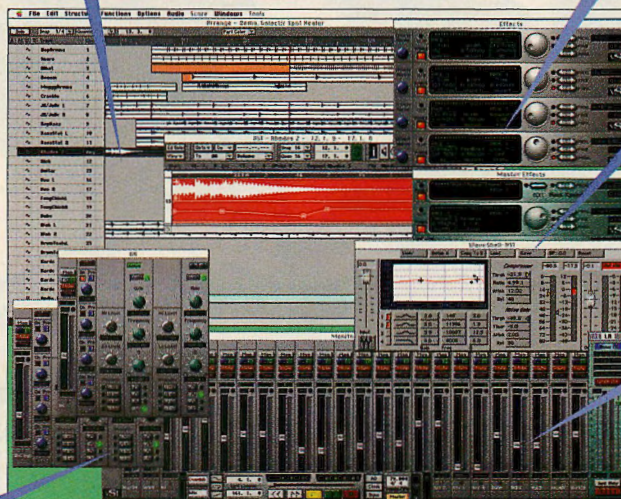
some unique capabilities. You can edit MIDI and waveforms and hear the changes in real time as well as synchronize music tracks to various time coding schemes. You also can record sound directly into the program as you mix up to 32 tracks with an onscreen virtual mixing board that looks just like the real thing. You don't need a digital-audio card as long as you are running the program on a Power Macintosh 6100/66 or faster with Level 2 cache. Expect to spend some late nights studying the manuals—Cubase's power is matched by its complexity.

The Arrange window contains Cubase's sequencer. A list of tracks runs down the left, while individual parts are shown as waveforms that can be rearranged at will.

Apply special audio effects, such as stereo pan, echo, and chorus, through the Effects panels.

Edit waveforms directly with Waveshell.

See the sound level of every track in the Monitors window.

If you're a virtual knob twiddler, Cubase's equalizer (EQ) will leave you ecstatic. Each track has its own EQ.

CUBASE'S INTERFACE RETAINS THE LOOK AND FEEL of pro audio equipment. Sound wizards will feel right at home, though others may be confused by the profusion of virtual meters, knobs, and sliders.

Record to Your Hard Disk

Time to cut some tracks. Get your audio up and running, then:

1. Open the Sound control panel (or the Monitors & Sound control panel, depending on which System version you use), and select the sound input you want to use. In most cases, this will be the microphone. Set the input level to three quarters, maximum. Also turn the Alert Sound volume to mute—you don't want to hear that during recording. These options are available also in the Monitors & Sound control panel under the Sound section.

2. In Cubase, open an existing song or set up a new song.

**3.** Create a new audio track, or choose an existing track from the pop-up list in the Track List.

4. Set the Record Status button in the Track Inspector to Enable. If you want to play the incoming audio through your Mac's speakers or headphones, also make sure that Monitoring is enabled in the Track Inspector and that the Global Disable Monitor option in the Audio menu is not checked.

5. Open the Monitors window by selecting Monitors in the Audio menu. If you've got some sound going in the studio, you should see action in the VU meter. If the clipping indicator is blinking, it means the sound input is louder than your system can comfortably handle without distortion. Adjust the

level of the sound source until the clipping indicator stays off.

6. Click the Record button in the Transport panel, or press the asterisk key. When you're done, press Stop.

You've laid down your first live audio track. You can record as many more tracks and segments as your storage space will allow, use Cubase's equalization and effects to play with them, then arrange them in the Arrange window (the sequencer). Have fun!
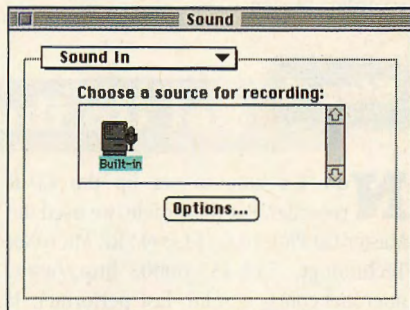
OPEN THE SOUND control panel and make sure sound input is set to Built-in.
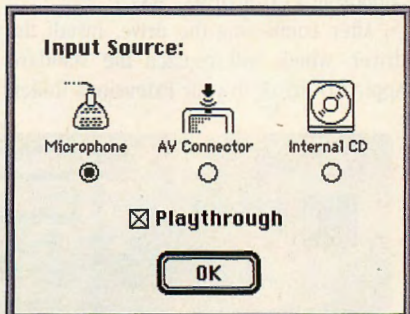
CHOOSE AN INTERNAL sound-input option from the Sound control panel.
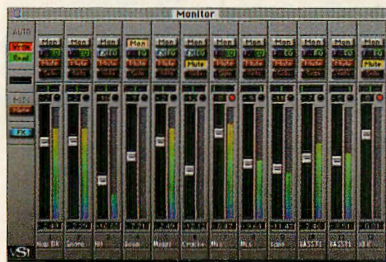
HERE'S WHERE YOU check the levels of audio coming into Cubase.

PLAY YOUR SONG and record new tracks from Cubase's Transport window.

Choosing a CD-R Drive

If you're shopping for a CD-R drive, there are three main factors to consider: drive speed, recording software, and compatibility.

Speed: Specs for CD-R drives cite two speeds: the recording speed and the playback speed. For example, a 2 x 4 drive records at 2X and plays at 4X. Currently, 6 x 6 drives are about the fastest you can buy. Faster drives are better, of course—a 2X drive masters a disc in 38 minutes, whereas a 6X drive takes less than 12 minutes for the same task—but they are also more expensive. Good bargains for 2 x 4 drives are available right now (less than $600).

Software: A CD-R drive is only as good as its premastering software. Adaptec's Toast CD-ROM Pro (formerly published by Astarte) is the program of choice for the Mac—it's full-featured, easy to use, and has thorough documentation.

Compatibility: Some drive mechanisms don't support the less common CD formats. Enhanced CD, also called CD Extra or CD Plus, causes particular problems for some drives. Check with the drive manufacturer before you buy, and, after purchase, regularly check for updated drivers on the manufacturer's bulletin board service or Web site.

What's a CD-R?

Compact Disc-Recordable (CD-R) is the standard format for direct desktop recording of CDs and CD-ROMs. Most CD-R drives can create discs in all the most common digital disc delivery formats: CD-ROM, Photo CD, Compact Disc-Interactive (CD-I), Video CD, and Audio CD.

The secret of CD-R recordability is in the CD-R disc's characteristic gold coating, actually a multilayer deposit containing a recording layer of light-sensitive dye

covered by a reflective gold layer and a scratch-resistant protective top layer. A high-powered writing laser in the CD-R deck creates microscopic "marks" in the recording layer of the blank disc that mimic the pits in a pressed (silver) CD. The writing process is usually called "burning a CD," and that's not just slang; you can feel the residual heat from the laser action if you touch a recently burned disc. But handle them with care: CD-Rs are more fragile than ordinary CDs.

CD-R blanks are inexpensive (around

$8), contain the same quantity of data as CD-ROMs (about 650MB), and can be played in any standard CD-ROM drive or player. That makes them an ideal data storage medium, except for one big limitation: The data you write is permanent.

If you know you won't fill up a disc in one recording session, you can format a *multisession* disc that can be written to over several sessions. You could, for example, write a 200MB session one day, then pop the disc back in the next day and write the remaining 450MB in a second session.

CD Format Coloring Book

You think Rhapsody with its Blue Box and Yellow Box is colorful? It's hue-deprived compared with the CD universe. Here's a chromatic guide to current CD formats, according to the cover colors of their published specifications.

Red Book: The original specification for audio CDs and the equipment needed to play them. Audio CDs can contain up to 74 minutes of 16-bit, 44.1kHz digital stereo audio. In other words, each audio sample occupies four bytes (two bytes or 16 bits per channel), and there are 44,100 samples per second of audio. Audio CDs are playable on nearly all compact disc equipment.

Blue Book: Specification for the Enhanced CD/CD Extra/CD Plus format, a multisession CD with audio tracks in its first session and a data track in its second session. Only the audio tracks are visible to an audio CD player; a CD-ROM player can also access the data session for MPEG video, still images, etc.

Yellow Book: Specification for the CD-ROM (CD Read-Only Memory) format. CD-ROMs contain data sectors formatted for one or more operating systems. You can format a CD-ROM for the Mac's HFS (Hierarchical File System); as an ISO 9660 disc, which can be read by Mac, Windows, and Unix machines but lacks support for Mac niceties like long file names; as a Mac/ISO hybrid disc, which can be played on various platforms but preserves the Mac interface when played on a Mac; and as a CD-ROM XA, which contains audio tracks in the first session and CD-ROM data in the second.

White Book: Specification for the Video CD format, which contains MPEG-compressed full-motion video for playback on special MPEG decoding systems such as CD-I players and some CD-ROM drives.

Green Book: Specification for the Compact Disc-Interactive (CD-I) format developed by Philips and playable on CD-Interactive equipment and some makes of CD-ROM drives.

Orange Book: Specification for Compact Disc-Recordable (CD-R), writeable compact discs that can be mastered in desktop CD-R drives.

Step 4 — Create a Sound File

Once your track is edited, you'll need to save it to a file that can be burned on a CD. That's no problem for Cubase audio files, which are automatically saved as AIFF files, the industry-standard, high-quality audio format. If you've been mixing MIDI tracks, you've got to get the MIDI into audio (AIFF) form. To do this, play the MIDI tracks through your MIDI instrument, output them as audio via the instrument's audio out, and bring them back into Cubase in an audio recording session.

Here's a brief outline of how to get a Cubase song ready for premastering:
1. Mix down all the audio tracks to two channels, for stereo left and right.
2. Select Pool from the Audio menu to see the Audio Pool window, a spreadsheet of all the audio files in your song.
3. Choose the Prepare Master option in the Audio Pool's pop-up File menu. This takes all the audio files used in your song and extracts only the parts the song actually uses. The result is a slimmer, trimmer song that takes up no more disc room than it needs.

Step 5 — Set Up the CD-R Drive

Now it's time to set up the CD-R recorder. For this article, we used the Master CD Plus 4 x 6 ($1,099 SRP, MicroNet Technology, 714-453-6000, http://www.micronet.com), a solid, fast performer. It functions as both a recordable unit and a standard CD-ROM/audio CD player. (See "Choosing a CD-R Drive," p47.)

After connecting the drive, install the driver, which will replace the standard Apple CD driver in your Extensions folder.

Keep a backup of the Apple driver in case you need it. The new CD-R driver will also manage your internal CD-ROM drive.

You'll also need to install CD premastering software. The Master CD Plus comes with Toast CD-ROM Pro 3.0 from Adaptec (408-945-8600, http://www.adaptec.com), the most popular mastering software available for the Mac. Toast is up to version 3.5 ($99 SRP), and it includes some new features worth checking out.
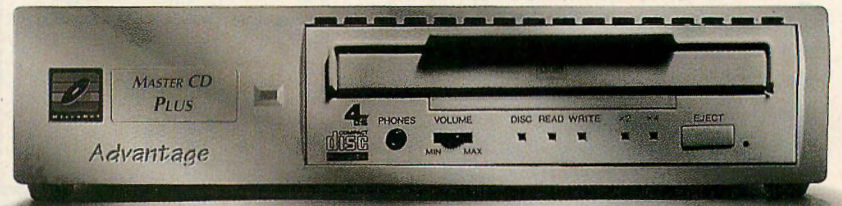

MICRONET'S MASTER CD PLUS is a solidly built 4X CD-R drive.

Step 6 — Premastering

Once you've got your music into stereo AIFF files, and the CD-R recorder is up and running, the next step is premastering—creating an exact replica of an audio CD file on your hard disk for eventual transfer to a CD. With Toast, this is a simple drag-and-drop operation:

1. Choose Audio CD from Toast's Format menu.
2. Drag your song from the Finder into the window. If you have more than one song, make sure they are in the exact order you want them on the CD. You can drag them around in the window as necessary.
3. Click the Check Speed… button. Toast will run a preliminary check to see if your system is fast enough to write the disc. If you
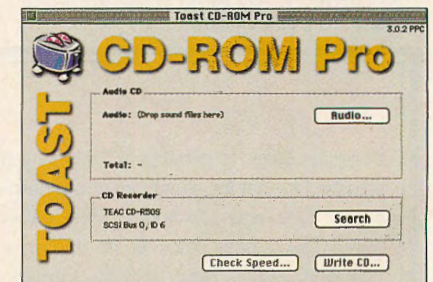
THE TOAST MAIN WINDOW. The interface couldn't be much simpler.

can't write it at 4X, Toast will step you back to 2X. The result will be the same; it will just take longer.
**4.** Conduct a complete premastering test by

writing in simulation mode first. Choose the Simulation Mode option in the Write CD dialog that appears when you choose Write CD in the Toast main window. The simulation process will do everything exactly as the real mastering process does, except turn on the laser. If you've made any mistakes, they'll show up before you've sacrificed a blank CD.

Keep in mind:
• Audio tracks must always be the first session on a CD; otherwise, audio CD players can't recognize them. If the first session is more than 625MB or 99 tracks, you won't be able to record a second session. (See "What's a CD-R?" p47 for more on sessions.)

• Make sure you've got roughly 10MB free on your hard disk for every minute of CD audio you want to premaster.

• Upping Toast's RAM cache will help to smooth out erratic data transfer rates. Choose Preferences from the Edit menu and set it to two times the drive's writing speed (the Generous setting). If you're using a 2X drive, the RAM cache will be set to 4MB.
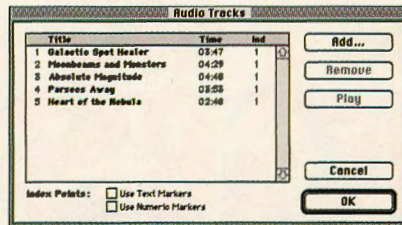
DRAG AND DROP TRACKS from the Finder into this window, then arrange them to suit.
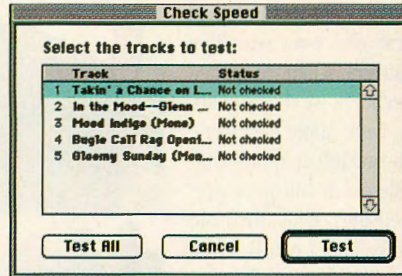
DO A SPEED CHECK before writing a CD to make sure your drive can feed data to the CD-R recorder fast enough.

Step 7 Mastering

The final step is to master the audio onto a blank CD:
1. Load a blank disc into the CD-R drive.
2. Click Write CD in Toast's main window.
3. Choose Write Session (if you want to put additional sessions on the disc later) or Write CD (if this is the only session).
4. You're off and writing. The write could take half an hour or more.

Pop out the hot disc—your first gold record. It may not be your ticket to stardom, but at least it's evidence that you've paid your Mac audio recording dues. ◼

As a boy, Steven Anzovin hung around in seedy nightclubs, spinning on the bar stools and whistling "Satin Doll."
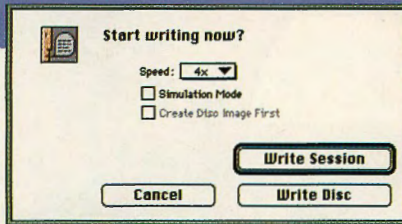

TIME TO WRITE TO THE DISC. This may take half an hour or more, depending on the number and length of your tracks.
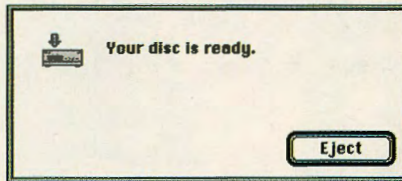
YOUR DISC is Toasted!

Toast CD-DA 2.0

Toast CD-ROM Pro is fine for basic audio CD premastering, but Adaptec has a mastering program geared specifically to the needs of pro audio. Toast CD-DA 2.0 ($149.95 SRP) adds features that give your disc professional polish, such as nondestructive cross-fades and level adjustments between tracks, and nonsilence gaps. (You can fill the standard two-second silence between tracks with applause, rude noises, etc.) Trimming functions make it easier to remove unwanted noise or silence at the beginning and end of a track. Toast CD-DA 2.0 supports WAV files and Split Stereo files as well as AIFF and Sound Designer II files (Digidesign's Sound Designer II is a high-end music recording and editing program). The program also batch-writes multiple CDs to autoloaders and transporters for high-volume mastering.
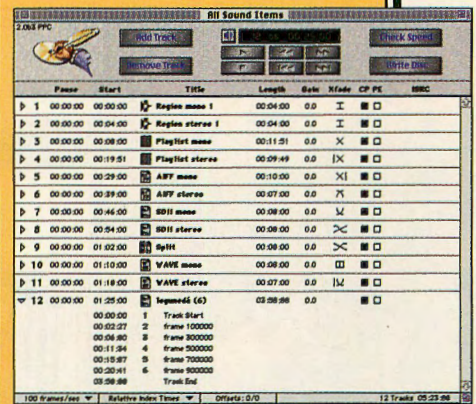

TOAST CD-DA 2.0 LETS YOU add sound in those wasted gaps between CD tracks.

Personal Hit Parade

Wish you could hear only your favorite cuts from your favorite artists without having to pop discs in and out and keep your finger on the Skip button? Sure, you could master your own custom greatest hits collections (subject to copyright restrictions, folks!) by capturing each track to your hard disk, then writing the files to a CD with your CD-R setup. But that's a time-sucking hassle that's probably more trouble than it's worth.

Although the product has been discontinued, Microtest (800-638-3497, http://www.microtest.com) came up with a better system that should appeal to any audiophile or DJ wannabe. Audiotracer automates the process of assembling tracks from various CDs onto one disc. Not only can you create custom drag-and-drop play lists, but Audiotracer supplies track tables of contents for 700 popular albums. Best of all, you can write directly from your Mac's internal CD-ROM player to a CD-R—no need to capture the tracks to a hard disk first.
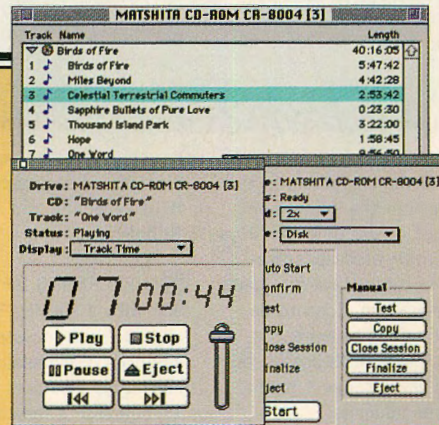
LOOK, MA, no premastering! Make your own greatest hits collections with Audiotracer.

Geekitectural Digest

By Kathy Tafel
Photos by Ken Bousquet

We're curious about anything concerning our beloved Macs. We've gone over them inside and out. Suddenly, it occurred to us, "Who makes these things?" Never ones to pass up an opportunity to procrastinate, we hopped in a car and went searching through Silicon Valley, seeking Apple software engineers. When we spotted three cars in one driveway sporting Apple decals, we knew we'd hit paydirt.

At one point, all except Bob, the lone PC guy, were Apple engineers. Since the restructuring in March, Mike is the only one left at Apple. They were too tight-lipped to tell us anything about Rhapsody but were perfectly willing to tell us their story and show us their digs. When their old house in the Santa Cruz hills decided to take a dive into a nearby river, they knew it was time to look for a new home. There were only two requirements: It had to be close to their jobs at Apple's Cupertino, California, headquarters, and it had to hold all their gear.

They found this home in the Belmont hills, took one look at the view, and knew they'd found the right place. They called the landlady on a cell phone, and the deal was done. We were lucky enough to get a tour of this high-tech heaven.

AS MIKE PUT IT: We wake up in the morning, look out the windows across the bay to San Francisco and the Bay Bridge, and say, "Gee, another gorgeous day in paradise. What a shock." (The MonkeyBoys, from left: Mike Kobb, Rick Mann, Christopher Cotton, and Bob Grosso.)

THE DEN
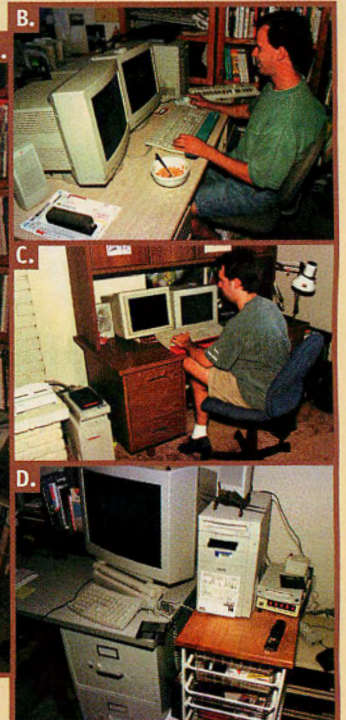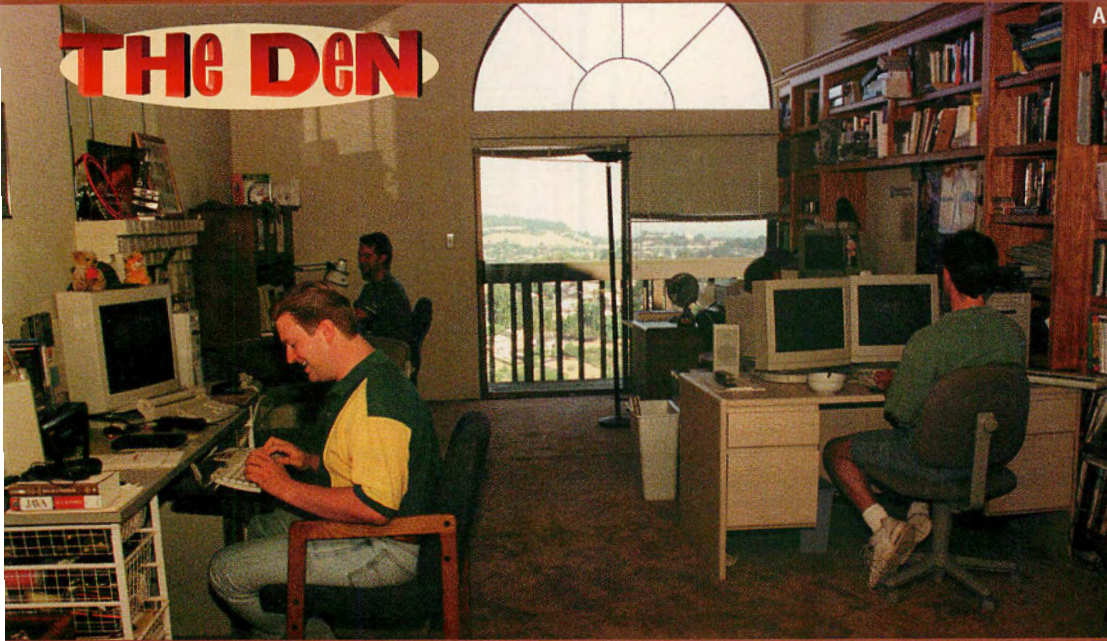
A. ONE HUNDRED FEET OF ETHERNET cable connect the computers in the den with those in the living room. Although most of the time the 'Boys have CodeWarrior fired up, sometimes you can catch them in a game of network Marathon. Soon to be added to the mix is an Ascend router to facilitate ISDN access, but for now they must connect to the Net with mere modems.

B. RICK'S POWERMAC 8500/180 is the most powerful desktop machine in the house. Plugged into it are two 17-inch monitors, AppleDesign Powered Speakers, Apple VideoPhone camera, CyberSound MIDI keyboard, and a Kensington TurboMouse.

C. CHRIS BEEFED UP HIS QUADRA 800 with a 100MHz PowerPC 601 upgrade card and uses two 13-inch monitors. Peripherally, Chris hooked up an Apple LaserWriter 16/600 with a fax card (named MonkeyFacts) and a Color PageWiz Scanner.

D. MIKE HAS A POWERMAC 8100/80AV with an Apple 20-inch multiscan monitor and an Apple 13-inch RGB monitor. A VCR is connected to the AV input on the 8100 so that he can watch TV while working on the 20-inch screen. AppleDesign Powered Speakers and a ThrustMaster joystick and Weapons Control System round out his accessories. Mike has a private pilot's license and flies a T-6 World War II advanced trainer; he's still searching for the perfect flight sim.

E. EVEN THE CATS HAVE HIGH-TECH TOYS. Here, Taylor chases a laser light pen beam up the wall.

LIVING ROOM

A. MIKE TRIES TO EXPLAIN why they need eight "universal" remotes. Additionally, Mike has programmed a Java applet on the 540c, which controls the infrared box connected to the serial port. We can understand why they go through a brick of AA batteries every two months.

B. THIS IS WHY THEY "NEED" THE REMOTES. The home theater comprises Mike's five-speaker surround-sound system, rear-projection television, five-disc CD changer, preamp/video switcher/Dolby Pro-Logic surround processor, tape deck, five-channel home theater amplifier, 2,700-watt Subwoofer, VCR, LaserDisc player, Nintendo 64, Sony PlayStation (co-owned with Chris), and video switcher. Mike also has X-10 dimmer control of the lights via radio frequency remote and autonomous computer-programmed interface. Rick contributed a Sony DVD player and Sony AC-3 Processor, while Chris added the complete Red Dwarf series.
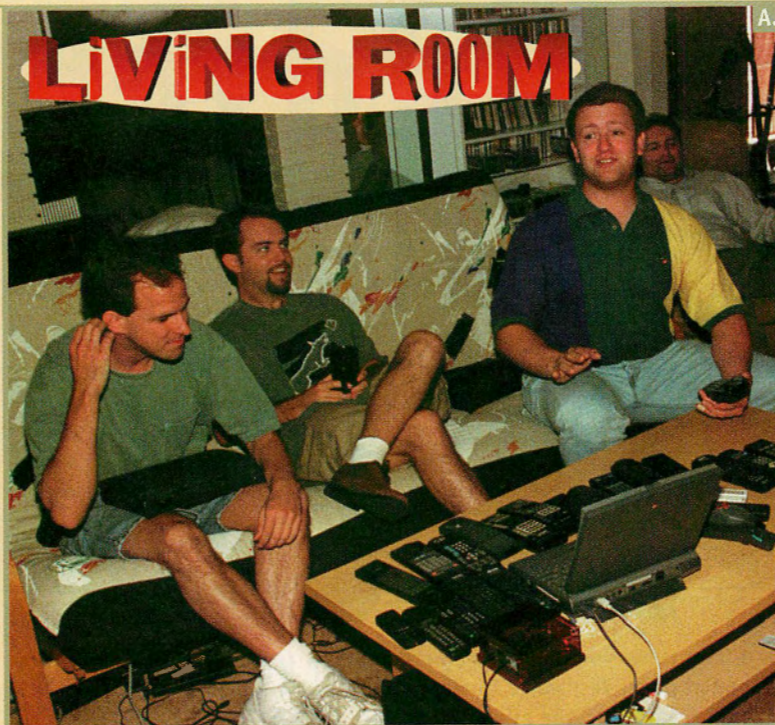
C. STARTING AT THE UPPER RIGHT and continuing clockwise is Mike's 540c, Rick's 3400, Bob's 133MHz Compaq, Mike's 3400, and Chris' Duo 280c. Rick and Mike have Ricochet modems for connectivity. Only the 540c has a permanent home on the coffee table, as, according to Mike, it's "the best-looking PowerBook Apple ever made."

D. EVERY KITCHEN NEEDS an X-10 controller.

MUSIC ROOM
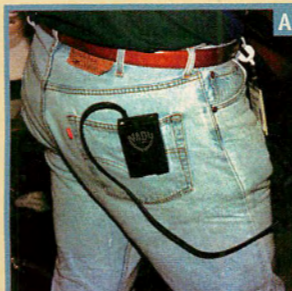
A. MIKE WOULD NEVER HAVE SOMETHING SO PLEBEIAN as a cable connecting his bass to the amp. This is a Nady wireless transmitter.

B. ONE ROOM IN THE HOUSE is devoted to storing all the boxes.

C. THIS HOUSE LOVES KITS. This space shuttle has a four-bar linkage.

D. ALL THE TALENTED MONKEYBOYS play an instrument. Mike owns a Michael Tobias Designs model 535 five-string fretted bass, Zon Legacy Elite I custom four-string fretless bass, Spector NS-2 four-string fretted bass, Steinberger XL-2DBA four-string fretted, Spector NS-2 four-string fretless bass, Spector NS-5 five-string fretted bass, as well as the piano and a Yamaha WX-7 MIDI wind controller (do you sense a trend here?). Bob strums an analog guitar, while Chris beats away at his drum set. He also has a Yamaha RX5 drum machine and a dk10 electronic drum pad. Rick is really playing "Chopsticks," but he uses his CyberSound MIDI keyboard to add sounds to his shareware game, Otiru. (MonkeyBoys is a nickname chosen after watching the movie *The Adventures of Buckaroo Banzai: Across the Eighth Dimension,* in which John Lithgow's alien character shouts, "Laugh while you can, Monkey Boy!") ◥

Kathy Tafel has half as many remotes per person at her house.
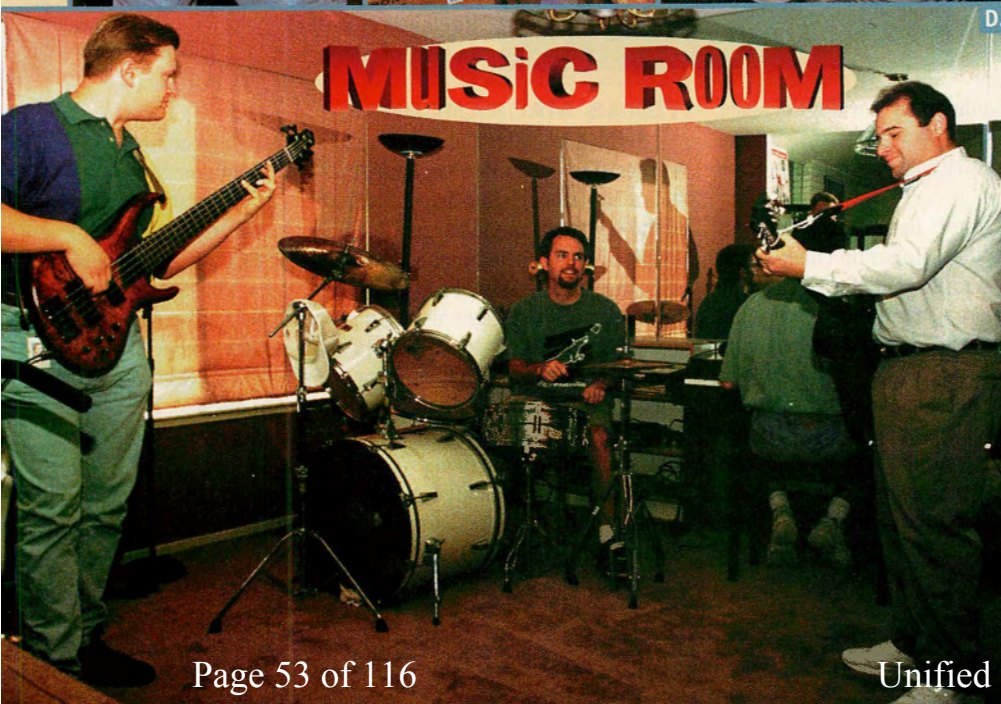
Mac Addict
of the
Year
1996

Mac Addict Of The Year

Mike Kerner

Photo by Aaron Lauer / Illustration by Tom White

I t's like buses: For a long time, you don't see a one, but then three come along at once. Yes, we've finally gotten through the mountain of materials, the pile of pleas, the Golgotha of "Gee, please!" and selected our choice for the Mac Addict of the Year. As testament to the quality and volume (that's amount, not loudness) of submissions, we've also chosen two Honorable Mentions for this august prize. When it all came down to it, our Mac Addicts are those who have done some truly useful things, and done good not just for the Mac but for the world at large.

AND THE WINNER IS...

Our 1996 Mac Addict of the Year is Mike Kerner. Mike began his Mac career at Ohio's Hiram College when a crowded computer lab forced him onto a Mac Plus. After whipping up a snazzy report with MacWrite, MacPaint, and a LaserWriter, he was hooked. In Mac love, he learned to hook up Macs, eventually building a Mac lab of a few dozen computers and LaserWriters. He even convinced the biology department to purchase a Mac II. He later hosted a series of seminars on HyperCard and the inner workings of Macs, and this in turn propelled him to a position as a Mac systems administrator. Not long after, he won the first ever comp.sys.mac.hypercard scripting contest. We're impressed.

All along, Mike was convincing others to use Macs, not only at grad school but at major corporations. He set up client-server projects for TRW's Law department, built the Mac-based Decision Support system for another company's marketing group, and continued to make Mac solutions more friendly for users and more compelling for managers.

Finally, he brought the cause home. His family company was using PCs, but soon Mike had the whole shebang running on Macs. He also has strengthened the Mac position in mixed-platform environments by creating a Java-based enterprise system. And not only that, Mike still does Mac consulting on the side and has convinced a whole gaggle of people to subscribe to *MacAddict*. All is now hunky-dory at the Kerner household, and a trail of happy Mac users leads up to it.
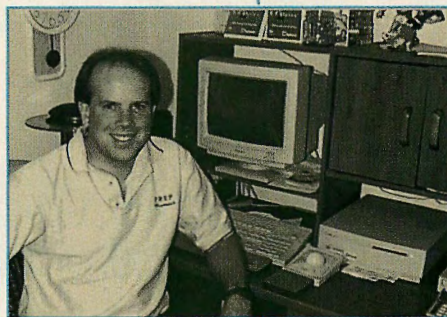
## THE HONORABLE MENTIONS
KEEPING SHARP

For most people, a diagnosis of Alzheimer's disease would be reason to give up. But when Dutch Schubert received the doctor's news, she decided to do something about it. To fight the memory lapses and speech problems, she went out, bought a Mac LC, and began working her way through the instructions. In about six weeks she found she could speak without losing words. A year later she took an introductory Macintosh class at a local community college, then followed that up with more classes. She also became involved with her local users group and was eventually invited to be on its board of directors. Dutch now does all her bookkeeping on her Mac, regularly emails all her friends, and periodically downloads new software and learns its ins and outs, just to keep her brain sharp. We can't say that a Mac will prevent the progression of Alzheimer's, but Dutch's Mac-fatuation seems to keep it at bay, and she's dedicated to spreading the good news by donating her time at local senior centers, teaching residents how to use a computer (a Mac, of course).

TEXAS MACRANGER

Herman Roessler's name came to us through an admiring co-worker. It's not that Herman hasn't ever owned any computer *other* than a Mac (though that helps), it's that he's the voluntary godfather to the 600 Macs in the Lorena, Texas, school district. And it's not simply because he has nothing else to do—Herman is the principal of Lorena Middle School and is responsible for 350 students. Still, Herman is fast to the rescue when problems pop up with any Mac in the district. His co-worker swears that sometimes Herman's voice alone is enough to calm the wayward Mac. We can't testify to that, but we can testify to Herman's commitment to the Mac, especially in the face of outside pressure to place in the school computers running some "other" operating system.

We'd like to thank all those who sent in nominations, poems, pictures, fully developed applications(!), bribes (which we can't really accept, you know), and just general good wishes. We wish all you Mac addicts the best, and keep the faith. *—Daniel Drew Turner*

Run Your Mac Faster and Save!
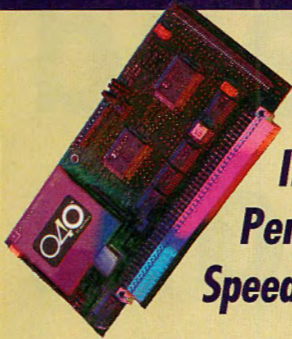
Accelerate Mac LC, LC II, Color Classic, IIci, IIsi, IIvx, or Performa 600 to '040 Speed Starting at $199

Sonnet Presto™ LC 040 50/25 MHz accelerators increase Mac LC, LC II or Color Classic performance 470% as fast as a stock machine (processor performance, MacBench2). Use RAMDoubler or Virtual Memory to break the 10MB barrier with the Presto LC (except Mac LC, OS 7.1+req'd). The Presto LC is only $199, or with hardware Floating Point Unit (FPU) $249.

The 80/40MHz version for the Mac IIsi*, IIci, IIvx, or Performa 600 increases processor performance by 250-500%. The 80/40 MHz Presto at only $299 includes a 128K level 2 cache, or $399 with FPU.

All Prestos are 100% application software compatible and run through System 7.6. The Prestos are easy to install in the Macs' processor direct slot, and come with clear installation instructions. (*Adapter req'd IIsi)

## Allegro's Fast 68030s Give New Life to Mac SE, II, IIx, LC, LC II, Color Classic from $99
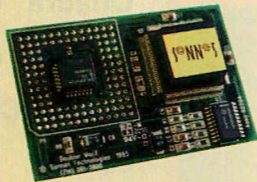
Give your older Mac more muscle. Sonnet Allegros™ are packed with features at bargain prices. The 33MHz Allegro LC for the Mac LC, LC II, Color Classic doubles your cpu speed, adds 16K level 2 cache and includes an FPU–all for only $149. The 33MHz Allegro SE increases performance 460%, includes an FPU and 4 SIMM slots to expand memory up to 16MB for a bargain $199. Allegro Mac II, IIx models double '030 speed to 33MHz for a mere $99.

7300-9600 Upgrade
150MHz 604 $199*
200MHz 604e $699*
233MHz 604e $999*

Give your Power Mac 7300, 7500, 7600, 8500, 8600, 9500, 9600 a PowerPC 604/604e upgrade. These power-packed upgrades are 100% compatible with your existing software and hardware. Just plug one in and enjoy the productivity you deserve. Add a 1MB cache card and double your performance! *with card trade-in.

Wow! IMS Twin Turbo 4MB VRAM...... $249
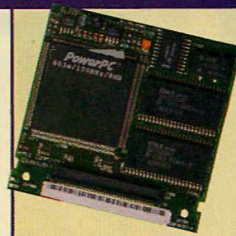
## Upgrade Your PowerBook 520/540 to 100MHz 603e with 8MB Memory for $399*

This is the genuine Apple Computer upgrade designed to bring your trusted PowerBook 520/540 into the PowerPC generation with a speedy 100MHz 603e PowerPC processor. With this upgrade you can run all native PowerPC applications. Upgrade your reliable ethernet-equipped PowerBook to PowerPC, and prepare for the MacOS future. The upgrade includes 8MB of memory and is compatible with your existing RAM expansion board. *Price after a $100 discount for trade-in of existing 68LC040 card.

Run the Fastest Quadra Ever! 100/50 MHz is Faster than 840AV   Only $399

Plug the Sonnet QuadDoubler™ into a Quadra 610, 660AV, 700, 900, or Centris 610*, 660AV, 650 and run virtually twice as fast as before for only $399. No software upgrades or changes are required. Just plug the QuadDoubler into your CPU socket and power up your Mac. A CPU extraction tool is even included to simplify installation. The QuadDoubler includes a Floating Point Unit for superfast rendering or calculations. A cache card is also available for the Quadra 700/900 for even more performance. *The Centris 610 QuadDoubler runs at 80/40 MHz and is value-priced at $299 (without FPU $199).
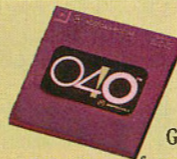
Add Math Coprocessor to 68040 Macs & PowerBooks

Give your Quadra, Centris, or PowerBook 520/540 a math coprocessor for rendering, Photoshop, CAD, or other Math intensive applications. 25MHz 68040 $125*, 33MHz 68040 with heat sink $169*. Add a full 66/33MHz 68040 with FPU to your PowerBook 520 or 540 for $199*. This upgrade also speeds 520 to 66/33MHz 540 performance. Call for PB190, Duo280 or 68882 FPU. *68LC040 trade-in required.

Cache Speeds!

PowerMac with 1MB cache runs twice as fast as cache-less (200MHz 604e, MacBench 4). We build 'em. Resellers call for volume pricing.

No Cache	100%
256k	138%
512k	169%
1MB	195%
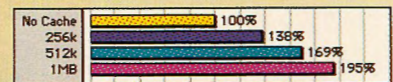
256K	6100/7100/7200/7500	$49
512K	7200/7300/7500/7600/8500/8600	$89
1M	7200/7300/7500/7600/8500/8600	$159
256K	5200/6360/5400/5500/6400/6500	$79
512K	5200/6360/5400/5500/6400/6500	$149
1M	5200/6360/5400/5500/6400/6500	$199

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VISA and MasterCard no surcharge. We used to have a surcharge; we don't anymore. Government, corporate and education P.O.s welcome. Tammy works diligently to process every in-stock order within 24 hours. You can wish her the best for her upcoming July wedding if you need to check on order status. One year limited warranty on all products. If you step on it and break it we limit the warranty, otherwise we don't limit it too much. All returns require an authorization and are subject to a restocking fee. ©1997 Sonnet Technologies, Inc. Sonnet, the Sonnet Logo, Allegro, Presto and QuadDoubler are trademarks of Sonnet Technologies.

This Old Mac:
The Centris and Quadra

By T. Kelley Boylan

The Centris series was Apple's top-of-the-line business models, ready for Ethernet and high-speed computing. Apple later renamed the series Quadra in an effort to simplify. The Quadras lasted longer and were essentially the same box as the Centris machines, only faster. There were nearly a dozen models:

Quadra 605, Quadra/Centris 610, Quadra 610 DOS, Quadra 630, Quadra/Centris 650, Quadra/Centris 660 AV, Quadra 700, Quadra 800, Quadra 840 AV, Quadra 900, and Quadra 950.

This article focuses on the mainstream 610 and 650 models, of which there were both a Centris and a Quadra. What's the difference? Remarkably little.

Photos courtesy of Apple Computer Inc.

What You Have to Work With

The Centris 610 does at 20MHz what the Quadra 610 does at 25MHz. Other than processor speed, they're identical—with one important difference. The Centris 610 uses a 68LC040 microprocessor (which means it doesn't have an integrated FPU), whereas the Quadra 610 uses a full-blown 68040, which makes the Quadra 610 a good deal faster with math than the Centris 610. It's a similar situation with the Centris 650 and Quadra 650—the Centris 650 has either a 25MHz 68040 or 68LC040 (although most are of the 68040 variety), and the Quadra 650 has a 33MHz 68040. Everything else is essentially the same.

There are physical differences between the 610 and 650. The 610 has a pizza-box case: that is, small and flat. It has room for only one add-on card (either NuBus or PDS), which usually requires an adapter. It has no room for an extra hard drive or CD-ROM drive. The 650 has a larger case with room for four cards—three NuBus and one PDS—and another half-height drive.

When upgrading a 610, don't spend more than $100. It's just too slow. The same cost limit probably applies to the 650, but for that

amount, you can have a darn serviceable machine. A used Centris 650 doesn't cost much. With 12MB of RAM and a 230MB hard drive, expect to pay around $400. Add RAM and an accelerator, and you have a machine that can't be beat for email, Web surfing, text handling, and general use.

RAM The 610 has two slots—room for up to 68MB of RAM. The 650 has four slots—room for up to 136MB of RAM, depending on the model. There are two 650 models: One shipped with 8MB of RAM soldered to the motherboard, the other with only 4MB. If you have the 4MB model, you can go only as high as 132MB.

The RAM itself for either Mac needs to be 72-pin SIMMs running at 80 nanoseconds (ns), minimum. Faster RAM is fine—a set of 70ns chips runs just as well—but it costs more. If the price is the same, the chips are the same, as far as the machine is concerned.

After years of SIMMs that had to be installed in pairs or groups of four, Apple engineers performed magic and dropped the requirement. You can add SIMMs in any quantity you like, one at a time or in groups.

The Centris/Quadra 650 (not the Centris/Quadra 610) and later models also can interleave RAM, making it faster and more efficient. That can mean a 10 to 20 percent speed increase (in special circumstances—don't expect to see it scrolling text). Interleaving occurs automatically when two SIMMs of the same size rest in adjoining banks. Simply put, SIMMs are happier working in matched pairs.

If you want to see where RAM resides on the motherboard, check out http://www.megamemory.com/ MacMemory/QuadraSeries/Quadra Series.html for a diagram.

Storage As with most modern Macs, the 610 and 650 are SCSI based. That means the internal drive is SCSI and can be formatted, initialized, and generally tweaked with Apple's standard HD SC Setup. You also can use FWB Software's Hard Disk Toolkit (http://www. fwb.com), La Cie's Silverlining (http://www.lacie.com), Charis-Mac Engineering's Anubis

(http://www.charismac.com), or other SCSI drive utilities.

External drives attach via the SCSI connector on the back. To add a CD-ROM drive to a 610, buy an external drive, set the SCSI ID, and plug it in. You can add an external CD-ROM drive to the 650, but if you don't want extra cords, cables, and boxes on your desk, add an internal drive. Some 650s shipped with them, and any 650 can handle one. There's a bay inside into which anyone can put a CD drive (or a second hard drive).

Call the folks at your favorite storage vendor (see the back pages of *MacAddict* for vendors galore), tell them you have a 650, and be sure that they include a replacement *bezel*—the plastic panel on the front of the machine. You'll be replacing it with one that has a slot for CDs.

How hard is it to install a second storage device? Not hard at all. Just unscrew the single screw on the back of the 650, slide the case off, slip the drive into its cage from the front, and plug in power and SCSI cables. The bezel on the CPU case unsnaps, and the new one snaps in. Voilà! An internal CD-ROM drive.

Do you already own an internal CD-ROM drive and don't want to bother with the bezel? No problem. Just pull the old bezel and install the drive. It won't be as pretty as a properly prepared panel, but it'll work just fine. To order a bezel, contact your local Apple dealer.

Acceleration and CPU Speed The faster, the better, and this is where an old 650 really shines. Believe it or not, an accelerated Centris 650 can run faster than a plain-Jane 6100 or even a slow 7100. Although it's no PowerPC (there were PowerPC upgrades for the 610 and the 650, but they were discontinued), the 650 is faster than you might think for an '040-based Mac. Remember: Until recently, most of the Mac OS wasn't PowerPC native, anyway.

Clock Chipping We covered clock-chip accelerators last month, and they come into play again today. With the 610 and 650, they make a bigger difference. An old '030 running a few megahertz faster doesn't seem much faster; however, an '040, faster from the

start, accelerates more effectively and really shows its stuff.

Macs run hotter at higher speeds, and they may need a fan or heat sink to keep cool. In our experience, it's only necessary if you're experiencing random crashes, even in a Mac with several extra cards installed. They're available from the same companies that make accelerators.

PowerPC Upgrades If a faster '040 doesn't cut it, you can always move to a full PowerPC. DayStar Digital used to make the PowerPro 601. It was discontinued, but the used market still has some. If you have a 610, you'll also need the PowerPro 610 Adapter. It came in 66MHz, 80MHz, and 100MHz models. Go for the 100MHz if you're going to do it.

DayStar's card turns your Quadra or Centris into something close to an 8100/100, with caveats. It's not approved for System software later than version 7.5.1. Why? It has been discontinued for some time.

Apple (http://www.apple.com) made a PowerPC upgrade, too: the Power Macintosh Upgrade Card. Original, eh? Naturally, this upgrade is long discontinued, but you can find some in the used market. You're literally turning your '040 into a 6100-class Mac.

Given how fast a clock-chipped '040 can be, it's probably not worth the trouble to go all the way to PowerPC unless you need to run PowerPC-only applications. Save up for a faster Power Mac. Keep upgrades to less than three or four hundred dollars, and remember, if you upgrade to PowerPC, you'll have to upgrade your applications, too. Otherwise, the speed jump falls off a cliff.

Video Any Mac of this era or later can use just about any monitor, meaning PC monitors. All you need is the right adapter, and both Sony Electronics and Griffin Technology make them. Visit Sony's and Griffin's Web sites (see "Hardware Sources") for their lineups. Any standard Mac monitor works, too.

Best of all, NuBus video cards are less than $100 and let you do something PC users only dream about—run multiple monitors. Although a new PCI-based PowerPC

old mac

MacADDICT **55**

old mac

Used-hardware Sources

Contact several vendors when you shop, and ask about warranties and return policies, just in case. This list isn't comprehensive, but it's a good place to start.

The Computer Exchange
800-304-4639
http://www.compexch.com

DataTech Remarketing
800-281-3661
http://datatechrmkt.com

GE Capital Computer Remarketing Services
http://www.geremarketing.com
800-431-7717

Hawke Business Systems
800-875-2610

MacResQ
888-44-RESCUE
http://www.macresq.com

Mac Sale International
800-729-7031
http://www.macsaleint.com

Pre-Owned Electronics
800-274-5343

Sun Remarketing
800-821-3221
http://www.sunrem.com

may have lots of speed, it costs more than $50 for a NuBus Toby card to run a second monitor. (Toby NuBus video cards are the original 8-bit video card from Mac II days.) A second video card is the single best upgrade you can make to a fully functioning system. Your best bet for a Toby card is to look for one on the used market.

The aforementioned Toby card only displays in hundreds of colors (8-bit) at 640-x-480-pixel resolution (a 14-inch display), but that's fine for a secondary monitor. Once you have a second screen, you'll soon find you can't live without it.

To display thousands of colors (16-bit), the minimum for graphics without graininess, you'll need at least 1MB of VRAM for a 17-inch monitor. VRAM is available from almost any computer store and is easily installed. For ordering information and a diagram of the slot, see Mega Memory's Web site (see "RAM" section above for URL).

Networking All Quadra and Centris Macs have built-in LocalTalk, and many of them have built-in AAUI-15 Ethernet. You'll need an Ethernet transceiver to get this going on a 10BaseT network. If your Centris doesn't have Ethernet, consider buying an Ethernet card. Farallon Communications makes them, as does Asanté Technologies. Be sure to buy one with an RJ-45 socket (for use with a 10BaseT network); it's easier to handle. If you have a 610, you'll soon run out of space, so consider Asanté's Slotless Ethernet.

Need token ring? Shop for a card and plug it in. System 7.6.1 token ring includes drivers, so you don't even need extra software. See Farallon and Asanté for cards.

Software System 7.6.1 fits fine and works well, and any application that isn't PowerPC-only will run. An '040 accelerated to 40MHz is decent at running even Adobe Photoshop, given enough RAM.

Rendering isn't fast, but it is acceptable. Use Microsoft Office, standard Internet tools, and standard utilities such as Norton Disk Doctor, part of Symantec's Norton Utilities (http://www.norton.com).

Games An open book. The best sites to peruse are http://www.macledge.com and http://www.tikkabik.com/mac_arcade.html. Even though many new games are PowerPC-only, there are hundreds of games that will run just fine—perhaps giving too much fun.

An accelerated Centris or Quadra can easily keep you going for the next several years. It won't fly like a Power Mac, but for text, email, Web surfing, and general computing, it's a bargain. Hold off on a Centris 610 upgrade; take a 650 as far as it'll go. ▧

T. Kelley Boylan has co-authored several books and articles and is a Mac administrator when he's not writing. He owns and uses Macs exclusively.

Speed Changes

Apple played a Wintel numbers speed game with these Macs, making them sound faster than they really are. Ads may claim speeds from 40MHz to 66MHz. Apple doubled the processor's clock speed, but that didn't double the machine's speed. Actually, it doesn't make much difference because all of the I/O (input/output) is still at the standard 20MHz, 25MHz, or 33MHz. If you see an unaccelerated 650 advertised at 66MHz, rest assured it's only going 33MHz.

A 25MHz '040 may not sound fast, but given a non-PowerPC-native Mac OS and a speed bump, it's a peppy little player. If you have a Centris 610, get an FPU. It costs only about $100 and is available from companies such as MicroMac Technology (800-600-6227, http://www.micromac.com) and Sonnet Technologies (see "Contacts").

The Short-lived DOS Card
A lot of people liked it, and many wish they had one, but Apple made only about 25,000 DOS-compatible 610s and discontinued the machine after only two months. Other than the DOS card, the 610 DOS compatible is the same as a standard 610.

Not All CPUs Are Created Alike
You may or may not be able to accelerate your Mac to the highest possible speed. Chips are rated for a particular speed when they come out of the factory, and like any rating, there's a fudge factor. A CPU that's rated for 25MHz may or may not run fine at 40MHz, and most upgrade makers supply several speeds from which to choose. If your Mac isn't stable at the highest speed, back the speed down a notch and see if all's well. In a worst-case scenario, you may have to return the upgrade, so be sure your vendor has a return policy with no extra "restocking" charges.

Processors for the 610 and the 650 run as follows:

Model	Speed
Centris 610	20MHz
Quadra 610	25MHz
Centris 650	25MHz
Quadra 650	33MHz

ALL BUT ONE OF THESE MODELS use the Motorola 68040 processor—the Centris 610 uses the 68LC040.

Fall Back to Savings

MicroMac Accelerator & Memory Upgrades

LC/LCII Power WorkStation

$199

Available for the LC and LCII (Performa 400/405/410/430), the Power WorkStation allows Ethernet and acceleration for faster Internet access. The Base Unit provides a 32MHz ThunderCache accelerator, a dual slot PDS adapter for an optional Ethernet card and room to accommodate three hard drives. Depending on your system needs, you can configure the Power WorkStation with Drive and Power Option upgrades ($49 each) to upgrade your workstation with a CD-ROM, Zip or Optical drives and power supply. Finally you have the option to expand your low profile Mac into a high-performance desktop workstation suitable for desktop publishing, educational programs and accessing the Internet.

Call for School Pricing

PowerPC 604 & 604e PowerMaster Accelerators

starting at $189

Available for PCI PowerPC computers, the PowerMaster accelerator features a fast 604 or 604e PowerPC processor running up to 233MHz. The PowerMaster is optimal for CAD graphics, high-end digital and video work, desktop publishing, graphic design and cutting edge Web technologies such as voice recognition/chat, video conferencing and interactive Web multimedia.

PowerMaster 604e

up to 233MHz

Compatible with PowerPC 7300, 7500, 7600, 8500, 8600, 9500, 9600 and most of the following Mac clones: PowerComputing®, PowerWave®, PowerTower® and UMAX SuperMac® 5900.

Mac II Series, SE/30 & LCIII Upgrades

starting at $199

Available for the Mac IIci, IIsi, IIcx, IIx, IIvx (IIvi, Performa 600), SE/30 and LCIII, the DiiMO 030 accelerator offers fast 50MHz 68030 performance with an integrated 64KB onboard cache, Zero-wait state technology and optional FPU for processing power equivalent to a 25MHz 68040 based Mac such as the Quadra 610.

starting at $149

Available for the Mac IIci, IIsi, IIcx and IIx, the Carrera040 features a 66/33MHz or 80/40MHz 68040 (with or without FPU) or a new blazing 68040 at 90/45MHz (with FPU). The Carrera040 offers advanced processing performance for instant screen redraws, better processor performance and increased computing power for demanding Web tasks. Optional FPUs and 128KB Cache card available (66/33MHz and 80/40MHz models only).

NEW 90MHz!

Send upgrade questions to me at mr.mac@micromac.com

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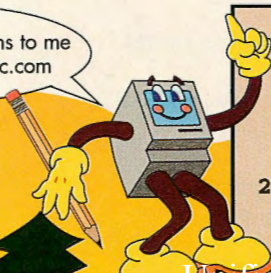
MicroMac Technology

27121 Aliso Creek Road, Suite 125
Aliso Viejo, CA 92656-3364

reviews

Secrets of Virtual PC, the Java-based Coda, and—oh yeah—some Mac stuff.

FREAKIN'
AWESOME

SPIFFY

YEA,
WHATEVER

BLECH!

Virtual PC 1.0

COMPANY: Connectix
CONTACT: 800-950-5880, http://www.connectix.com
PRICE: $149 (street)
REQUIREMENTS (to run Windows 95): 100MHz PowerPC 601-based Mac, 24MB of RAM, 150MB of hard disk space, 256K of L2 cache, System 7.5.5 or later, CD-ROM drive

I've grown accustomed to keeping two computers on my desk. Front and center is my Mac, where 90 percent of my work gets done. Off the to side is a Pentium PC for specialized tasks: searching CD-ROM databases in DOS format, running a Windows Web browser, and playing PC-only games. The arrangement is awkward at best. Exchanging data between the Mac and the PC is a daily hassle, and I've thought often about replacing my Wintel box with a PC coprocessor board or Insignia's SoftWindows emulator. But coprocessors are too expensive, and emulation is too slow for gaming and graphics.

At first glance, Connectix Virtual PC looked like the solution to my problem: a low-cost emulator that was easy to use. Well, Virtual PC is all that, and though it isn't everything I need, it's definitely a must-have for any owner of a fast Mac who has dealings with Windows.

Virtual PC boasts the most comprehensive PC emulation available. It runs all x86 operating systems—DOS, Windows 3.1x, Windows 95, Windows NT, OS/2, and OpenStep—under the Intel Triton Pentium MMX chipset. The Windows 95 version (which most

WITH VIRTUAL PC, you can indeed see this in a window on your Mac...
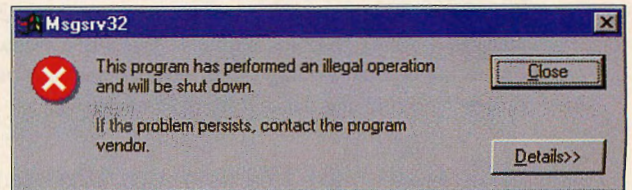
...BUT SOONER OR LATER you'll also see this. It's Windows, after all!

people will order for its multimedia compatibility) comes with Windows 95 installed.

Easy installation is one of Virtual PC's best features. It literally is easier to install Win95 on your Mac than on a PC. Virtual PC creates its own disk partition—actually, it's a separate app that acts as the C: drive. You'll want at least a 300MB partition to hold Win95 and your software. The CD drive is D:, and you can set up drive F: as a shared folder for PC files that you also want to be accessible to your Mac apps. A fast-startup feature saves your Windows state when you quit Virtual PC. On your next launch, it pops you right back where you were—in seconds. SoftWindows has this, too—so why can't we have this for the Mac OS?

Basic services work more or less as you'd hope. Sound routes flawlessly through Virtual PC's Sound Blaster emulation (but you can't use the Mac's microphone to record into Windows). I was able to print directly to my HP Laserjet 6MP without even entering Windows' printer driver installer. Installing and configuring Microsoft Internet Explorer went as expected; I connected to my ISP with no unusual trouble. Networking, however, caused unresolved hassles, such as repeated error messages about a wrongly configured DEC 21041-based PCI Ethernet adapter card, although my Mac is not on an Ethernet network. (Virtual PC bases its Ethernet support on that card's protocols.) By the way, don't expect to pop Wintel PCI cards into your Mac and run them under Virtual PC, even if you install the necessary

Revving Virtual PC

YOU WANT WINDOWS PERFORMANCE? HERE'S HOW TO GET THE MOST FROM VIRTUAL PC:

- Add an L2 cache card, or install a bigger one. It makes a dramatic difference.
- Switch from internal video to a PCI graphics accelerator. Even an inexpensive card (less than $150) yields a major speed increase.
- Allocate more RAM to Virtual PC. Windows runs faster with more memory, up to 32MB. Above that, the speed increase drops off.
- Switch from millions of colors to 256 colors, especially for games.
- Run with a minimal set of system extensions and as few Mac programs open as possible.
- Decrease RAM Doubler's memory multiplier (go from 3X RAM to 2X or 1.5X RAM).
- Run games under DOS, not Windows 95.
- Get a two-button mouse. It doesn't speed Virtual PC, but it definitely will increase your Windows productivity.