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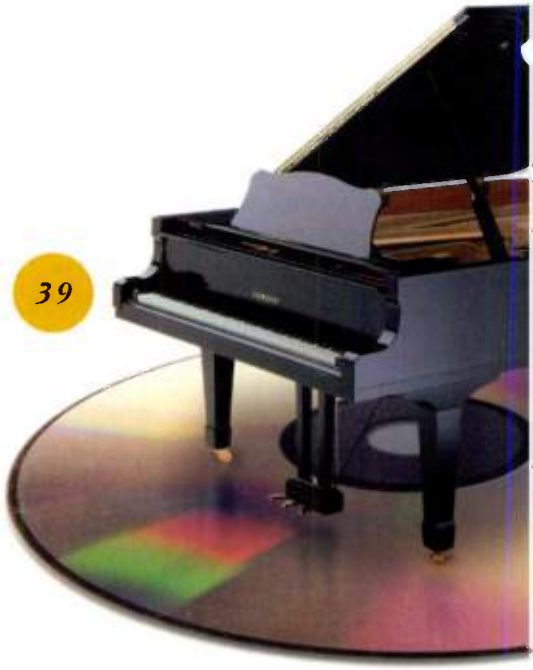

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Celebrating a Revolution

DAN PHILLIPS

This year marks the 20th anniversary of the adoption of the MIDI Specification, the fruit of a rare cooperative effort between manufacturers, primarily Sequential Circuits, Roland, and Yamaha. For a long time, the Musical Instrument Digital Interface was considered esoteric, and even after it had been around four or five years, a surprising number of musicians were unfamiliar with it. Amusingly, some even mispronounced the acronym as "mye-dye" or "em-one, dee-one."

Before MIDI, interfacing studio gear mostly consisted of sending audio signals from one device to another, the same way things had been done for decades. Control voltages offered rudimentary control of a few synths, and several companies had proprietary networking schemes. But if you wanted synths from different companies to work together, your options were slim.

Esoteric and underrated it may have been, but MIDI revolutionized the world of music production in the personal studio. True, the later development of powerful computers and affordable digital audio recording and editing, combined with a variety of lower-cost components, brought about another sea change. But MIDI was there first, and for many musicians it made one-person production efforts practical.

Today, with a few obvious exceptions, virtually everything in the studio can be MIDI controlled, and with some preparation, you can treat your hardware and software as if they were a single integrated device. Sequencing has become a fine art, and a single sequencer template can load every device's sounds and settings. You can even use MIDI to control stage lighting and some forms of home automation.

The MIDI Specification is still at version 1.0, but it has been expanded considerably over the years. Manufacturers have also gone beyond the spec; for instance, MIDI data is now carried over FireWire and USB. Nevertheless, MIDI could still be improved. It is a low-resolution protocol, with most messages being limited to 128 values. MIDI devices do not intelligently exchange detailed information about their features; you have to know the MIDI implementation for each device and program accordingly. High-speed networking protocols that support MIDI (such as mLAN) are still in their infancy. MIDI is not an ideal protocol for some types of instrument controllers, and parts of the spec are underutilized, such as Polyphonic Aftertouch.

Developing standards is very difficult in the music-tech industry, despite the efforts of the MIDI Manufacturers Association, which is entrusted with MIDI's development. Most companies look for ways to differentiate their products, not standardize them, unless they can see an immediate payoff. That is understandable, but MIDI is proof that well-developed standards help expand the overall market. Clearly, the companies that created MIDI in the face of apathy and even opposition deserve a lot of praise.

An improved MIDI spec and better support for the existing protocol may be long overdue, but MIDI 1.0 works pretty darned well as is. MIDI's 20th birthday is a great achievement, marking a development that has benefited all electronic musicians.

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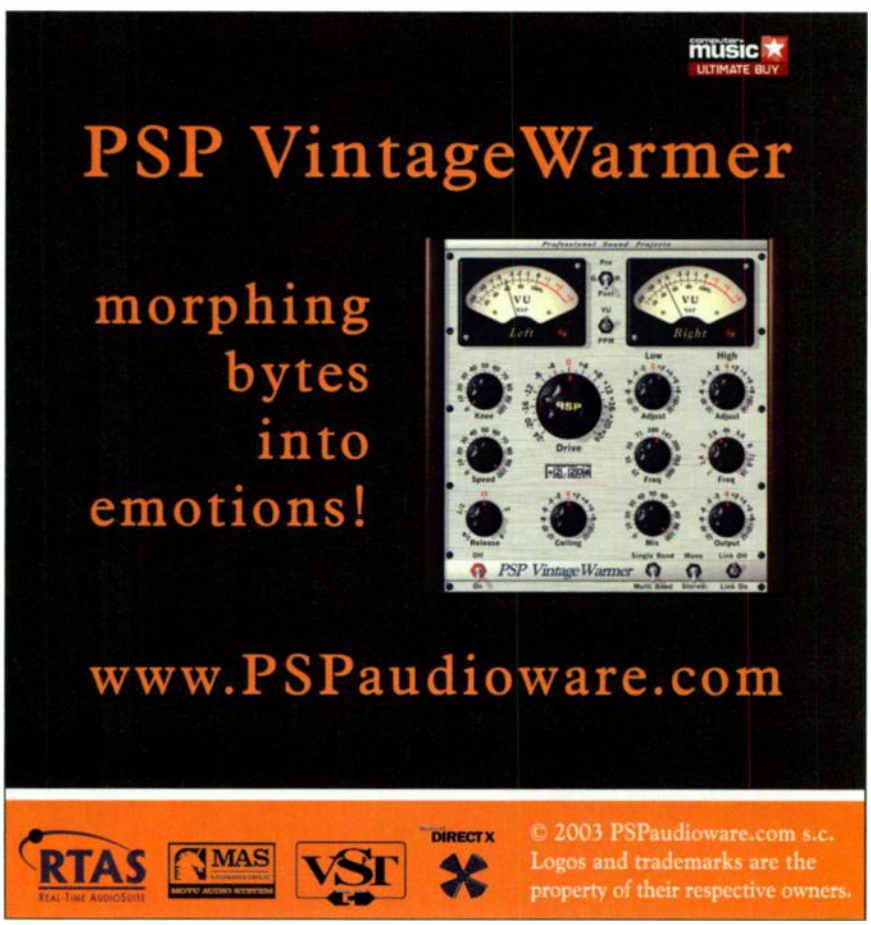

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MAE LAROBIS

APHEX PROTESTS

Aphex appreciates the opportunity to directly address **EM** readers regarding the review of the Model 207 by Myles Boisen (December 2002). The listening tests he performed were flawed in that each and every comparison was made with the 207 being lower in level anywhere from 0.48 to 1.14 dB. There were two series of listening tests done. The first showed a 0.8 dB differential. We asked that the tests be redone. Yet the second tests showed as much as a 1.14 dB differential!

The sound of the 207 is very forward and present, so it is a very common mistake for people to compare it at a lower level to other preamps. We encountered this phenomenon when we introduced the Model 107 over eight years ago. That is specifically why we developed a switch box that allows an easy way to compare any two pieces of equipment, not just mic preamps, that assures level matching within 0.1 dB. Once levels are equal, comparisons can be made fairly. This box was sent to **EM** and on to the reviewer. The response was that it was "useless."

A review that reports that the 207 sounds "compressed" in comparison to another preamp when it is over 1 dB lower is not consistent with professional standards and is a false conclusion. Aphex discovered the discrepancy and reported it to the editors before publication, yet they chose to print the review, disregarding Mr. Boisen's failure to apply easily measured calibration procedures. We believe that readers deserve to know all the relevant test conditions, including something so fundamental as level differentials, before they are asked to accept a reviewer's conclusions.

One conclusion that a reader can logically draw from this is that since the sound of the 207 has the same 'loudness' at lower actual levels, the sound will be that much bigger and fuller at equal levels. That is why professionals, including some of the top musicians in the world, have made the Model 207 an essential piece of their gear.

Aphex sincerely hopes that **EM** will be more rigorous in conducting future reviews and insure that testing parameters are as equal as possible. Only in that way readers will have the confidence that all comparative tests are accurate and scientifically acceptable.

Marvin Caesar
President
Aphex Systems, Ltd.

Dear Readers—As we have often stated, our reviews are field tests, not bench tests, and author Myles Boisen did extensive field tests the same way a typical engineer would test a preamp. His comparative listening tests were done several different ways. The first set of reference tracks were level-matched using level meters; these are the tests in which Mr. Caesar alleges the 207 output and the output levels of the other preamps are not matched, with a difference of 0.8 dB. This is curious, considering that several different preamps were used in the tests, but for argument's sake, we'll accept his figure. The second set of tracks were level-matched, per Mr. Caesar's request, by phase-inversion cancellation, and Mr. Caesar's tests apparently show these to be off by 1.14 dB. If that's accurate, our original test methods were more accurate than his suggested method.

Mr. Caesar tested the preamp output levels by measuring, in Pro Tools, copies of Boisen's tracks, as derived from a pair of reference CDs (one for each set of test tracks). These were not the original analog tracks Boisen used for his personal listening tests, but a digital copy made specifically for the editors to hear. We sent a copy of the two CDs to Mr. Caesar because our experience was that in every case, the Aphex 207 had a distinctive sonic signature, regardless of which way we tested it. Four of our editors listened independently to both sets of test tracks, and each editor was able to identify the 207 in each and every test. The distinctive sound we heard was not merely a matter of "fullness" that might result from a significant level difference; a simple rereading of the review will show that. We thought hearing was believing, and that Mr. Caesar would hear the same rather obvious sonic signature we heard.

Given that we consistently heard the same sonic signature in every test, we believe the alleged output-level difference of less than a decibel—or even the 1.14 dB level difference—is irrelevant to our practical results, and we stand by our review.—Steve O

HIGH-FIVE FOR LIVE

I want to compliment Len Sasso on his great Master Class for Ableton Live 1.5 in the December 2002 issue ("Master Class: Going Live"). I've been using Live since its initial release, both in the studio and onstage, and I'm still amazed by its strangely simple yet complex design. Your article taught me some new things, and reminded me of others

Dave Nicholson – Developer, Cubase SX – The Mixer

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that I'd forgotten. I wrote a review of Live for a U.K. magazine, and I wish I'd been able to cover it in the depth that you did. Thanks, and keep up the good work.

Martin Delaney
via e-mail

IS IT IN THE CARDS?

I am a semiprofessional musician who would like to do some decent quality recording at home. I like working with MIDI and live recording as well as using my computer for other pursuits such as games and home theater. About two years ago, I bought a sound card that was supposed to be able to handle games, MIDI, and full duplex recording. However, it does not do a very good job of that because of too much latency and instability. I have been waiting for something better to come along.

What with current advances in electronics and technology, you'd think that someone could design a sound card that provides the fully functioning MIDI and gaming sound of a good sound card, as well as the precision, speed, and quality of a good digital audio card with a breakout box. Is it so impossible for the engineers to combine these features in one card? It seems to me that the manufacturers have been moving slowly in that direction, but everyone one of them stops short and leaves out one important feature or piece of functionality.

What are they thinking? Are they so out of touch with what consumers want? Why is it so difficult to give us a truly all-in-one sound or audio card that we can use in one computer and does it all? I'd really like for someone to explain to me what the problem is.

David40
via e-mail

David—The issue is not engineering prowess. The recording and gaming markets have different needs, for the most part. For example, game cards usually include a low-cost synth chip, which is unnecessary and undesirable in a studio product because recording musicians generally have higher-quality hardware and/or software synthesizers. Putting a low-end synthesizer chip in a studio-quality interface is a waste of money and will not improve sales to studio users.

On the other hand, most game cards offer at most six analog outputs (for 5.1 surround), and many only support stereo analog I/O. Their digital I/O usually is limited to one stereo S/PDIF pair. In contrast, most studio-grade cards start at 8 analog I/O pairs, and many have 24 analog I/O pairs, along with at least 8 channels of digital I/O. Furthermore, the current crop of studio cards is designed to handle 24-bit, 96 kHz (if not 32-bit, 192 kHz) digital audio, which is overkill for a gaming card that is usually expected to play back 16-bit, 44.1 kHz WAV files. And the quality of the converters and accompanying analog electronics is generally much higher on studio-grade cards. Issues such as latency are far less critical when you just have to play back two (or even six) channels of audio for a game than when you have to simultaneously record and play back on up to 24 channels in a studio environment in which there is no margin for error.

All this makes for a significant cost difference. Gamers are unlikely to pay higher prices for features they don't need and can't use, and studio recording musicians are unlikely to settle for less. We are talking about two very different applications, and it usually does not make sense for a company to make the exact same product for both markets.

Incidentally, be sure to check your sound-card manufacturer's Web site to make sure you have the very latest drivers. That way, you can get the most out of your existing hardware. I also suggest you consider doing what many studio musicians do: keep the game card but add a high-quality audio interface for your recording work. That way, you'll have the best of both worlds.—Steve O

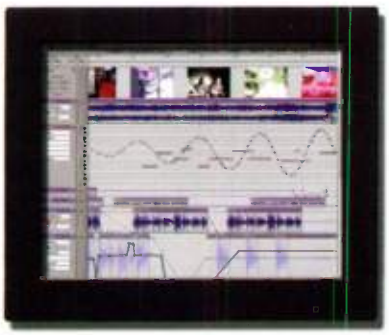
ERROR LOG

December 2002, "What's New: Sound Advice" p. 26: There is an omission in the description of Patchman Music's *Volume 1: Wind Controller Essentials*. The write-up should state that the collection is a bank of Patches and Performances for Roland's XV-Series synthesizers.

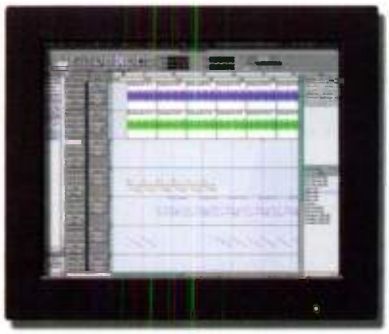
WE WELCOME YOUR FEEDBACK.
Address correspondence and e-mail to "Letters," Electronic Musician, *6400 Hollis Street, Suite 12, Emeryville, CA, 94608 or emeditorial@primediabusiness.com. Published letters may be edited for space and clarity.*

"The compatibility champion is clearly the US-428."

- Brian Smithers, Electronic Musician, February 2002

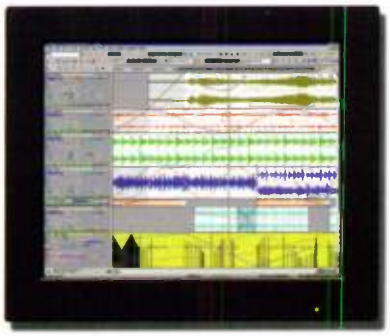


MOTU™ Digital Performer



Digidesign™ Pro Tools

Native Instruments™ B4



Cakewalk™ Sonar

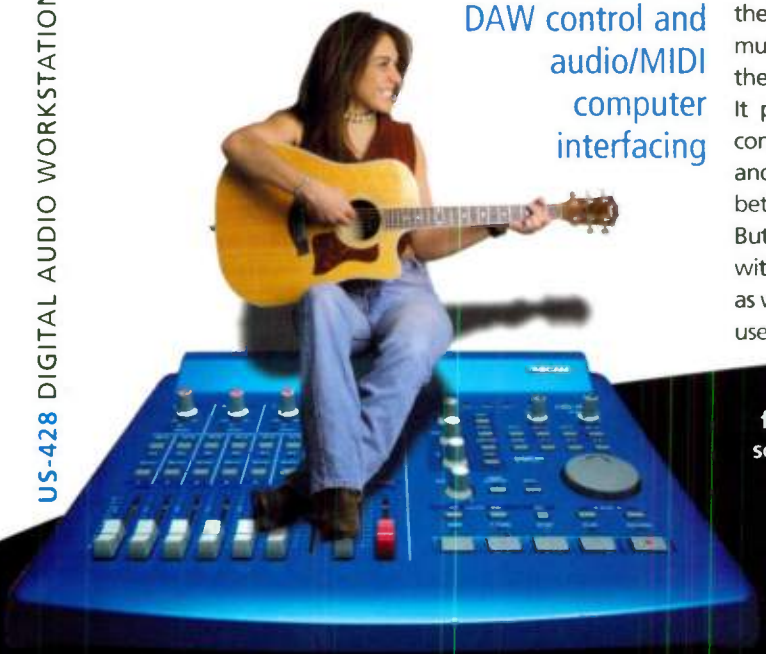
Steinberg™ Cubase

eMagic™ Logic

US-428 DIGITAL AUDIO WORKSTATION CONTROLLER/USB INTERFACE

US-428:

The champion in DAW control and audio/MIDI computer interfacing



If your DAW control surface isn't compatible with your preferred DAW software, there are still some good uses for it...like a doorstop. Or a paperweight. But if you want the controller that works with the widest variety of music/audio software applications, your solution is clear: the **US-428** by TASCAM and Frontier Design Group. It provides real faders and knobs to give you creative control of the parameters of your favorite audio software, and also acts as a high-quality audio and MIDI interface between your music and your USB-equipped Mac or PC. But the big advantage of the US-428 is that it's compatible with nearly every popular audio/MIDI software application as well as many virtual instruments, so no matter what you use to make music, it's ready to rock.

Visit your TASCAM dealer or www.tascam.com for more info on the world's leading control/interface solution (and the compatibility champion): the US-428.

TASCAM US-428 by FRONTIER DESIGN GROUP

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www.tascam.com

Here are some of the innovative software developers who offer support for the US-428, with more apps added all the time. See the TASCAM web site for the latest info.

Visit us at NAMM, Booth # 6491.

FRONT PANEL

Download of the Month

By Len Sasso

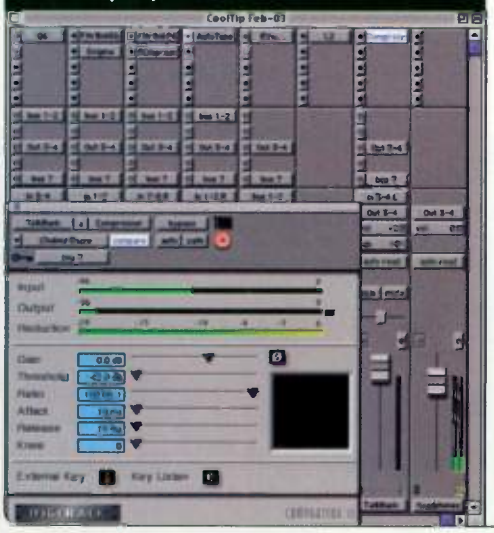
InTime Tempo Tracking System (Win, $119) from Circular Logic is a program that its manufacturer calls "a metronome on steroids." Instead of dictating tempo, it follows you and adjusts its tempo as you play. That may seem a little contrary to the usual purpose of a metronome (though learning to control and manipulate its tempo is an interesting practice exercise), but InTime doesn't just play clicks. It also plays Standard MIDI Files (SMFs) and generates MIDI Clock data for controlling external MIDI devices and other MIDI software running on your computer. You can select a separate MIDI routing for each of its outputs.

InTime is primarily a performance tool that lets you breathe life into the tempo or groove of MIDI sequences being played by either internal or external sequencers. If you use a sequencer to play backing tracks, InTime will synchronize the sequencer's tempo to your live playing. A little time is required to master InTime in performance, but it provides Advanced Tracking parameters to optimize its tracking of various input devices, including keyboard, wind, percussion, and guitar controllers. InTime will also record your playing, complete with tempo changes. You can save the result as an SMF and import it into another sequencer or notation program for fast scoring or tempo matching of your performance.

You can download a time-limited demo at Circular Logic's Web site (www.circular-logic.com). You can also find detailed tutorials and MP3 files that illustrate InTime's three main functions. The first uses an InTime-captured tempo map to groove a straight-ahead MIDI rhythm track. The second uses an InTime-recorded classical performance to produce a nearly flawless score. The score without InTime tempo adjustments is provided for comparison. In the third tutorial, InTime tracks a drummer while controlling the tempo of a performance in Reason. The examples will give you a good idea what InTime can do and help you determine if it's suitable for you.

TIPS

Cool Tip of the Month



Setting Up a Talkback Mic in Pro Tools

The **EM** *Cool Tip of the Month is presented courtesy of Cool Breeze Systems.*

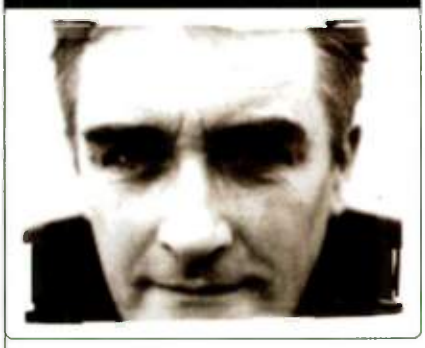
If you're recording tracks in a studio, a good line of communication between the control room and tracking room can be crucial to maintaining a creative production environment. To make communication as easy as possible, I set up a mic in the control room (out of the feedback zone) and control it with my DAW software. Personally, I hate to play with a talkback button, so I keep the talkback mic open to the headphones whenever we are *not* rolling, and then close it when the tune starts.

Most professional DAW programs let you set up talkback and automate the process. In this example (see example at left), I'm using Pro Tools with a multiport audio interface.

1. Once you've configured the mixer and headphone mix, select New Track from the File menu and create an aux input (Command + Shift + N on the Mac, or Control + Shift + N in Windows). Name the aux input "Talkback." (To review setting up a headphone mix, check out "Cool Tip of the Month" in the July 2002 issue.)

Band on the Web

By Geary Yelton



Though hardly a household name, Fred Frith has been making records since 1973. That year saw the release of the first album by British progressive-rock band Henry Cow, with multi-instrumentalist Frith on guitar. Boasting a loyal following in Europe and especially the United Kingdom, Henry Cow had an anticommercial attitude and never gained more than a cult following in the United States.

Never content to be pigeonholed, Frith has since teamed with luminaries such as Brian Eno, John Zorn, the Residents, Yo-Yo Ma, Terry Riley, Ensemble Modern, Bill Laswell, Robert Wyatt, and Bay Area guitarist Henry Kaiser. In the past few years, he has concentrated on composing music for small ensembles, film, theater, and dance. A worldwide audience ensures that he travels extensively for performances and recording projects with an international cast of musicians. He has lived for extended periods in New York and California as well as his native England. He is currently based in the San Francisco Bay Area, where he is professor of composition and improvisation at Mills College in Oakland.

The Fred Frith Web site (www.fredfrith.com) will bring you up to date with Frith's musical activities and interests. It contains all the resources you might hope to find in an artist's site. A schedule keeps you informed of his recent and upcoming performances. News of the past and present is provided on the home page and on a Previous News page that encompasses almost four years of announcements. A guest book provides space to leave comments and read the comments of other visitors. You can also subscribe to the Fred List, an e-mail forum that brings Frith fans together to discuss his music.

If you're interested in Frith's music, probably the most useful online resources are the discographies, which detail dozens of records that he has composed or played on. A few entries provide links for listening to excerpts. His biography is presented in both abbreviated and extended forms. As a familiar name to followers of the avant-garde for more than a third of a century, Fred Frith has had a remarkable influence on hundreds of musicians. His Web site is a treasure trove of information for fans and curious initiates alike.

Key Changes

By Marty Cutler

Sibelius Software (www.sibelius.com) has acquired worldwide distribution rights for Australia-based Rising Software's music education software, Auralia and Musition . . . **LinPlug** (www.linplug.de) has announced that a number of the company's virtual instruments are now available for Mac OS X. Soft synths include the Alpha Classic and FreeAlpha, Element P Percussion Synthesizer, daOrgan Drawbar Organ, CronoX Sample Synthesizer and Delta III Matrix Synthesizer . . . Synthesizer pioneer **Dr. Robert Moog** received an honorary doctor of music degree at Berklee College of Music's 2002 Entering Student Convocation . . . **The Hearing Aid Music Foundation** (www.hearingaidmusic.com) has announced the completion of a 15-minute educational film entitled *Listen Smart—Safely Handling the Power of Sound*. The film was designed to create awareness about noise-induced hearing loss (NIHL) and to encourage safer practices in consuming high decibel sound . . . Line 6 Amp Farm is now available for Mac OS X– and Windows XP-based Pro Tools HD systems. The software is distributed by **Digidesign** (www.digidesign.com) . . . Interested users can download mtofhex, Victor Cerullo's Max/MSP External object for Cycling 74's Pluggo 3. The file allows users to tune VST instrument synth plug-ins to a 16-tone-per-octave equal-tempered-system scale. You can download the object in the Files section at http://groups.yahoo.com/group/16tone.

2. Plug the control-room microphone in to the input you've assigned as the talkback. Don't forget that the microphone's signal must be routed through either an external preamp or a preamp built in to your interface.

3. In this session, you're using sends 3 and 4 for your headphone mix, so assign the output of the talkback aux to sends 3 and 4.

4. To control talkback, insert a compressor (Compressor II); set the threshold, attack, release, and knee to the lowest settings; and set the ratio to maximum (100.00:1).

5. Click the External Key button and select a key source from the drop-down menu. The key source should be a continuous signal, such as a bus feed by another track or a SMPTE LTC signal if you're triggering one.

The talkback mic will now be open when no music is playing, and it will close when music begins playing.

—Steve Albanese

Make sure to check out the streaming movie tutorial of this tip to view this procedure in action. Log on to www.emusician.com/cooltip to take part in this online adventure. Also, if you dare, take the quiz to review what you've learned!

Rev Up

By Marty Cutler

Cakewalk

Version 2.1 of Cakewalk Sonar (Win, $479) is a free download for registered users. Major enhancements include an expanded number of import and export formats.

The software now supports OMFI and Broadcast Wave (BWF), which provide sample-accurate transfer of audio files and sequences without the need to run a separate application. Files in those formats offer cross-platform compatibility with OMF host applications such as Digidesign Pro Tools, Emagic Logic, and MOTU Digital Performer.

Support for Windows Media 9 Series audio export keeps the program in line with Microsoft's current audio-streaming technology, enabling distribution of high-quality audio over the Internet. Sonar now accepts Universal SysEx messages, which allows the program to respond to MIDI Machine Control (MMC) messages. Currently supported hardware controllers include Mackie Control, Radikal SAC 2K, CM MotorMix, and the Tascam US-428. A Generic Global Control Panel with a Fast Learn mode lets you press additional hardware controllers into service.

Changes to the Import Audio dialog let you simultaneously import multiple files. The program's Note Inspector is now a free-floating application toolbar and is available from any viewing arrangement. Sonar 2.1 requires a Pentium III/500 MHz computer with Windows 98SE, 2000, or XP and 64 MB of RAM.

Ableton

Among the major new features in Live 2 (Mac/Win, $399; download upgrade, $69; boxed upgrade, $89) is its capacity to record unlimited takes of real-time audio with an unlimited track count (dependent on processor speed and RAM). Other major improvements provide new time-stretching capabilities and new effects types.

Ableton Live 2 accommodates linear recording directly into the Arranger or Session views. Because the program supports changing pitch and tempo independently, you can now tap tempo during audio playback without affecting pitch, and you can edit tempo as a continuous curve. Conversely, the program can transpose audio independently of tempo, allowing you to create key changes or modulations at any point in the material.

Ableton Live 2 also adds support for Propellerhead Software's ReWire, letting you integrate the program with other music software. You also get solo and prefader listening modes, improvements in file management, a refined mapping of MIDI-and key-command mapping, and support for multiport MIDI interfaces.

Live 2 requires a Macintosh G3 with 256

TIPS

New! Improved!

It should be obvious that when you're recording digital audio—especially on critical projects—you need the best digital converters you can get your hands on. Generally, that means using recently manufactured A/D and D/A converters. Like computers, converters tend to get noticeably better every year; even newer, affordable converters (such as the A.R.T. DI/O) tend to offer conspicuous improvements over older, more-expensive converters.

I recently mixed an album in a studio in which the mixdown deck was a nine-year-old DAT machine. I mentioned to the producer that a more modern A/D converter would likely improve the sound considerably. Thankfully, he heeded my advice and rented a high-end converter from a local pro-audio shop. While still monitoring through the DAT deck's original converters, we printed our mix for comparison purposes. Then we patched in the newer A/D converter—set to the same bit-rate and sampling frequency as the DAT—and printed the mix again. The difference was palpable: the low end on the second mix was bigger, deeper, more solid, and more pleasing to listen to; the highs were smoother and more airy; and, overall, the sound seemed more natural and true. Even the stereo imaging was enhanced, making it easier to pinpoint instrument locations on the soundstage. In the end, the couple of hundred dollars it took to rent the new-generation, high-end A/D converter was money well spent.

—*Brian Knave*

Lord of the Ring Modulator

Ring modulation (also known as balanced modulation) is a process that takes two input signals (a carrier and a modulator or program) and outputs only the sum and difference of the two tones. For example, if you feed the ring modulator a pair of sine waves, 300 Hz and 200 Hz respectively, you will get tones at 100 and 500 Hz outputs. At the same time, the original signals should be removed.

If you are using a Big Briar (now Moog Music)

MB of RAM running either OS 9.1 or OS X. PC users need at least a Pentium/400 MHz computer with 128 MB of RAM and Windows 98, 2000, or XP. You will also need a Windows-compatible soundcard, preferably with a DirectX or ASIO driver. M-Audio/Midiman; tel. (800) 969-6434 or (626) 445-2842; e-mail info@midiman.net; Web www.m-audio.com.

Innovative Music Systems

Version 5.0 of Intelliscore (Win, boxed $99; download, $79; upgrade, $39) provides enhanced pitch-detection algorithms. The program can now derive MIDI data from stereo polyphonic audio tracks and adds support for a wider variety of audio formats, bit depths, and sample rates.

A new Patch Map feature lets you separate detected notes and assign them to different instruments on individual MIDI channels based on pitch and location of the audio in the stereo field. The manufacturer supplies 23 patch maps, and you can create and save custom maps. You can use an instrument's position in the stereo field to isolate or remove it from Intelliscore's pitch-to-MIDI conversion process, letting you remove or transcribe a vocal part, for example.

According to Innovative Music Systems, an overall improvement in the software's pitch-detection algorithm promises much greater transcription accuracy. For more realistic interpretations of a performance, the program can reportedly transcribe continuous changes in tempo so that the resulting MIDI file contains ritardando, accelerando, rubato, or fermatas. With monophonic audio tracks, Intelliscore will capture changes in volume and pitch for sustained notes to re-create portamento, vibrato, tremolo, and Pitch Bend.

Intelliscore now supports MP3, WAV, and real-time audio input. The program can handle audio bit depths of 8, 16, 24, and 32 bits at sampling rates ranging from 11.025 to 44.1 kHz.

Intelliscore requires a Pentium-class processor or higher with at least a Pentium II for the program's Live Performance mode. You will need 128 MB of RAM and Windows 95, 2000, NT4, or XP. Innovative Music Systems, Inc.; tel. (954) 753-3278; e-mail info@intelliscore.net; Web www.intelliscore.net.

TIPS

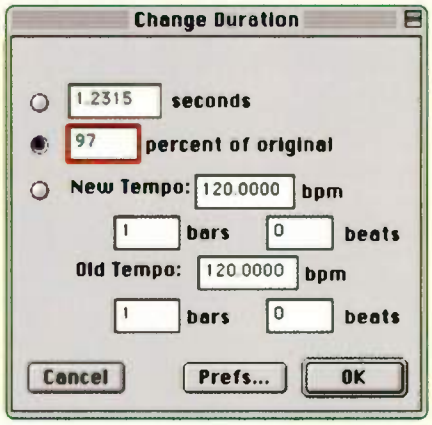
MF-102 Ring Modulator and you hear the original tones bleeding through, a simple procedure can eliminate them. You'll need a sound source that gates quickly (such as keyboard sound with a brief decay). Begin by removing the bottom panel of the MF-102. Note where the VR1 trimmer is located: it is the one closest to the rear-panel jacks and has the blue cap. You will be adjusting this trimmer with a small screwdriver.

Set the oscillator Frequency control to a high pitch (around 2 kHz will do). Plug your keyboard or sound source in to the input and send the output to your amplifier. Play a short note; you'll hear the carrier die out about two to three seconds later. Keep hitting short notes in order to keep the squelch open. As you play, adjust VR1 until you hear the absolute minimum carrier bleed-through. You may be unable to attain absolute zero bleed; just strive for the minimum point. In doing so, you are nulling the carrier signal that comes from the balanced modulator.

—Gino Robair

Time Off

Time stretching and time compressing are now standard features in most audio-editing programs, and those functions can be lifesavers if a block of dialog or a musical cue is a tad long or short for a particular



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KEYBOARD KB AWARD REVIEW

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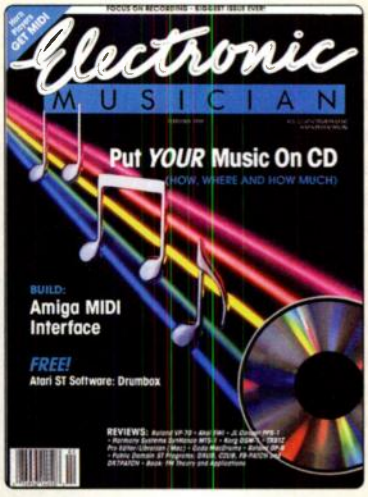
15 Years Ago in EM

By Steve Oppenheimer

Our February 1988 EM ran 140 pages, counting the covers, which is impressive considering that the February 1987 issue was 116 pages and the February 1986 issue was 72 pages. Clearly, the magazine was growing quickly, reflecting the growth in personal-studio recording.



CDs were still new in February 1988: the first CD pressing plant in the United States opened in 1984 but initial acceptance was slow. Our cover story, "Compact Disc Production for the Independent Musician," provided a broad overview of how CDs are manufactured and packaged, along with basic information about preparing your music for CD release. We also published a variety of secondary features. In a thought piece called "Making Musical Instruments Magical," Craig Anderton reminded us that no two machines are identical; each has its own "personality," and the chemistry between you and your machine results in unique creative "magic." On the tech side, Bob Mithoff's "Three-Dimensional Textures in Electronic Music" discussed how to add motion to your sounds by layering sounds and judiciously applying effects. In "MIDI by the Numbers," Dick Valenti provided tables that showed the hexadecimal and decimal formats for a variety of MIDI messages, which was handier than the way the information was presented in the MIDI specification. Otari service tech Mike Babbitt lightened things up with "The Alignment Caper," a fun short story about a private eye that explained how to align a tape deck's heads.

We published two DIYs. Mark Braunstein's MIDI interface for the Amiga 1000 was easy to build, and the parts only cost about $25. David Snow's Drumbox was a drum-pattern generator and editor program for the Atari ST computer and Casio CZ-101 synth. We accompanied the story with patch sheets for nine CZ-101 drum sounds, which I've provided on our Web site (www.emusician.com) for all you CZ-101 and CZ-1000 fans.

EMWEB CLIPS

We offered three full-length reviews. Tim Tully's warm endorsement of the sax-like Akai EWI1000 woodwind controller and EWV2000 sound module was actually listed as a "Special Feature" in the table of contents, but it's tagged as a review in the text; go figure. Paul Lehrman gave the Roland VP-70 voice processor an enthusiastic review, for the most part. The VP-70 was a vocal-harmony processor that offered vocoding and pitch-to-MIDI conversion, a combination that had previously been unavailable for anything close to the VP-70's list price of $1,495. Craig Anderton weighed in with a face-off between the budget-priced Harmony Systems MTS-1 and JLCooper PPS-1 SMPTE synchronizers, essential tools if you wanted to sync a tape deck to a MIDI sequencer. In our "First Takes" section, we raved about the Korg DSM-1 sampling synth module, which offered an extremely powerful and flexible synthesis architecture for its day.

But my favorite part of the issue was a full-page letter from the peerless Wendy Carlos, correcting and augmenting information we had presented in our October 1987 story on alternate tunings, "Alternate Scales on the Commodore 64." Thanks again, Wendy!

TIPS

time segment. Keep in mind, however, that stretching and compressing time are highly complex DSP operations, and they always degrade the audio to some extent.

Most audio editors offer a range that extends from half speed (50 percent) to double speed (200 percent), but the outer limits of the range are practical only when fidelity is not important or when you're purposely creating special effects. If your intent is to shorten or lengthen an audio clip without introducing excessive distortion, clicking, or other artifacts, you'll have to abide by some practical limits. Here are some rough guidelines to follow when stretching or compressing sound files:

In order to achieve the best results with speech, keep your stretch factors within about ±30 percent. For musical arrangements with overlapping instruments, it's best not to exceed about ±10 percent. For solo piano, classical music, and other orchestral styles, you will probably need to stay within ±3 percent.

—David Rubin

Multiplying Loops

You can achieve interesting rhythmic effects by overlapping drum loops or any sounds with a beat-synchronized component. Instead of simply laying them end-to-end at measure boundaries, try placing a loop so that it starts at a quarter, eighth, or 16th note after the downbeat of the previous loop. This technique works equally well for different loops or for multiple iterations of the same loop.

—Marty Cutler

Fade to Black

A classic recording-studio technique can create the illusion that your music is fading into the distance. At the end of a song, as you bring down the main faders for an extended fadeout, gradually bring up the reverb level on the main mix. As the sound level diminishes, its perceived distance will increase.

—Geary Yelton

For more EM Cool Tips, visit our Web site at www.emusician.com.

WHAT'S NEW

By Marty Cutler

▲ GREAT RIVER ELECTRONICS ME-1NV

Revered for its expensive high-end preamps, Great River Electronics has introduced the comparatively affordable ME-1NV ($1,299), a single-channel preamp. Great River claims that the unit maintains the integrity, accuracy, and tunability of its predecessor, the MP-2NV.

The ME-1NV has an unbalanced ¼-inch high-impedance input jack on the front panel and balanced XLR input connectors on the rear panel. You also get a TRS insert jack to patch a compressor or an EQ in front of the output amp.

The controls have up to 70 dB of input gain in 5 dB steps. The output gain offers a range from –25 dB to +10 dB. To provide feedback on gain staging, the ME-1NV sports separate LED input and output monitoring meters.

Dedicated buttons located on the front panel let you switch polarity, phantom power, input impedance, and output loading. A rear-panel switch allows you to accommodate 110 or 220V operation. All switch contacts are gold plated. Great River Electronics; tel. (651) 455-1846; e-mail dkennedy@minn.net; Web www.greatriverelectronics.com.

▶ CAKEWALK PROJECT 5

Project 5 (Win, $399) provides a suite of software synths and samplers, and tools for drum programming and audio looping in an integrated sequencing environment. The software's support for DX, DXi, VST, and VSTi lets you add third-party synths and audio-processing plug-ins. Compatibility with a number of audio and sampler file formats increases the program's flexibility.

Project 5 ships with a polyphonic analog-modeling synthesizer and drum machine, a sampling drum machine, a DXi phrase sampler, and an arpeggiator. The sequencer offers real-time recording and step sequencing with piano-roll editing. The program gives you extensive real-time control over synthesis parameters and synthesizer keyboard mapping and layering capabilities. You can also trigger patterns in real time.

The sample-based drum machine is compatible with LM4, WAV, and AIFF samples, and the soft sampler reads Akai S5000 and 6000 format samples as well as SoundFont 2, Kurzweil, AIFF, and WAV formats. The program is also compatible with Sonic Foundry's Acid-format loops, and Cakewalk supplies a hefty count of Groove Clips to get you started.

Project 5 supports ASIO, DX, DXi, MFX, ReWire, WDM, VST and VSTi, and can operate as a ReWire client. The program requires that you use a Pentium II/400 MHz with 256 MB of RAM, running Windows 2000 or XP. Cakewalk; tel. (888) CAKEWALK or (617) 423-9004; e-mail sales@cakewalk.com; Web www.cakewalk.com.

▼ E-MU VINTAGE PRO

The single-rackspace Vintage Pro ($795) from E-mu delivers a 32 MB sound set that focuses on classic keyboards from the '60s through the '80s. The unit features completely new samples along with selected PCM material from the company's B-3 module. E-mu says its programmers voiced the sounds in the Vintage Pro using side-by-side comparisons with the original instrument.

Samples for the Vintage Pro's ROM derive from the Fender Rhodes, ARP 2600, Oberheim OBX, Yamaha DX7, Mellotron, and various Sequential Circuits, Roland, and Moog synthesizers. Vintage Pro's sound set can be augmented with up to three Proteus expansion ROMs. The instrument has 128-note polyphony and 32 multitimbral parts (thanks to two separate MIDI inputs). The synthesis engine is identical to that of the Proteus 2000, with 50 filter types and up to 12 8-stage envelope generators per preset.

Effects include reverb, delay, flange, and distortion. The Vintage Pro has four real-time control knobs and over 100 parameters per preset for tweaking. Many of the parameters can be synced to MIDI Clock.

In keeping with the vintage theme, the synth's faceplate and knobs feature a retro design. Vintage Pro offers six unbalanced ¼-inch analog outputs as well as a coaxial S/PDIF digital output jack. E-mu Systems; tel. (831) 438-1921; e-mail info@emu.com; Web www.emu.com.

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▼ KID NEPRO

Kid Nepro's *The King's Collection,* vol. 2 ($100), presents more than 1,000 new multisampled instruments. The samples come on a CD-ROM in AIFF and WAV formats.

The multisampled instruments are primarily keyboard and synthesizer sounds, including Steinway pianos, Fender Rhodes, Wurlitzers, Farfisa and Hammond organs, Mellotron, and Minimoogs. The synthesizer sounds include pads, lead instruments, and basses.

In addition to multisampled instruments, you also receive an assortment of drum grooves and other rhythmic loops. Loops indicate their original beats per minute in the title.

Many of the instruments and the grooves in the collection can be downloaded as individual files from the Kid's Web site for $5 per instrument. Kid Nepro; tel. (246) 420-4504; e-mail kidnepro@aol.com; Web www.kidnepro.com.

▶ WIZOO

Wizoo GmbH presents *HALion String Edition* (Mac/Win, $379), a sound set for Steinberg's HALion, along with the HALion String Player, a VSTi and DXi for playing the samples without using HALion. The collection compiles 5 GB of samples. Wizoo claims that the samples are suitable for styles ranging from classical to contemporary music.

The HALion String Player has no controls for filter, envelopes, LFOs, or other synthesis parameters. However, the programs offer additional features including crescendo crossfading, switching, and alternate bowings.

The design team recorded string sections with 8 double basses, 10 cellos, 12 violas, and 16 violins, playing with a variety of techniques including legato, spiccato, and tremolo. The software adds real-time control of expressive maneuvers such as crescendo, diminuendo, bowing, and portamento. The programs offer as many as nine Velocity layers.

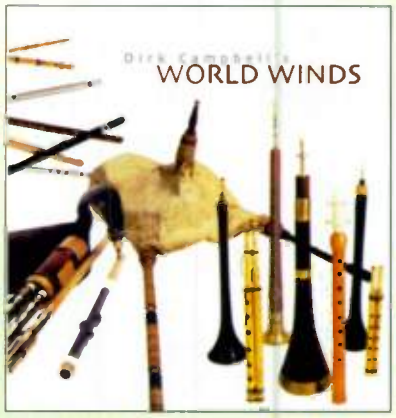
To use the HALion String Player, Mac users will need a G3/500, Mac OS 9 or OS X 10.2 with a 100 MHz system bus, 256 MB of RAM, and a VST 2.0 host. The Windows side requires a 400 MHz Pentium II or AMD-processor equivalent; 256 MB RAM; Windows 98, ME, 2000, or XP; and a VST 2.0 or DXi compatible host. Wizoo GmbH; tel. 49-421-701-870; e-mail info@wizoo.com; Web www.wizoo.com.

▶ ILIO ENTERTAINMENTS

Ilio Entertainments' *World Winds* (Akai S3000-compatible CD-ROM, $199) taps the ethnic wind instrument collection of U.K. composer and multi-instrumentalist Dirk Campbell. In addition, Ilio sampled an Andean panpipe player and a shakuhachi master. The result is a collection of evocative wind-instrument samples gathered from around the world.

You get samples of a variety of flutes including the Indian bansuri, Turkish and Persian ney, the kaval from Southeast Europe, and sulings in slendro and pelog tunings from Java. The CD-ROM offers several types of bagpipes such as the gaida, which is usually found in Greece and Bulgaria; medieval Praetorius bagpipes; and Uillean pipes. The collection also presents a number of horns such as the nafir and African kudu horn.

In addition to multisampled instruments, the library includes articulated samples with up and down bends, grace notes, and authentic phrases and performances. The programs are primarily tuned to concert pitch, but the collection provides instruments with basic programs that demonstrate native tunings, scales, and pitch ranges. The programmers also used the samples to design atmospheric pads and textures. Ilio Entertainments; tel. (800) 747-4546 or (818) 707-7222; e-mail ilioinfo@ilio.com; Web www.ilio.com.



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SYNTHESIS TECHNOLOGY MOTM 500/600-SERIES

Synthesis Technology has announced the release of several new modules for its MOTM analog modular synthesizer. The company's 500-series modules use a combination of analog and digital circuitry for audio generation and modification, whereas the 600-series are mostly for generating control voltages.

Dubbed the WaveWarper, the MOTM-510 ($349) features a self-contained, wide-band analog computer that provides laser-trimmed log and antilog amplifiers. The module can accept three separate control voltages. The net result warps waveforms or control voltages into new shapes. This module is also available in kit form ($229).

The MOTM-520 Cloud Generator ($389) is a voltage-controlled oscillator with eight independent sine- or square-wave numerically controlled oscillators and a 40 MHz processor. The module's 16-bit analog-to-digital converter accepts control voltages for pitch, frequency spread, and phase spread, and generates what the manufacturer calls a detuned tonal cloud. The unit also provides pulse-width modulation for generating harmonic animation.

The MOTM-600 ($389) is a step sequencer with nine patterns, each containing 99 steps. You can enter notes with MIDI or with the optical rotary encoder. The module accepts two control voltages, which you can use to modify a variety of parameters: tempo, transposition, start, stop, rest, gate time, modification, and sequence length.

MOTM-650 ($389) has four channels of MIDI-to-CV conversion. You get four dedicated ¼-inch TRS CV jacks per channel and a separate jack for converting analog pulses to MIDI clock. You can multiply or divide MIDI Clock. The converter supports polyphonic conversion and multiple tuning tables (including microtones). Synthesis Technology MOTM; tel. (888) 818-6686; e-mail synth1@airmail.net; Web www.synthtech.com.

ELIAS AUDIO SILENCE CASES

Elias Audio has several different-size isolation boxes, accommodating different computer systems. The company also solicits custom-design isolation boxes such as rackmounted enclosures.

You can purchase any of four standard models: SC1 ($429) holds a single computer; SC2 ($459) houses a single computer with a five-inch external drive bay; SC3 ($529) can accommodate two computer units; and SC4 ($559) houses two computers and a five-inch external drive bay.

All of the boxes feature a sound-attenuating ventilation system with manually defeatable cooling fans. To eliminate noise leakage, single-PC enclosures have a sealed cable pass, and double enclosures offer two.

The isolation boxes are constructed of ¾-inch ply with a natural wood finish. Elias Audio also offers a variety of shades to match studio décor. To protect the units in transit, the company offers an optional slipcover ($39). Elias Audio; tel. (510) 655-3440; e-mail info@elias-audio.net; Web www.elias-audio.net.

ANWIDA SOFT L1V 1.1

L1V 1.1 (Win, $59) is Anwida Soft's limiter-maximizer for VST 2.0 hosts. The manufacturer boasts of the software's extremely transparent operation and its natural and smooth response to dynamics, citing the product's usefulness on individual tracks as well as strapped across a mix bus.

The plug-in offers 64-bit internal resolution and support for 24-bit, 96 kHz audio. Depending on your host program, the plug-in supports full parameter automation.

You get eight presets, including peak limiting, hard limiting, and level-maximizing applications. L1V requires a Pentium II/200; Windows 95, 2000, ME, NT4, or XP; and 32 MB of RAM. Anwida Soft; e-mail info@anwida.com; Web www.anwida.com.

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JOSEPHSON SERIES FOUR

Josephson Engineering designed the C42 and C42H ($480 for either one) to serve in a wide variety of recording applications. The manufacturer claims that the microphones are suitable for recording acoustic and amplified instruments, instrumental ensembles and choirs, live concerts, sound effects, and vocals. The C42H differs only in its accommodation of a higher sound-pressure level for close-mic applications.

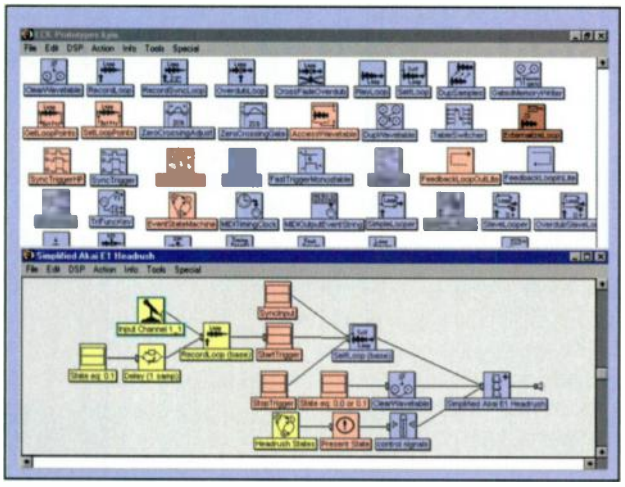
The mics feature a discrete field-effect transistor and a balanced, transformerless output. Josephson Engineering claims that output impedance is low enough to support very long cable runs without signal degradation. Although the mics typically use 48V phantom power, they can operate with phantom power as low as 24V, albeit with diminished maximum SPL.

Josephson rates the mics with a frequency response of 40 Hz to 20 kHz. The maximum SPL of the C42 is 135 dB, with the C42H rated at 155 dB. Equivalent noise level is ≤21 dB for the C42, the C42H offers ≤40 dB.

The C42 and C42H are housed in stainless steel that has a satin finish. The manufacturer also offers a matched pair of black-chrome-finished C42 microphones (C42MP, $1,060) in a carrying case. Josephson Engineering; tel. (831) 420-0888; e-mail info@josephson.com; Web www.josephson.com.

GREEN TEA SOFTWARE LOOPER CONSTRUCTION KIT

The Looper Construction Kit ($349) from Green Tea Software offers roughly 50 new modules that are optimized for real-time looping in Symbolic Sound's Editors' Choice award–winning Kyma system (www.symbolicsound.com). The package includes models of several hardware looping devices including Akai's E1 Headrush, the Lexicon JamMan, and the Line 6 DL4.



The kit gives you the ability to modify the models in order to create your own devices and arrange the modules to construct looping tools that have a wide variety of properties. A random sampling of the provided modules includes the OverdubSlaveLooper, which records, loops, and overdubs audio input while synchronized to a timing event; the CrossFadeOverdub module, which crossfades audio input into the looping wavetable; the ExternalizeLoop, which embeds control information into independent left and right output streams; the SelfLoop, which offers automatic looping and synchronization features and provides forward and reverse playback capabilities; and the CapyToDisk, which appends and saves sequential takes of looping wavetables to disk.

The kit offers a variety of control and utility functions, which have MIDI control and synchronization utilities. The software requires that the user have Kyma 5.26 and a Capybara-320, -320A, or -LS Accelerator. Green Tea Software; e-mail info@greenteasoftware.com; Web www.greenteasoftware.com.

SPL USA TRANSIENT DESIGNER

SPL USA's dual-channel Transient Designer 2 ($599) and four-channel Transient Designer 4 ($1,199) are as much sound-shaping tools as they are dynamics processors. The functionality for both units is identical and differ only in the number of available channels for processing and type of I/O connectors.

SPL says that the Transient Designers can be used to modify the length of percussive signals, amplify the picking transients on guitars, create artificial piano sustain-pedal effects, and modify aspects of an instrument's presence in a mix without EQ or compression. Unlike typical compressors and limiters, the Transient Designers track a signal's contour with envelope followers. Operating the Transient Designer is a simple matter; each channel offers a knob for attack and one for sustain. The manufacturer claims that the unit optimizes settings automatically in response to input level. You can operate channels independently or use the link button to process stereo pairs.

The 2-channel unit gives you a pair of balanced ¼-inch TRS analog inputs and outputs, whereas the Transient Designer 4 has four XLR analog ins and outs. SPL USA; tel. (866) 477-5872 or (805) 241-5140; e-mail info@spl-usa.com; Web www.spl-usa.com.

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PLUGSOUND KEYBOARDS COLLECTION

Plugsound offers Keyboards Collection (Mac/Win, $99), a new software sound-module plug-in. The software ships with versions for MAS, RTAS, and VST on a single CD-ROM.

Keyboards Collection comes with 256 presets that draw upon more than 3,000 samples. The sound set offers a wide variety of acoustic and electric pianos, Clavinets, and organs. As with other modules in the series, there is no capability to import samples, but the Plugsound synth engine gives you plenty of customizable synth parameters, including dual multimode filters and discrete envelope generators for the filter and amplifier. The software allows you to edit keyboard zones, so you create your own splits, layers, and Velocity crossfades.

With the release of the Plugsound 1.72 engine comes access to every knob and slider with MIDI Control Change messages, an improved reverb, a release trigger parameter, and greater overall efficiency in the code for roughly 20 percent more polyphony.

Plugsound requires a VST, MAS, or RTAS host program. Mac users will need a PPC 604e/120 with Mac OS 8.6 and a minimum of 128 MB of RAM. PC users need a Pentium II/300 or the Athlon or Duron equivalent with Windows 98, 2000, ME, NT, or XP and 128 MB of RAM. Big Fish Audio (distributor); tel. (800) 717-FISH or (818) 768-6115; e-mail info@bigfishaudio.com; Web www.plugsound.com.

SOUNDTOYS PLUG-INS

Soundtoys, a division of Wave Mechanics, is releasing a batch of new plug-ins for Digidesign Pro Tools systems. The plug-ins are compatible with TDM, RTAS, and AudioSuite formats for Mac and Windows platforms.

FilterFreak ($349) is the first of the plug-ins to be released. It offers filters with slopes as steep as 48 dB and the ability to increase resonance to self-oscillation levels. For triggering, FilterFreak has an envelope follower, a bpm-synced low-frequency oscillator, and a triggered ADSR envelope generator.

EchoBoy ($349) is a beat-synced analog delay simulator. Tremolator ($299) gives you tremolo effects with adjustable grooves, accents, and rhythmic patterns. In addition, you can lock the patterns to tempo. PhaseMistress ($299) models analog phase shifters and features programmable LFO shapes and tempo-controlled modulation features.

Soundtoys will release additional plug-ins shortly, but the company has not yet determined prices for them. Among these new releases will be Crystallizer, which is inspired by the Eventide H3000 and creates synthesizer-like sounds from simple audio sources, and Decapitator, which provides control over bit depth and sample rate in real time and adds aliasing and other low-fidelity artifacts. Wave Mechanics (distributor); tel. (877) COOL-EFX or (973) 746-9417; e-mail sales@wavemechanics.com; Web www.soundtoys.com.

PRIMERA TECHNOLOY BRAVO DISC PUBLISHER

Creating one-off copies of your audio, video, or data CDs or DVDs is a tedious process. Unfortunately, the cost of most duplication systems starts at around $4,000, pricing them out of reach of many budget-conscious musicians. Primera Technology's Bravo Disc Publisher (CD only, $1,995; DVD and CD together, $2,495) integrates with your PC to give you affordable automated disc-duplication and printing. You can create label art, then copy and print as many as 25 CDs or DVDs per task.

A robotic mechanism transports discs into the unit's built-in 48× CD-R recorder. The CD/DVD combo unit has 16× recording for CD-R and 4× for DVD. After the recording process, discs are shunted to an integrated printer with full-color compatibility at a resolution as high as 2,400 dpi.

The Bravo system can connect to any computer with Windows 2000 or XP and USB or FireWire ports. The manufacturer provides Prassi PrimoDVD software for managing the CD recording and SureThing CD Primera Edition CD-labeling software. For an additional $199, you can add an adapter kit that will let you copy and print 80 mm minidiscs, rounded "hockey rink" minidiscs, and business-card-shaped CD-Rs. Primera Technology, Inc.; tel. (800) 797-2772 or (763) 475-6676; Web www.primeratechnology.com. ●

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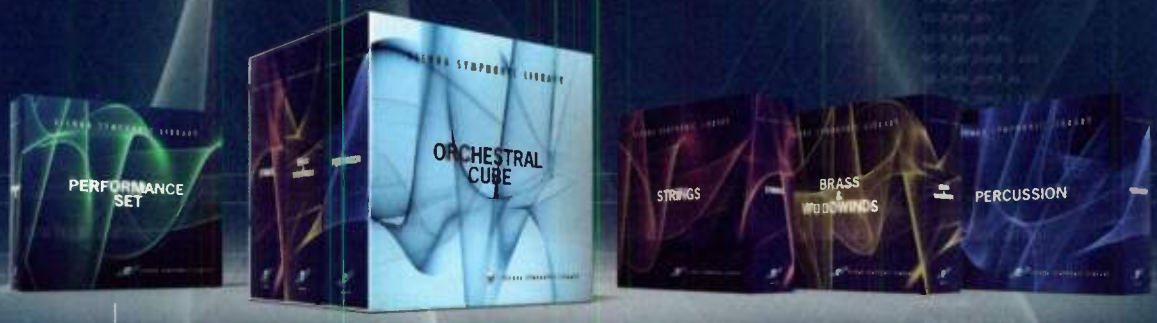

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ILIO

By Scott Wilkinson

Kinesthetic Calisthenics

Not being a keyboard player, I've always been interested in alternate controllers. Such controllers, however, often suffer from inherent deficiencies that limit their usefulness as expressive musical instruments. For example, many players of string-based MIDI controllers complain about a lack of expressive capability caused by a sense of disconnection between their gestures and the music they are trying to play. This is especially apparent when the controller makes no sound of its own.

Kinesthetic feedback could lead to a more expressive bowed-string controller.

To address this problem, Charles Nichols (www.charlesnichols.com), assistant professor of composition and music technology at the University of Montana, is developing a new type of bowed-string controller, called the vBow, as part of his doctoral work at Stanford University's Center for Computer Research in Music and Acoustics (CCRMA). His original idea was to design a controller that mapped a violinist's gestures to various synthesis parameters. However, he discovered that isn't enough to provide a complete sense of connection with the music.

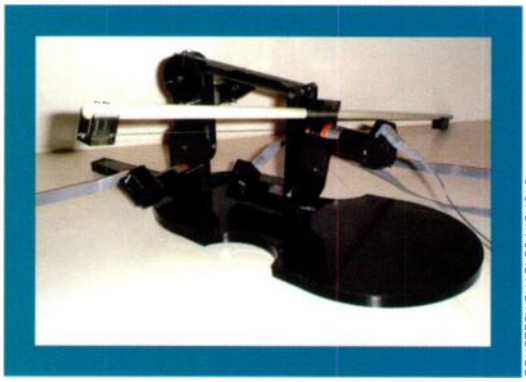
After studying experiments in kinesthetic, or *haptic*, feedback conducted by Sile O'Modhrain and Chris Chafe at CCRMA, Nichols realized that such physical feedback improves a controller's playability and the performer's response to the system. As a result, the vBow not only controls sound parameters according to various bowing gestures, but it gives kinesthetic cues to the performer, similar to what they would feel playing a real violin.

In the current incarnation of the vBow, several pieces of custom-milled acrylic are assembled with servomotors, cables, and capstans into a mechanism mounted on a violin-shaped base, and a fiberglass stick resembling a violin bow passes through a hole in one of the pieces (see Fig. 1). Encoders attached to the servomotors sense the bow's movement in four degrees of freedom: lateral (across the "strings"), rotational (which "strings" are being played), vertical (degree of pressure on the "strings"), and longitudinal (along the length of the "strings"). It's important to understand that the vBow simulates the sound and feel of bowing strings; there are no physical strings involved.

The encoders send their data to a computer running software that applies the information to various parameters of a bowed-string physical model. In addition, the computer sends control voltages back to the servomotors, which impede the bow just enough to simulate the haptic feedback of a real violin; specifically, friction (lateral and longitudinal), vibration (lateral), string-crossing detents (rotational), and string elasticity (vertical).

The physical-modeling synthesis software was written by Stefania Serafin using Synthesis ToolKit, a collection of C++ objects developed at CCRMA for generating computer-synthesized sound. The control software, which provides the haptic feedback, was also written in C++ using libraries supplied with the ServoToGo servomotor-control and data-acquisition card used by the computer to communicate with the vBow.

The latency imposed by Nichols' current computer, a 600 MHz Pentium III running Windows 98, is quite noticeable. As a result, he intends to port the whole thing to a faster processor running RTLinux to reduce that latency and ensure nearly real-time performance. In addition, the system is currently limited to the four open "strings" of a violin; future versions will include vStrings that will track finger positions to derive pitches. Clearly, the vBow is a bold step toward a new type of bowed-string instrument controller that will be far more expressive than anything available today.



COURTESY CHARLES NICHOLS

FIG. 1: The vBow senses the motion of a violin bow in four degrees of freedom, using the data to control synthesis software and provide kinesthetic feedback to the performer.

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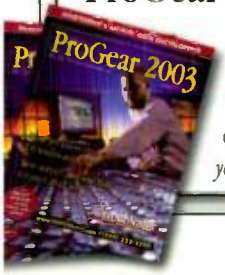

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PRO FILE

By Matt Gallagher

Sound Thinking

Steve Tibbetts's ECM release *A Man About a Horse* is awash in layered guitar and percussion parts that coalesce into a variety of sonic textures. The album melds Eastern and Western musical influences, and often spotlights tabla, gamelan, and gongs in conjunction with electric and acoustic guitars. The music is a result of spontaneous creation combined with meticulous editing and rearranging.

Steve Tibbetts is inspired by chaotic moments in the studio.

Tibbetts began tracking in his studio with two nights of free-form improvisation on guitar. "I record the guitar dry through the [Line 6] Pod and run the signal into a Marshall JCM900 [guitar amp] that I put in the bathroom," he says. "I also run it into an old, 15-watt Matchless Lightning 15 that has a clean sound. Then it's fun to mix them all together. It's a process of layering and forgetting: when something doesn't work, forget about it." After sketching rough guitar parts, Tibbetts enlisted percussionists Marc Anderson and Marcus Wise and bassist Jim Anton to collaborate with him.

"A lot of techniques let you create music without really thinking it out," Tibbetts says. "You can set up a guitar to play diatonic samples. It's like instant composition." Tibbetts uses a Roland GK-2A pickup and a Roland GI-10 guitar-to-MIDI converter to trigger custom samples stored in a pair of Roland S-760 samplers. "I have patches of samples set up on six channels—one for each string. Usually, I'll set up similar groupings of instruments. You can come up with lines of harmonic interest. Pretty soon you end up with a big pile of garbage."

Tibbetts's studio is an analog-digital hybrid featuring a Tascam MS16 16-track reel-to-reel machine that he uses to influence and shape sounds as well as performances. "Analog tape is like playing with clay: it's more amenable to shaping. You can get deeper chorusing and flanging sounds by dipping the speed or ramping it up a tiny bit," he says. Tibbetts further sculpts his sounds with outboard processors: an Eventide GTR4000 Ultra-Harmonizer, a Lexicon LXP1, an Orban 622B parametric EQ, and two Urei LA-4 compressor/limiters. His mic cabinet consists of a Neumann TLM 170, a pair of Neumann KM 184s, and an AKG C 451.

All tracks end up in a Mac G3 with a 500 MHz G4 processor running MOTU's Digital Performer. "I often slave to SMPTE from the 16-track," Tibbetts adds, using a MOTU Digital Timepiece and MOTU MIDI Timepiece AV. He performed mixdown operations on a Power Mac 7100 running Digidesign's Sound Designer II.

Tibbetts's sonic signature includes carefully blended sounds "that you can't identify. I like to take highly evocative sounds like speech and fold them into similar sounds," he says. "A group of voices is a complex sound—it has a lot of overtones and white noise—and a cymbal is like that, too, so it's a good marriage. With Digital Performer, you can get a level of precision that lets you fold low Tibetan horns into a fretless guitar or bass."

Tibbetts built his sample library from his travels in Asia during the 1990s. "I brought a little HHB Portadat and a couple of Neumanns," he says. "I tried to get good samples." Tibbetts finds powerful inspiration in field recordings. "You could wander around any city and record a bed of sounds," he says. "Play any instrument over that, and [the performance] will be loaded with emotion and meaning. Then you can get rid of the background. It's a much more fertile plain to work on than coming in cold and trying to be inspired by the same old sounds."

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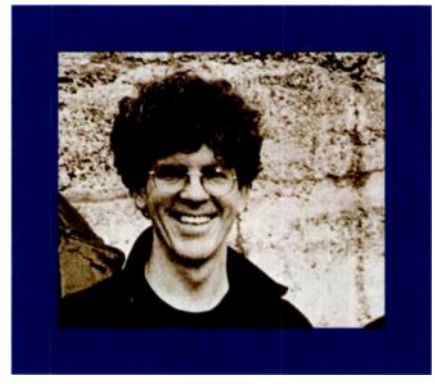

DANIEL CORRIGAN

***A Man About a Horse*/Steve Tibbetts**

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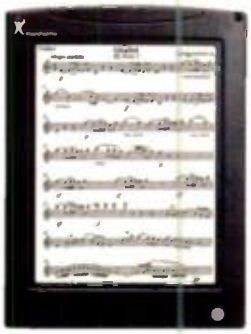

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Ain't It Grand!

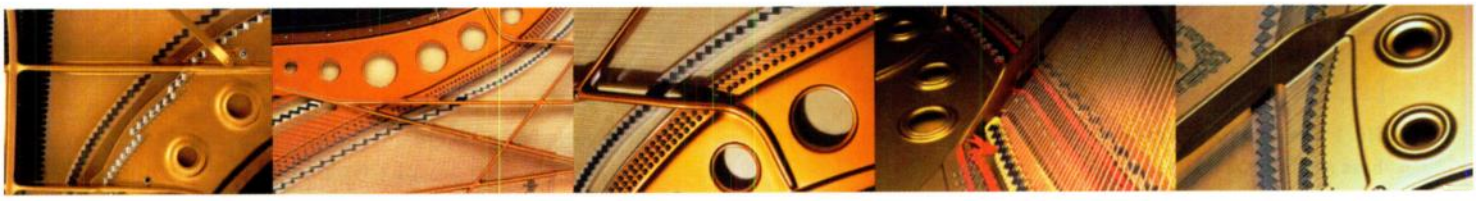
How well have sample-library developers captured the grand piano's many nuances?

By any measure, the concert-size grand piano is a remarkable and awe-inspiring musical instrument. With a length of approximately nine feet and a weight of more than 1,000 pounds, it is the biggest and heaviest acoustic instrument that is commonly used for recording and concertizing (see **Fig. 1**). Except for the pipe organ (which is typically part of a permanent installation), the concert grand piano has the widest range of pitches (over seven octaves) and the widest dynamic range of any acoustic instrument. It is also a highly sensitive and complex piece of machinery that has more than 9,000 individual parts. The piano's great complexity and the arcane nature of its inner workings have made it the ultimate "black box" of musical instruments; even many accomplished pianists aren't quite sure how the instrument really works.

The grand piano's impressive power and wide range of expressiveness have created an unparalleled demand for the instrument. That, in turn, has impelled a growing number of sample-library developers to capture the essence of the piano on sample CDs—a noble cause indeed, for few desktop musicians can afford to park an instrument the size of a station wagon next to their hard-disk recording system. With the newest breed of samplers, especially the powerful new software samplers, the sounds of a concert grand can be triggered—often with surprising realism—from a simple garden-variety MIDI keyboard.

The grand piano, however, is a tricky beast to capture. Its subtle nuances and changing interactive sonorities don't lend themselves easily to the more limited world of samplers. Developers have therefore focused their resources on different aspects of the piano sound, and the resulting sample libraries each offer an individual take on what makes a piano sound like a piano. To fully appreciate their efforts and to assess the appropriateness of a library for your needs, you must first know something of the inner life of a grand piano and what the instrument's true capabilities are.

By David Rubin



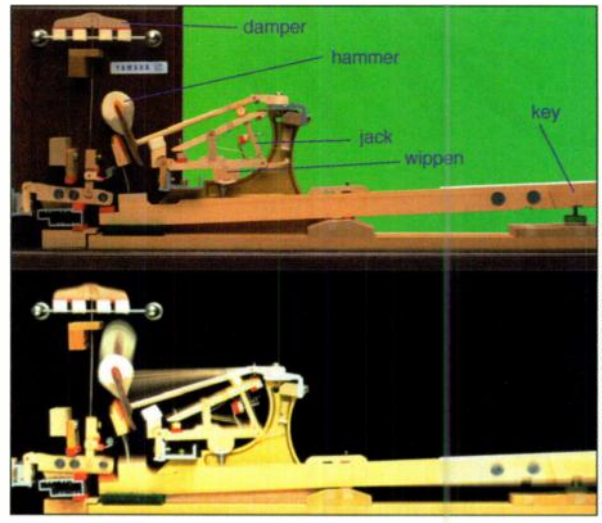
Ain't It Grand!

A LOOK INSIDE

A piano key is simply a wooden lever. When you press the front part of the key, the back end rises and pushes up on the *wippen*, a complex little mechanism made of springs, felt, hinges, adjustment screws, and wooden levers (for a brief glossary of terms, see the sidebar "Piano Parts"). A small fingerlike protrusion within the wippen called the *jack* pushes on the hammer and drives it upward in an arc toward the string (see **Fig. 2**).

If the jack pushed the hammer all the way to the string, it would produce an unpleasant "thunk" because the hammer would strike the string and simultaneously block it from vibrating. The wippen therefore includes an *escapement* mechanism. The jack pushes the hammer almost all the way to the string and then at the last moment (at roughly an eighth of an inch from the string), the jack flips out of the way and sends the hammer into free flight. After striking the string, the hammer rebounds to an intermediate resting position (well away from the string) until you release the key. At that point, the hammer returns all the way to rest.

Some people mistakenly believe that you can shape the tone of a piano by caressing the keys or striking them in a particular way. As you can see, however, the hammer is on its own just before striking the string, so the pianist really only has control over two parameters: how long a note is held and how loudly it is played.



COURTESY YAMAHA CORPORATION OF AMERICA

FIG. 2: The upper photo shows a cross section of the mechanism associated with a single piano key when the key is at rest. In the lower photo, the piano key is activated and the hammer is driven toward the string.

Aside from activating the hammer, the back of the key also raises a small lever that lifts a felt damper off of the string just before the string is hit. When the key is released, the damper drops back onto the string to muffle it.

Ideally, the damper should stop the sound immediately, but in the real world, one or two small pieces of felt are no match for the energy generated by a loudly vibrating piano string, especially the longer, more powerful strings. Moreover, the damper can't really stop the resonance that is generated within the body of the instrument. The cutoff is therefore not always entirely clean (especially after a forceful staccato note). A good piano sample should therefore not impose an envelope with a cutoff that is too abrupt, or it won't sound natural. Some sampled piano libraries even include a separate set of "release" samples to properly capture the sound of the damper cutoff.

Many people are not aware that the dampers cover only about the lower three-fourths of the keyboard (see **Fig. 3**). The short strings in the top one to two octaves die out on their own after being struck (an important point to keep in mind when editing samples). In addition, upper strings are always free to vibrate sympathetically when excited by the upper harmonics from the lower strings. The lack of dampers in the upper register adds a subtle sheen to the sound of a well-tuned piano. A close-miked, carefully recorded sample can capture that characteristic for added realism.

COURTESY BÖSENDORFER KLAVIERFABRIK

FIG. 1: The Bösendorfer model 280 exemplifies the modern concert grand piano with its powerful bass and brilliant treble sections.

STRING THINGS

The piano produces its sounds with two types of strings. In the lower third of

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the keyboard range (the bass section), the strings have a steel core with a copper winding. Since the middle of the 19th century, grand pianos have used an *overstrung* design, wherein the bass strings are mounted diagonally and overlap the other strings. The first several notes in the bass section use single strings, while the rest of the section usually consists of double unison strings; a few models also add several triple unisons (see **Fig. 4**).

The remaining strings are referred to as the treble section. They use unwound steel strings of progressively thinner gauge as the notes move from the low-treble (the tenor section) to the high-treble section. All of the notes in the treble section use triple strings tuned in unison.

The different types of strings have different acoustic properties, and the different configurations mean that there are at least two transitions that are potentially problematic. The transition from single to double bass strings is usually not a serious problem in a well-designed instrument: all the strings are wound, they're strung in the same plane, and the transition is at the low end of the range.

The transition from the bass section to the tenor section is another story. On either side of the *break*, as it's called, the strings are not parallel to each other (the hammers in the bass and treble sections are mounted at different angles), the strings change from wound to plain steel, and the string groups typically change from double to triple unisons. The result is a noticeable change in tone as you play across the break.

Piano technicians refer to the combination of the string lengths, tensions, and wire gauges used in a piano as its *scale*, and one of the objectives of a well-designed scale is to minimize the transition across the break. In addition, careful *voicing* (tone regulation) can help smooth things out. Because different pianos use different scales, the number of bass strings varies from one instrument to the next, and the break may therefore occur at different locations. An astute listener will probably hear the transition even on a good piano. If the transition is too jarring, however, the piano may not have been properly prepared, or it may not be a particularly good instrument. Careful editing and processing

COURTESY STEINWAY & SONS

FIG. 3: In this overhead view of a Steinway model D, you can see that the row of black damper heads ends before it reaches the top section of treble strings. On this piano, the top 17 notes are free to vibrate after their keys are released.

WHAT'S IN A NAME?

All grand pianos have strings that run parallel to the floor, and they all work in more or less the same way. The smaller instruments such as parlor grands, studio grands, and baby grands (see **Fig. A**) simply have shorter bass strings and usually don't sound as good as concert grands, which range in size from a fraction of an inch under nine feet (Steinway D) to more than ten feet (Fazioli Concert Grand).

Verticals, such as consoles, spinets, and uprights use a different kind of mechanism (with many similar parts but a different design) because the strings run vertically at right angles to the plane of the keyboard.

Grand pianos offer a more responsive feel with better tactile control in part because they make better use of gravity in the design of their mechanism. Verticals with their upright orientation must rely more on springs to make the mechanism function, and that along with other design factors often gives them a less precise feel.

COURTESY YAMAHA CORPORATION OF AMERICA

FIG. A: Smaller grand pianos such as Yamaha's 5-foot, 3-inch GH1B are designed to fit into most living rooms but are seldom used in professional recordings or for sample libraries.

It's a mistake, however, to assume that all verticals sound inferior to all grands. Many of the old uprights had bass strings that were as long or longer than some baby grands. Those old pianos offered a dark, rich sound that was often quite pleasing.

Nonetheless, most people buy verticals because they want a compact instrument, and the smaller consoles and spinets with their short, stiff strings can deliver only a mediocre tone quality at best.

To offer the most desirable sound quality and timbre, virtually all piano sample libraries use grands ranging from around six feet to over nine feet in length.

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of samples can sometimes mitigate the problem.

PEDAL POWER

Most high-quality grand pianos have three pedals (see Fig. 5). Let's look at each one individually.

Damper. The pedal on the far right is properly called the *damper* pedal, although it is often referred to as the *sustain* pedal (especially with electronic instruments that don't have actual dampers). When you press the damper pedal, it raises all of the dampers at once. Any notes played while the damper pedal is down blend together and continue to ring until they die out naturally or until you release the pedal. A single note played with the damper pedal down sounds different than the same note with the pedal up, because releasing the dampers from the neighboring strings allows them to vibrate sympathetically, adding a much fuller but less distinct sound to the note.

The damper pedal is used most effectively for connecting chords. You play a chord and press the pedal before releasing the keys. The pedal sustains the notes as you move your fingers into position for the next chord. You then play the next chord as you release the pedal to cut off the previous notes. Press the pedal again to sustain the current chord and the pattern repeats.

The damper pedal is the most important pedal on the piano, but in many sampled piano libraries, it is not very effectively rendered. The usual approach is to have the MIDI keyboard's sustain pedal extend the sustain segment of an

A GRAND HISTORY

Harps, zithers, dulcimers, and similar stringed instruments have been around for thousands of years, but it was not until the Renaissance period that a set of strings was combined with a keyboard and a mechanical interface to create an early form of the harpsichord. The harpsichord eventually caught on throughout Europe during the Baroque period and quickly displaced the lute as the instrument of choice for accompaniment and solo performance. It also set the stage for the later arrival of the piano.

The harpsichord produced its sound by plucking the strings with quills when the keys were pressed. However, because of the nature of the mechanism (called the *action*), performers could produce only a single dynamic level regardless of how hard or soft the key was struck. In more elaborate harpsichords, a second mechanism and set of strings (often tuned an octave higher or lower) could be linked to the first set to provide more volume. The second set was typically activated with a hand stop.

Having only a couple of volume levels was fine during much of the Baroque period, with its "terraced" dynamics. By the late 17th century, however, keyboard players were demanding a greater degree of expressiveness. They wanted more than just loud and soft; they wanted all the gradations in between.

Instrument makers in several countries began working on a solution, but it was the ingenious design of an Italian harpsichord maker named Bartolommeo Cristofori (1655–1730) that proved to be most successful. Around 1709, Cristofori introduced his new *gravicembalo col piano e forte* (harpsichord with soft and loud), which came to be known as the pianoforte and eventually as simply the piano.

By 1720 Cristofori had further improved his design. Although the piano continued to evolve over the next 150 years, its essential design concept has remained unchanged to this day: pressing a key activates a hammer (originally leather but now felt) that strikes a string or group of unison strings. The harder you strike the key, the harder the hammer strikes the string. As the key is pressed, a felt damper is released from the string to allow the string to vibrate. When the key is released, the damper returns to stop the sound.

Cristofori's design not only allowed subtle gradations in loudness, but it let the musicians play different notes with different dynamics simultaneously. That feature proved to be essential to the instrument as the new music of the time began to stress prominent *cantabile* melodies against more restrained accompaniments.

Cristofori's groundbreaking invention garnered little press in his home country. But in Germany, Austria, England, France, and later the United States, the piano evolved rapidly in myriad ways as its popularity grew.

The 19th century brought several important innovations to the grand piano. In 1821 Sébastien Érard introduced his *double-escapement mechanism*, which allowed for extremely fast repetition of notes. Four years later, Alpheus Babcock invented the one-piece cast-iron plate (frame), which by then was needed to withstand the increasing tension caused by the growing number and thickness of the piano strings.

The brilliant and thunderous 88-note concert pianos of the late 19th century were a far cry from the modest four-octave Italian instrument that spawned them. Modern grand pianos typically have more than 230 individual strings that exert a combined tension of more than 20 tons on the plate! In a concert-size grand, the lowest string has a speaking length of well over six feet, while the highest string is only a few inches long. It's easy to see how the piano's dynamic qualities, combined with its wide range of pitch and expressiveness, make it a daunting challenge to sample effectively.

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ADSR envelope. That comes close to achieving the right effect, but it doesn't take into account the interaction of the whole range of undamped strings and the resulting sympathetic vibrations that occur.

More sophisticated (and larger) libraries address this issue by including several layers of samples with the pedal down and with the pedal up. That creates a more complex sampled instrument but one that comes closer to the original sound. The MIDI Specification designates controller number 64 for the damper pedal, and all MIDI keyboard controllers provide a ¼-inch damper-pedal (or sustain) output jack.

Sostenuto. The middle pedal is the *sostenuto* pedal. As its name suggests, it is used to sustain notes. But unlike the damper pedal, which indiscriminately holds notes by lifting all the dampers at once, the sostenuto pedal sustains only those notes that are being held when the pedal is pressed. Through the use of a clever device, the sostenuto mechanism catches and holds any dampers that are in the raised position; notes played after the pedal is pressed behave in the usual manner.

For example, you could play a triad with the left hand and press the sostenuto pedal to sustain those notes. You could then use both hands to play scales, melodies, and other chords while the original triad sustains until it dies out naturally (or you release the pedal). A common use of the sostenuto pedal is to play an octave as a held "pedal point" in the bass as you improvise against it in the treble.

Historically speaking, the sostenuto pedal is a rather recent addition to the piano, and its appearance in the literature is relatively less common than with the other pedals. Nonetheless, it is a useful resource to keep in mind when sequencing with sampled pianos. The MIDI sustain pedal could work as a sostenuto pedal, but you'll have to split the piano part between two tracks to separate the sustained notes from the others. You can, however, create the sostenuto's three-hands-playing illusion with a little planning and some careful MIDI editing. If your MIDI keyboard supports it, you can also use a pedal to send MIDI controller number 66 messages, which are designated in the MIDI Spec for sostenuto.

Una corda. The pedal on the left is the *una corda* pedal, but most people

PIANO PARTS

action—the mechanism of a piano, consisting of thousands of parts, that enables the pianist to play the notes.

bass section—the lowest-sounding section of strings on the far left of the piano, which consists of the copper-wound steel-core strings. The number of bass notes varies from piano to piano based on the stringing *scale*.

break—the transition between the *bass section* and the *tenor section*.

concert grand—the largest of the grand pianos—usually around nine feet long. It is used extensively in jazz and classical concert performances as well as in many recording sessions.

damper—a device that uses small blocks of felt to cut off the sound of a vibrating string when the key is released.

damper pedal—the pedal on the far right which when pressed raises all of the dampers at once. It is also called the *sustain pedal*.

equal temperament—a system of tuning wherein each octave is divided into 12 equal semitones.

escapement—a mechanism that flips the *jack* out of the way at the last moment, allowing the hammer to freely strike the string and rebound to a position that is clear of the vibrations.

inharmonicity—the discrepancy between the actual overtone frequencies produced by a vibrating string and the theoretical (mathematical) overtone frequencies from the same fundamental.

jack—a small wooden fingerlike device (part of the *wippen* assembly) that pushes against the hammer, driving it toward the string.

regulating—adjusting the moving parts in a piano to establish the proper alignments, clearances, and other specifications.

scale—to piano technicians and designers, the scale—also known as the stringing scale—refers to the combination of string lengths, gauges, and tensions used in a piano.

soft pedal—see *una corda pedal*.

sostenuto pedal—this pedal functions as a type of selective damper pedal. Playing one or more keys and then pressing the sostenuto pedal before releasing the keys sustains only those notes; keys played after the pedal is pressed are not sustained and function normally.

sustain pedal—see *damper pedal*.

tenor section—the section of strings (part of the *treble section*) just to the right of the *bass section;* the tenor section has the longest unwound strings.

treble section—the range of unwound steel strings that includes all of the notes except the bass notes.

una corda pedal—this pedal, also called the *soft pedal,* shifts the keybed and hammers a small amount to the right, producing a quieter sound with a softer timbre.

voicing—adjusting the tone of a piano by hardening or softening the hammers and by *regulating* the instrument to optimize tonal quality.

wippen—the small triangular mechanism (which includes the *jack*) that serves as the mechanical interface between the back of the key and the corresponding hammer.

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just call it the *soft* pedal. When you press the soft pedal, the entire key bed—keys, hammers, and wippens—shift slightly to the right (in most cases) so that in the treble, the hammers strike only two of the three strings in each unison group. (In the upper bass, the hammers strike only one of the two strings.)

Of course, having fewer strings hit per note makes the notes quieter, but there's much more to the soft pedal than most people realize. Notes played with the soft pedal aren't just quieter, they also have a noticeably different timbre. That's partly because a two-string unison simply sounds different than a three-string unison. But more importantly, the change in timbre comes from the fact that the hammers have shifted out of their usual positions and are now hitting the strings with a part of the hammer surface that is not normally used. The more compacted part of the hammer's striking point is temporarily replaced with softer, less used felt.

COURTESY BÖSENDORFER KLAVIERFABRIK

FIG. 4: The bass section of this 88-note Bösendorfer concert grand has 17 notes: 7 single-string notes and 10 double-string notes. Other makes and models of pianos may have different numbers of bass notes with different combinations.

Even with a well-voiced piano with relatively new hammers, you can still perceive a subtle change in timbre. In addition, the unstruck string in each group is still free to vibrate sympathetically with its neighbors, adding another subtle element to the tone color.

As you can see, the soft pedal produces notes that are softer both in volume and in timbre. A truly complete sampled piano library should include samples with the soft pedal engaged, because you can't accurately capture the sound by just lowering the volume. The MIDI Spec designates controller number 67 for triggering the soft-pedal effect, but unless you have a separate set of samples (a rarity), the effect probably won't be too realistic.

One final point should be made, especially for nonpianists: you don't have to use the pedals one at a time. Any combination of pedals is theoretically possible, although some combinations make more sense than others. Nevertheless, you could, for example, use the una corda pedal to soften the tone while pressing the damper pedal to sustain the notes. Or you could hold notes with the sostenuto pedal while pressing and releasing the damper pedal. Re-creating various pedal combinations is a big problem when working with sampled pianos, but the more sophisticated libraries with more samples might get you closer to a convincing sound.

FINE-TUNING

Much has been written in recent years on the subject of various alternate and historical tuning systems, and new approaches to tuning continue to appear. Most people, however, are only concerned with having a piano that sounds as clean as possible and they aren't seeking arcane historical or experimental tunings. Nevertheless, the wide range and unique design of the piano can cause problems—even with a standard tuning—when the instrument is added to an ensemble. It may therefore be helpful to take a brief look at how pianos are tuned.

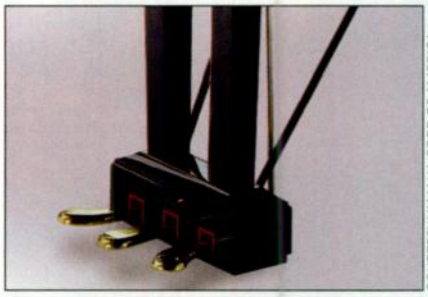

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FIG. 5: Most high-quality grand pianos have three pedals (from left to right): the una corda, sostenuto, and damper pedal.

Because of certain laws of physics (I won't bore you with the details), it is simply impossible to divide an octave into 12 chromatic steps in such a way that all possible intervals (thirds, fourths, fifths, sixths, and so forth) sound optimal. When you slightly widen or contract certain intervals to favor them, other intervals suffer.

All tuning systems, or *temperaments*, involve some kind of compromise. For example, the *mean-tone temperament* that was widely used throughout the 16th and 17th centuries offered a pure-sounding third and an almost pure-sounding fifth. That yielded a more sonorous sound than modern tunings do, but only in a few keys The rest of the keys (beyond about one or two sharps or flats) went from bad to worse. Several keys were simply unusable.

A newer system called *equal temperament* began to catch on in the 18th century, although its roots go back much farther than that. The idea behind equal temperament was to divide a pure octave into 12 equal semitones. That means that no interval except the octave is acoustically pure, but the amount of deviation in the various intervals is kept acceptably small by spreading it out more or less evenly. Thanks to equal temperament, pianists can transpose into any key they want, composers can fluently modulate into and out of different tonal centers, and jazz players can continue to expand the harmonic vocabulary of music.

However, not all equal temperaments are equal. In an ensemble, oboists, trombonists, vocalists, violinists and other players are constantly making

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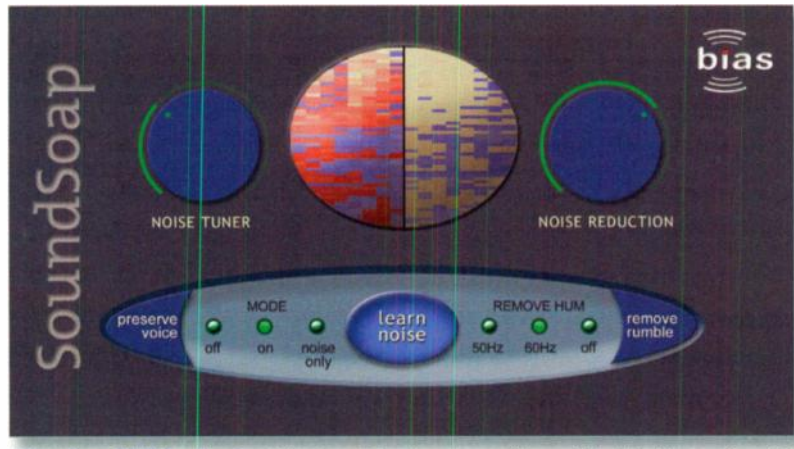

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subtle adjustments in pitch to blend in. The piano's pitches, on the other hand, are fixed. It doesn't seem like that should be a problem, but it can be.

Inharmonicity. When a piano string is struck, it vibrates as a whole (generating a *fundamental* frequency) as well as in progressively shorter segments producing a series of *overtones*. The shorter a string (or vibrating segment) is, relative to its thickness, the stiffer it is. And the stiffer a string (or segment) is, the faster it vibrates. The first overtone of A 440 should vibrate at exactly 880 Hz, and the third overtone should vibrate at 1760 Hz. Because the segments get progressively shorter, however, the pitches get progressively sharper. That discrepancy between the theoretical pitches and the actual pitches of the overtones is called *inharmonicity*.

To compensate for inharmonicity, piano technicians "stretch" the octaves slightly so that the first overtone of a note doesn't clash with the fundamental of the note an octave above. Following the procedure up the keyboard from the middle section yields progressively more deviation as notes get

THE LIST GOES ON

It is truly amazing how many sampled-piano libraries are currently being marketed. All of the major sample-library distributors have at least one title and as you can see from this article, a number of smaller companies have also gotten into the act. Although I couldn't possibly review all of the available piano libraries in detail, here are several more worth considering.

Bigga Giggas
Post Piano Suite, vol. 1
This is another library from Michiel Post, the world's busiest piano-sample producer. It includes a good general-purpose unlooped Steinway D with four pedal-up layers, two pedal-down layers, and a release layer. Other patches include several pitched percussion instruments (including celeste, marimba, and vibes), electric pianos, and prepared piano.

BitHeadz
Black & Whites
Black & Whites is a standalone sampled piano that is also a piano module for use with Unity DS-1. The module includes mono and stereo samples from a Steinway B and D with three pedal-up layers *(p, mf, f)*. It also includes several Rhodes electric piano patches and a string-ensemble patch.

Miroslav Vitous
Acoustic Piano
This library contains mono and stereo patches based on a Hamburg Steinway D from a popular Prague concert hall. It has two pedal-up Velocity layers and no pedal-down or release layers.

Patchman Music
Studio Series MegaPiano
The MegaPiano library for Unity DS-1 and Akai S5000 is based on a Steinway grand. It was recorded dry and offers as many as three unlooped pedal-up Velocity layers with about half the notes sampled. Pedal-down layers are not offered but the Akai version includes release samples and several strummed and plucked-string patches.

Prosonus
Grand Piano
The Prosonus library is based on a Steinway grand with samples of all 88 notes. Two pedal-up Velocity layers are provided *(mf and ff)* in the largest (128 MB) bank. Smaller banks are also included.

Steinberg
The Grand
Steinberg's The Grand is not really a sample library but rather a complete VST instrument with its own editing window, user interface, and onscreen keyboard. The Grand is based on the same recordings as Wizoo's Platinum24 Grand Piano. The cross-platform three-CD set demands plenty of free RAM to function properly and includes multiple unlooped pedal-up and pedal-down layers, release layers, true sostenuto action, and hammer release sounds along with several other features and editable parameters.

Universal Sound Bank
Acoustic Pianos, vol. 1
This library, recorded in Paris, includes a Steinway D and a Yamaha C7 with up to four pedal-up layers.

William Coakley
The Perfect Piano Series, vols. I and II
These are the first in a series of piano libraries from developer William Coakley. Volume I offers multilayered Steinway D and Kawai B grands with 16-bit, 16 MB looped patches in a variety of formats. Volume II offers a Fazioli concert grand and a Steinway D with 32 MB looped patches.

Wizoo
Platinum24 Grand Piano
The Platinum24 library is based on the same recordings (but edited differently) that were used to create Steinberg's The Grand VSTi. A late-model, top-of-the-line, $100,000 concert grand (Wizoo and Steinberg refuse to divulge the make) was meticulously sampled in state-of-the-art German facilities. The largest (1.1 GB) preset provides five pedal-up layers, five pedal-down layers, and no release layers. Depending on the preset, 22 or 42 samples are used per layer. Four different timbres—Natural, Bright, Hard, and Soft—are provided in three preset sizes.

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tuned higher. From the middle of the keyboard down, the notes get progressively lower as the octaves stretch in the opposite direction. When properly done, the piano sounds perfectly in tune with itself, but the notes in the high treble and low bass may not match the same notes from an instrument that doesn't suffer from inharmonicity.

For example, writing a unison line in the high treble for synthesizer and piano or electric organ and piano is sure to cause trouble. The piano will most likely sound sharp in that register compared to the other instruments. In some cases, you may be able to alter the tuning of specific notes in your synthesizer or sampler. If you're handy with SysEx data, you can try using MIDI's Single Note Tuning Change message to adjust notes on the fly, but it's far easier to simply avoid problems through careful orchestration.

Surprisingly, two pianos may not even match each other. A large piano will likely have much less inharmonicity

Product Information

Company	Title	Format	Price	Contact
Art Vista	Malmsjö Acoustic Grand	Giga	$100.00	(310) 398-4625; www.artvista.net
Bardstown Audio	Bösendorfer Imperial Grand	EXS24, Giga, HALion	$199.00	(800) 814-0820 or (502) 349-1589; www.bardstownaudio.com
Best Service/dist. by EastWest	Total Piano	Akai S1000/5000/6000, E-mu EOS, Giga	$175.00	(800) 969-9449 or (310) 271-6969; www.bestservice.de
Big Fish Audio	John Cage Prepared Piano	Akai S1000, Giga	$199.95	(800) 717-3474 or (818) 768-6115; www.bigfishaudio.com
Bigga Giggas	Estonia Acoustic Grand	Giga	$95.00	(760) 789-3791; www.biggagiggas.com
Bigga Giggas	FortePiano	Giga	$95.00	(760) 789-3791; www.biggagiggas.com
Bigga Giggas	Post Piano Suite, vol. 1	Giga	$129.00	(760) 789-3791; www.biggagiggas.com
BitHeadz	Black & Whites	Unity DS-1	$199.00	(831) 465-9898; www.bitheadz.com
EastWest	Bösendorfer	Giga, HALion	$199.95	(800) 969-9449 or (310) 271-6969; www.soundsonline.com
EastWest	Steinway B	Giga, HALion	$199.95	(800) 969-9449 or (310) 271-6969; www.soundsonline.com
EastWest	Ultimate Piano Collection	Akai S1000, E-mu EOS	$199.95	(800) 969-9449 or (310) 271-6969; www.soundsonline.com
Miroslav Vitous	Acoustic Piano	Akai S1000, E-mu EOS, Roland	$149.00	(800) 747-4546 or (818) 707-7222; www.ilio.com
Northstar	Grand Gold Pianos	E-mu EOS/ESI/EIII	$249.00	(503) 760-7777; www.northstarsamples.com
Patchman Music	Studio Series MegaPiano	Akai S5000, Unity DS-1	$145.00	(216) 221-8282; www.patchmanmusic.com
Post Musical Instruments	Grandioso Steinway D	Giga	$295.00	(323) 726-0303; www.tascam.com
Prosonus	Grand Piano	Akai S1000/5000, E-mu, Kurzweil, Roland	$199.95	(800) 717-3474 or (818) 768-6115; www.bigfishaudio.com
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Steinberg North America	The Grand	VSTi	$299.99	(818) 678-5100; www.us.steinberg.net
Tascam/NemeSys	GigaPiano	Giga	$99.00	(323) 726-0303; www.tascam.com
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than a small piano (due in part to the different stringing scales), so note for note, its top register will not sound as sharp as the small instrument's top end. In rare cases, a sampled piano may be offered with an alternate tuning, but most of the time the pianos are tuned to sound their best by themselves, and in most settings that works out the best.

PIANO MOVES

Before you go shopping for a piano-sample library, keep in mind that there is no objective standard for how a piano should sound. It's largely a matter of opinion and personal taste. Moreover, different pianos work better in different settings. For example, a piano that sounds too strident when playing Debussy may be perfect in a rock piece where it has to cut through a busy arrangement. And a piano that sounds great as a solo instrument might not play well with others in an ensemble. For that reason, many desktop musicians keep several piano libraries on hand so they can have some latitude in choosing the proper sound.

Sampled pianos are also greatly affected by the miking techniques used and by the acoustic characteristics of the room where the recording was made. Some people prefer their samples to be very dry so they can completely control how much reverb is added; other people prefer samples with a bit of natural reverb so the instrument sounds more realistic right out of the box. Some sample libraries offer both dry and processed presets.

In several of the sampled pianos, the notes pan from left to right as you move up the keyboard. That's great if you like hearing the instrument from the player's perspective, but it could be a problem if you're adding the piano part to other instruments in a score. You may have to do some minor editing if the panning causes a problem. Some libraries include presets from the player's as well as from the audience's perspective.

A number of piano libraries include individual samples for each of the keyboard's 88 notes (and for each of several Velocity layers). That approach yields the most accurate reproduction of the instrument, but it doesn't necessarily guarantee the best overall sound. Even the best pianos have a few weak notes here and there, so choosing the best of the 88 notes and spreading them out to fill the keyboard range may provide a more uniform sound.

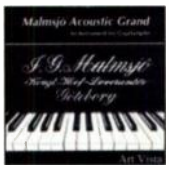
An 88-sample patch could produce the ultimate virtual piano, but only if the original instrument is in excellent condition and is carefully tuned and regulated before being sampled. Otherwise, you simply end up with an accurate re-creation of a second-rate instrument.

On the other hand, using fewer than

about 30 samples to represent the entire keyboard range robs the instrument of some of its unique character and blurs the natural timbral changes that appear when playing a real piano. As you can see, there are no definitive guidelines to rely on; each sampled piano must be assessed according to its intended use. In some recording situations, for example, uniformity might trump strict realism; as always, it's a matter of taste and expectations.

PIANO IMPRESSIONS

It would be completely impractical to review every sampled-piano library on the market; there are far too many. The following reviews, however, represent a good cross section, and several of the products reviewed are among the best that are currently available. Not surprisingly, the top-notch libraries are often the largest in size, with several Giga and HALion format instruments exceeding 1 GB. In general, the most realistic instruments have several Velocity layers for damper-pedal-up and damper-pedal-down (sustained) notes, and some also include separate release (or resonance) samples for added verisimilitude. Whenever possible, try to get a demo of the product before making a purchase. And remember that one piano seldom works in all situations.



Art Vista Malmsjö Acoustic Grand

Art Vista's two-CD Malmsjö (pronounced malm-sheu) Acoustic Grand library offers GigaStudio users a chance to play a rare 19th-century Swedish "salon" grand. The six-foot Malmsjö was made in 1894, and its interesting provenance is detailed on the Art Vista Web site.

Each note on the piano was sampled at four levels *(ppp, p, mf, f)* and allowed to ring until it faded out. The choice of recorded dynamic levels and the careful calibration of the dynamic response has yielded an instrument with smooth control over quieter, more subtle dynamics. Because the Malmsjö has an 85-note keyboard (not unusual for a 19th-century instrument), the top three notes are pitch-shifted up from lower samples.

In an unusual (some might say questionable) move, developer Hans Adamson decided to sample all of the notes with the damper pedal down. That yields a more resonant sound that works well when you use your MIDI keyboard's sustain pedal, but some people might object to the lack of focus when playing individual notes. The piano's sound is soft and velvety, and the added resonance provides a faintly ethereal reverb quality. The bass notes, however, lack the punch of a large modern piano, and the overall sound may not hold up well in a hard-hitting mix, although it might blend nicely in some orchestral settings.

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All of the samples have been carefully edited and processed, resulting in a smooth and consistent keyboard sound without any obvious breaks. The amplitude-envelope releases seem a bit unnatural, because each note transitions quickly from the resonant pedal-down sound to silence. Still, if historical instruments appeal to you and if you like your pianos mellow, this might make an appropriate choice for many new-age, classical, or pop projects.

Bardstown Audio
Bösendorfer Imperial Grand

With a length of 9 feet, 6 inches, the Austrian-made Bösendorfer Imperial Grand model 290 is a formidable piece of work, and developer Kip McGinnis has done an admirable job of capturing this top-of-the-line instrument. The Imperial Grand is famous for its 97-note keyboard; the extra keys are added to the bass section with the keytop colors reversed so they'll stand out.

A few 19th- and 20th-century piano pieces make use of the extended bass section, but even with pieces written for the traditional 88-note keyboard, the extra bass strings contribute to the sound. With the damper pedal down, the low strings are free to vibrate sympathetically, adding a subtle richness to the piano's timbre, especially in the bass and tenor sections.

Because MIDI keyboards don't usually have more than 88 keys, McGinnis decided to limit his sampled piano to the traditional keyboard range. (Each note was individually sampled.) The extra bass strings do come into play, however, because the Bardstown Bösendorfer library includes four Velocity layers with the damper pedal up, four layers with the pedal down, and a complete set of release samples.

The resulting sampled piano is highly responsive and real sounding. The Bösendorfer's "European" sound is bright but not edgy or strident. The bass notes are assertive, punchy, and clear without the clashing overtones and muddy sound of some smaller instruments. The treble is clean and focused all the way to the top. Because the piano was recorded in a concert hall setting, a modest amount of natural reverb is present.

Bardstown's version 2.3 upgrade adds a second, heavier Velocity curve to mimic a real piano keyboard more closely, and it adds a smoothed-out patch where the samples have been processed to minimize the natural variations between notes (although the original unaltered samples sound great). The Bardstown Audio Bösendorfer is a versatile instrument that is equally well suited to classical, jazz, or pop music. It shines as a solo instrument and should hold up beautifully in most mixes. Aside from the original 16-bit Giga version, this library is also offered in an improved four-CD 24-bit version for HALion and EXS24. By the time you read this, a version should also be available for Native Instruments' Kontakt.

Best Service
Total Piano

The two-disc Total Piano library from Best Service was produced by well-known sample-master Peter Siedlaczek. Recorded at the Chopin Academy of Music in Warsaw, this wide-ranging collection of piano sounds offers a rich potpourri of exotic unprocessed acoustic sounds and special effects that are often quite surprising.

The first part of the collection offers two main patches: a Brilliant Classical Piano patch and a Pop Piano patch. Both offer pedal-up and pedal-down samples, but they rely on only two Velocity layers *(mp* and *ff)* and lack separate release samples. In addition, only about every third or fourth note was sampled across the keyboard.

I like the bright Pop Piano patch with its buoyant quality; it might work well for some styles of ragtime or country-western music. The Classical Piano is more useful as a general-purpose instrument, although it lacks the subtlety and sophistication of some of the high-end libraries.

The rest of the Total Piano collection is more fun than a barrel of monkeys. The Harpsichord patch, for example, was created by playing the strings with a metal plectrum. The resulting sound is an unusual hybrid that melds the twangy timbre of a harpsichord with the range, depth, and damper-pedal capabilities of a piano. Cimbalom was created by hitting the strings with wooden mallets. It has an appealing ethnic-sounding quality that is vaguely like a cross between a hammered dulcimer and an Irish harp. The Circular Saw patch was produced by vibrating the strings with a "motor-driven cogwheel." The zingy sound takes on an almost Asian quality in some registers. The Hyper Piano and Magic Piano patches transform the piano notes into muted ethereal sounds.

Thai Piano was recorded with metal screws between the strings; Rubbery Piano used bits of rubber instead of screws. The Thumb Tack Piano patch offers a very nice harpsichord-like variation. The rest of the library includes an array of percussive sounds, ambient textures, musical effects, noises, and sound effects too numerous to list. The samples are all great and should provide valuable fodder the next time you have to score a sci-fi or horror flick.

Big Fish Audio
John Cage Prepared Piano

If you're a fan of John Cage or you've ever wanted to experiment with "prepared" piano, this library is the ultimate resource. Based on Cage's written instructions, the two-CD set meticulously re-creates the preparation used in *Sonatas & Interludes,* the composer's landmark work from the mid-1940s. Nuts, bolts, screws, and pieces of rubber and wood (most from the original collection) were wedged between

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the strings of a Steinway model B according to Cage's detailed Table of Preparation at the head of the score.

The piano was then sampled in 24-bit resolution at three dynamic levels *(p, mf, f)* for staccato and sustained notes with all pedals up and also with the soft pedal down. The wide-ranging collection of presets is the only sample library authorized by the John Cage Trust. It affords a rare opportunity to accurately reproduce the music of John Cage without jamming a bunch of hardware into the family piano.

If you're not interested in its historical value, you can use the library as a palette for creating new sonic textures. Improvising on many of the patches produces an Indonesian-gamelan-meets-American-Steinway sound that is both fascinating and fun to play.

Bigga Giggas Estonia Acoustic Grand

Wedged between Russia and Latvia and bordering the chilly Baltic Sea, Estonia is a small country with a history of piano making that dates as far back as the latter part of the 18th century. Although it's not one of the big names in the world of piano manufacturing, the country's primary piano maker, the Estonia Piano Factory (founded in 1873), continues to produce a limited line of high-quality European-style grand pianos that have garnered rave reviews from a number of famous pianists.

The Bigga Giggas Estonia Acoustic Grand library was produced by prolific piano-sampler Michiel Post who captured the 9-foot concert grand with three pedal-up layers, three pedal-down layers, and four release layers (two up, two down). The full keyboard range was derived from 53 individual samples in each layer, and the notes have been left unlooped.

The first thing you notice when you play this instrument is how inviting it sounds. The lush bass section blends easily into a genteel tenor section; the low treble is smooth and velvety. The notes above the damper section have noticeably more resonance from the open strings than most other pianos, which may not appeal to everyone, but it gives the top octaves a nice luster. Minor flaws in the sound (a very faint buzzing in a couple of notes and some unevenness in the bass section) don't distract from the warm, understated character of the instrument.

The Estonia isn't the kind of piano to use for playing Little Richard hits;

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it's more appropriate for slow ballads, soft jazz, and a wide range of classical styles. And best of all, this elegant Eastern European piano can be yours for less than a hundred dollars, making it one of the least expensive libraries in this roundup.

Bigga Giggas FortePiano

If you've only played Mozart and Haydn on modern pianos then you've never really heard the music as the composers did. The 18th century pianoforte (also known as the fortepiano) was much smaller and lighter than the modern piano. The hammers were also smaller and the strings were under considerably less tension (see the sidebar "A Grand History"). The resulting tone was bright and limpid but with less sustain and with a narrower dynamic range.

Functional pianofortes from the 18th century are quite rare, but producer Michiel Post has successfully sampled a restored Anton Walter instrument. The 73-note FortePiano library includes three pedal-up, three pedal-down, and one release layer. The smaller hammers and lower string tension add a harpsichord-like flavor to the sound, although the response is definitely that of a piano. The Bigga Giggas FortePiano library provides a great chance to explore the true sound of the modern piano's early predecessor, and you can do it for less than $100.

EastWest Bösendorfer

For producing EastWest's Bösendorfer sampled piano library, Olivier Truan chose a 1995 Bösendorfer model 275. At just over nine feet in length, the 275 is a substantial instrument, although unlike the model 290, it "only" offers four extra notes in the bass; EastWest includes the extra notes in the library, extending the range down to F below the usual bottom A.

The piano was close-miked by Truan and his team in a Swiss studio, and each note was sampled at four Velocity levels with the pedal up and four levels with the pedal down. No release samples are included, although the releases sound convincing thanks to some careful editing of the unlooped stereo samples. In this library, every note was not sampled; depending on the layer, roughly two to three dozen notes throughout the range were derived by pitch-shifting a neighboring note.

The overall sound of the piano is smooth and transparent, the bass is full and brassy and the top octave shines with crystalline clarity. The voicing and tuning are exemplary. Unlike the Bardstown Bösendorfer, which includes a small amount of natural reverb, the EastWest Bösendorfer was recorded rather dry. The pristine recording quality, however, offers an excellent basis for adding your own processing.

Ain't It Grand!

EastWest's Bösendorfer is a highly responsive instrument and the four layers (*p, mf, f, ff*) blend seamlessly into one another providing a satisfying and realistic playing experience. If you need a good general-purpose piano, the 1.8 GB EastWest Bösendorfer is worth considering. It would be just as much at home playing Brahms or Chopin as contemporary jazz or pop.

EastWest
Steinway B

Steinway's model B has long been a favorite for schools and recording studios because it offers a punchy professional-level sound in a more compact 6-foot, 11-inch case. For EastWest's library, producer Olivier Truan sampled a fine Hamburg Steinway in the same Swiss studio that he used for the Bösendorfer library. (Many performers prefer the German Steinway to its American counterpart.)

The Steinway appears to have been miked in a similar way to the Bösendorfer, with little natural room reverb. The digital recordings are very clean, and the careful editing has yielded excellent results. Unlike the Bösendorfer library, however, the Steinway library only offers six Velocity layers: three with pedal up and three with pedal down. Separate release samples are not included.

With only three layers for each pedal position, the Steinway's dynamic transitions are not quite as smooth as the Bösendorfer's. The jump to the highest level is occasionally noticeable. The stereo samples are all unlooped and allowed to fully decay (up to two minutes in a few cases). Unlike the Bösendorfer library, every note on the keyboard was sampled.

The Steinway's overall sound is broad and well-balanced. The low bass growls nicely yet remains warm and sonorous. The tenor section is assertive yet smooth. The high treble is clean, bright, and resonant right to the top of the keyboard. In short, this is a fine midsize piano that is well suited to a range of contemporary styles. If you're looking for that characteristic Steinway sound for recording or studio work, this library could serve you well.

EastWest
The Ultimate Piano Collection

Like the previous two EastWest libraries, the Ultimate Piano Collection was recorded in Switzerland by developer Olivier Truan. Released in 1995, this single-CD collection preceded the other two libraries by a few years and was created specifically for hardware samplers (first Akai, then E-mu). As the name suggests, this is not a one-piano library but rather a collection of four top-notch instruments: Fazioli F-228 (7 feet, 6 inches), Bösendorfer 225 (7 feet, 4 inches), Steinway D (8 feet, 11.75 inches), and Steinway C (7 feet, 5 inches).

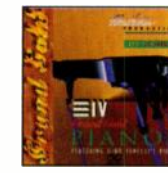
Although the pianos themselves are excellent instruments, the sample libraries that were derived from them are seriously hampered by the inherent RAM restrictions imposed by the hardware samplers. As a result, only a few banks of samples are offered for each piano. (You can combine the banks as needed for various controller- or Velocity-switching presets.)

The Steinway D and the Fazioli provide Loud, Soft, Pedal-down, and Marcato banks. The Steinway C offers Loud, Pedal-down, and Marcato; the Bösendorfer only offers Loud and Marcato. The confusingly named "Marcato" samples are actually the same as the loud samples, but they're edited down to 2.5 seconds to conserve memory. The shorter samples make it feasible to include more individual samples in a bank, which minimizes the need for pitch-shifting samples. The Steinway D, for instance, has every note sampled in the Marcato bank but only has 55 individual samples in the Soft bank. The Marcato bank makes sense if you play a lot of fast music; long samples would simply eat up RAM unnecessarily.

The Fazioli F-228 is a highly regarded handmade instrument from a small Italian company founded by Paolo Fazioli in 1979. Faziolis are noted for their meticulous craftsmanship and astronomical price tags. EastWest's Fazioli has a pleasing velvety smooth sound from the tenor section all the way to the top of the treble. I especially like the strong clear bass.

The Bösendorfer sounds a bit too thin and edgy for my taste, although it has the usual clean Bösendorfer bass section including four extra "sub-bass" notes. The concert-size 1978 Hamburg Steinway D offers the famous Steinway sound, including a powerful and luscious bass section. The Hamburg Steinway C has a relatively smooth tenor and treble, but the bass section is less gutsy than that of the model D.

When this library was first released, it represented a significant offering. Many musicians, however, may find this collection too heavily compromised in the current era of software samplers and their large highly detailed libraries.



Northstar
Grand Gold Pianos

Created specifically for E-mu samplers, Northstar's Grand Gold Pianos is offered in 64 MB and 128 MB versions to accommodate samplers with different RAM allotments. To conserve memory, the samples (ranging from 3 to 9 seconds in length) are looped, and in some of the 64 MB presets, the sampling rate has been lowered from 44.1 to as low as 17 kHz (for some of the lower notes) to reduce bank sizes.

The Grand Gold library features three pianos: an American Steinway Concert D, Gino Vannelli's Yamaha C7 (7 feet, 6 inches), and Northstar's own Yamaha G3 (6 feet). The pianos are offered in different bank sizes with different characteristics, but the largest banks provide four Velocity-switched pedal-up layers based on 31 samples spread out across the full keyboard range. Vannelli's C7

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is also offered in a full 88-sample version but with only three layers.

In a unique approach to piano sampling, the Northstar library does not offer separate pedal-down samples. Instead, all notes start as pedal-up samples and about a second after a note is played, a pedal-down sample emerges in a very subtle way. That yields a faintly resonant sound without muddying the initial tone. Northstar calls this process Resonant Sampling Technique. Sustained notes and releases are created with standard amplitude envelopes rather than with separate samples.

The Steinway D has a pleasant general-purpose sound with a smooth midrange and a clean, solid treble. The bass has a nice characteristic timbre, but the lowest octave is weak and lacks punch.

The Yamaha C7 (a popular model in recording studios) is bright and assertive from bottom to top. This is no shrinking violet; it could easily cut through any mix and would definitely stand out in a crowd. That makes it a natural choice for gospel accompaniment as well as for rock and pop.

The Yamaha G3 is a curious addition to the library. It offers a nice generic midsize grand sound, but lacks any noteworthy characteristics and suffers from a less focused bass section than the other instruments.

All three of the pianos were recorded with an array of eight high-end mics that were mixed to stereo (or mono for some presets). The recording quality is quite good. The best part of this library, however, is the long list of presets (over 100) for each piano. Several processed patches are great fun to experiment with and offer lots of creative potential, especially for film scoring and sound designing. One patch, for example, produces vocal-sounding notes with mod-wheel control over formantlike characteristics. Another preset generates unusual sci-fi sound effects from the notes. I especially like the patch that plays fourths on each note; it's simple but effective.

Post Musical Instruments
Grandioso Steinway D

Producer Michiel Post has created a mammoth four-CD GigaStudio library based on a single concert grand. Recorded in the Netherlands, the 1965 Hamburg Steinway had served for decades in a Rotterdam concert hall before being brought to Bloomline Studio, where it was sampled. Omnidirectional mics were placed in a stereo configuration roughly five feet from the strings. The recording quality is excellent.

The main Instrument is the 1.7 GB Classic preset. It provides four pedal-up layers *(p, mf, f, and ff)*, four pedal-down layers, and four release-triggered layers of soundboard resonance. In this patch, the Mod wheel can be used to attenuate the release samples. Six pedal-up and pedal-down layers were actually recorded for each note; they're offered in various combinations in different presets, some of which include several "virtual" layers.

All of the notes were sampled for their full duration and left unlooped. A new Maple Grandioso FX plug-in has recently been released by the developer; it adds new features to GigaStudio, allowing enhanced real-time sustain-pedal functions that provide smooth crossfades between individual sustained notes and pedal-down samples.

Two other Instrument sets are also included: a Compressed preset with processed samples and a Distant patch made entirely of ambient samples. When combined with the Classic patch, the Distant patch offers some intriguing possibilities for surround-sound mixing (ambient samples to the rear speakers, Classic patch to the front).

The Classic patch is full and powerful with a particularly wide dynamic range. The middle of the keyboard is relatively even and robust; the treble is clear, although in the original preset it's a bit weak in the upper range. (That problem has been resolved through a free downloadable update.) A few notes at the very top sound a bit more woody than their neighboring notes, and the top three notes produce a discernible knocking sound (most likely caused by an improper striking point). Fortunately, those notes are seldom used.

The thunderous and brassy bass section barks energetically, although I find the midbass section to be a bit difficult to play with consistency. Adjacent layers within some of the notes produce sudden timbral changes that are sometimes hard to control. A note might change from a cottony warm sound at a moderate Velocity level to a brash metallic sound with only a slight change in Velocity. A noticeable transition across the break adds to the problem.

With a little practice, you can learn to harness the keyboard's idiosyncrasies and capitalize on the Steinway's power and personality, but it may take some getting used to. (The new updates have helped to minimize the problems as well.) Post Musical Instruments has also just released a new Bösendorfer 290 library—part of its expanding Grandioso series.

The Grandioso Steinway D deserves special praise for its exemplary documentation. The library's informative 26-page booklet is filled with graphics and color screenshots and includes a great deal of technical information and background material. It should serve as a model for other sample-library developers.

Q Up Arts
The Holy Grail Piano

The Holy Grail Piano library from Q Up Arts is based on a Kawai GS-50 (6 foot, 9 inch) grand—a well-designed and generally well-regarded instrument with a clean, transparent sound. The library includes three pedal-up layers *(pp, mf, ff)* and one pedal-down (sustain) layer. Every note on the piano is sampled (for the largest bank), looped, and presented without separate release samples.

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Ain't It Grand!

Unlike other libraries, the Holy Grail Piano includes several peripheral and nonmusical sounds that are produced by pianos when they're played but which are generally ignored by sample-library developers. Using a process called V.M.S. (Virtual Model Sampling), Q Up Arts adds several sound components (essentially individual sound effects) to the notes that the piano generates.

The added sounds include a Hammer On sample, which is the faint sound made by the hammer and wippen when a key is played so lightly that the string is not struck (a Velocity of 0 to 10 in this case). A Hammer Off sample reproduces the sound made when a key is released and the hammer and key return to rest after the note is played (at any Velocity). Another sample captures the ever-present sympathetic vibrations of the top register (above the damper section), adding a slight sheen or resonance to the other notes. And finally, the library includes the clunky sound that the damper pedal makes when it is operated.

Unless you revel in re-creating mechanical artifacts from musical instruments, you will probably find the V.M.S. sound effects to be a bit intrusive. Furthermore, the added noise may be inappropriate in a number of recording situations. For example, the Hammer Off effect was especially distracting because it obscured the note releases with a disembodied thumping sound.

The Holy Grail library was originally developed for E-mu samplers and was later adapted to the Akai format. On those platforms, adjusting the relative levels of the nonmusical sounds is relatively easy and straightforward. With a little effort, you can tone down the effects to make them work a bit better if you really like them (some people do, especially for solo work). In the GigaStudio version, you can use a multiple-output patch to control (or disable) individual V.M.S. components. The new EXS24 and HALion versions also let you control the V.M.S. effects.

If you eliminate the sound effects, you're left with a perfectly fine mid-size grand piano library. The nicely voiced GS-50 has a smooth, satiny tone that remains consistent from bottom to top. The transition across the break is barely noticeable, and the top end has a crystalline clarity. The low bass is perhaps a bit less weighty than on a full-size concert grand, but it's clear and has plenty of bite for most kinds of music.

The Holy Grail Piano may not be the ultimate piano library that its name suggests, but it's a good general-purpose instrument suitable for jazz, classical, and popular arrangements. And with

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the sound effects disabled, it should serve well in most tracking and mixing situations.

Sonic Reality Concert Grand Pianos

Although it works just fine with software samplers, Sonic Reality's library was actually created originally to meet the needs of hardware samplers. The Concert Grand Pianos library is based on two popular Yamaha models (only one of which is actually a "concert" grand): the midsize C7 (7 feet, 6 inches) and the concert-size CFIIIS (9 feet).

Both pianos were recorded with two pedal-up layers (*mf* and *f*) and one pedal-down layer. In the largest C7 bank, 67 samples are spread across the keyboard range for each pedal-up layer, fewer than three dozen samples provide the pedal-down layer. The largest CFIIIS bank spreads 40 pedal-up samples across the range with fewer than two dozen pedal-down samples. All of the notes have been carefully looped and presented with minimal processing. Separate release samples are not included.

The C7 was recorded in the "piano room" of a busy Los Angeles studio; the CFIIIS was recorded in a large soundstage studio where it had just been used in a film-scoring session. Both pianos exhibit the characteristically bright Yamaha sound that is favored by many producers because it cuts through a mix and carries well.

The C7 has a strong, slightly uneven bass, a fairly smooth midrange, and a sparkling top end. With only two dynamic layers, changes in Velocity can produce sudden shifts in timbre as well as in loudness, because the two layers have quite distinct characteristics and don't always provide a smooth transition from one to the other (that is especially true of notes in the lower register).

The CFIIIS sounds much like the C7 but with a darker bottom end; because of the different room and mic placement it has a somewhat less in-your-face quality. It too suffers from the two-layer limitation.

The CFIIIS has another problem as well: three notes right in the middle of the keyboard have noticeably out-of-tune unisons. Those notes should have been resampled, or the samples should have been replaced by pitch-shifted samples from the neighboring notes. It's unfortunate that they're in a part of the range that gets such heavy use. The C7 would therefore be a better choice for any exposed piano part.

The Concert Grand Pianos library is offered in a large number of formats for hardware and software samplers. And various presets are included in each library to accommodate different setups and RAM capacities.

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Tascam GigaPiano

Developed originally by NemeSys Music Technology, GigaPiano kicked off the whole gigantic-sampled-piano craze with its introduction in 1998. In those days, many sampler owners wondered aloud about whether a 1 GB sampled piano was really just a bit much. The ensuing tidal wave of huge piano libraries, however, has shown that the demand is definitely there for high-end highly detailed sampled pianos, and several libraries have since surpassed GigaPiano in size.

GigaPiano is bundled with GigaStudio 160 and 96 (it's also available separately), so most GigaStudio owners are familiar with this library. It's based on a Yamaha C7 that was recorded in a popular Austin recording studio. The instrument was recorded with three pedal-up, three pedal-down, and one release layer. Thirty-one samples (selected from the original 88) were evenly spaced across the keyboard and left unlooped.

GigaPiano nicely captures the characteristic Yamaha sound: well-balanced and bright. The assertive bass section blends smoothly into a forceful but well controlled midrange. The lively treble is clean all the way to the top with a bit more open-string resonance in the top octave than is found in most other piano libraries. GigaPiano responds well to the touch; the different dynamic layers blend naturally into each other. Overall, this piano is a musical chameleon, serving adeptly for pop, rock, country, and several styles of jazz.

Before entering the glamorous world of magazine publishing, associate editor **David Rubin** *spent a decade as a Registered Craftsman member of the Piano Technicians Guild.*

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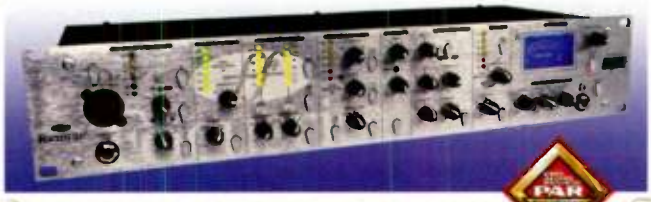

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SOUND JUDGMENT

Over the years, EM has done several comparison reviews of lower-end, "affordable" studio reference monitors, covering both powered and unpowered models. Now that powered monitors have gained such prominence in the market, we felt it was time to give a listen to some popular higher-end models—not the most expensive available, but those that represent a significant step up from the least expensive, or what I call "the low end of the high end." We designated this the midpriced range.

To make sure we compared apples to apples, we decided to look only at two-way powered systems with woofers between six and seven inches in diameter. (For comprehensive information about studio reference monitors, see "Good References" in the June 2001 issue.) That narrowed the field, but still left us with more than two dozen models. Next we had to determine what constituted midpriced. Naturally, that also meant determining where the low end and the high end are. After careful consideration, we concluded that, generally speaking, low end refers most aptly to powered monitors costing $1,000 or less, and high end to powered monitors costing $2,500 or more (MSRP).

Photo by Ron Miller

By Larry the O

Even after those deliberations, we still were looking at a dozen different monitors—far too many to compare at one time. So, aiming toward the middle of the midpriced zone, we kept tightening the price range until we ended up with five models: the ADAM P11-A, the Dynaudio Acoustics BM6A, the Genelec 1030A, the NHTPro A-20, and the Tannoy System 800A. These five monitors each cost between $1,895 and $2,098—a spread of only about $200.

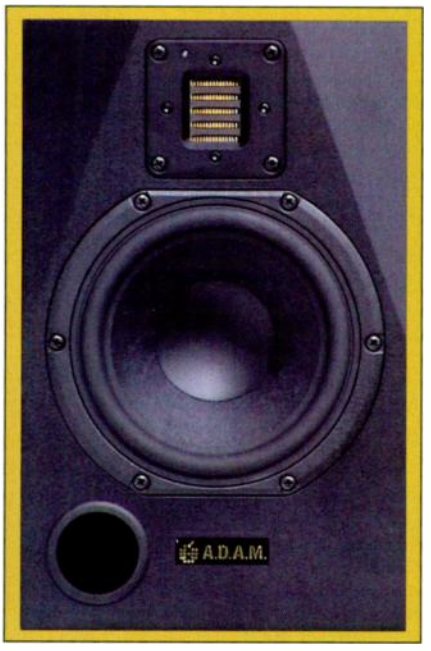
For some readers, dropping two grand on a pair of monitors will seem extravagant, if not out of the question entirely. But most people who are serious about audio production come to understand the singular importance of the reference monitor—it is, after all, the only link in the signal chain that lets you hear what you're producing. Fortunately, quality reference monitors are a long-term investment; with proper care, they can be expected to provide many years of trouble-free service.

A comparison review of midpriced powered studio reference monitors.

SOUND JUDGMENT

The issue of price brings up a critical point: that monitors in this price range are typically expected to function as sole or primary monitors rather than as a secondary pair for checking mixes. That presents a challenge because low-frequency response is necessarily limited by woofers that are only six to seven inches in diameter. Certainly, none of the monitors in this test group could reproduce frequencies below 40 Hz at a usable level; some barely went below 60 Hz. For that reason, I have also mentioned each company's subwoofer offerings.

I evaluated the five monitors extensively in listening tests conducted at Toys in the Attic, my personal production facility, where applications range from album work to film and industrial sound design. I'll start by describing each monitor and its features, then move to the listening tests.



The ADAM P11-A uses a unique folded-ribbon tweeter design. A monitor with attitude to spare, it was impressive for being able to muster punch and crunch even at low monitoring levels.

ADAM P11-A

New to the U.S. market, ADAM (Advanced Dynamic Audio Monitors) is a German manufacturer of both hi-fi speaker and studio reference-monitor systems. The P11-A is the least expensive monitor in the company's professional line.

The P11-A's compact enclosure houses a 7.1-inch Nomex woofer and a unique folded-ribbon tweeter design (which is used in all other ADAM speakers and monitors as well). Dubbed Accelerated Ribbon Technology (ART), the proprietary design employs a ribbon that it is folded in accordion-like pleats, allowing its large surface area—2.8 inches long—to fit inside a much smaller space. According to ADAM, the ART tweeter offers better acoustical loading than piston-type tweeters and therefore is more efficient and provides superior transient response. Other front baffle features include sharply beveled edges on the top half of the cabinet (to reduce diffraction effects), a circular bass port in the lower left corner, and a green power LED that turns red if the amp clips.

Inside, the P11-A's woofer and tweeter are powered by separate 80W RMS amplifiers and are actively crossed over at 2 kHz. The system's frequency-response plot shows the highs extending all the way to 35 kHz and the lows down to 48 Hz (±3 dB). Tweeter gain can be adjusted 4 dB up or down with a pot on the rear panel. Also found on the back are contour controls (±3 dB) for high- and low-shelf filters at 6 kHz and 160 Hz, respectively. Speaker input is on a balanced XLR connector.

For those in need of a subwoofer, ADAM recommends its Sub-P for use with the P11-A. The Sub-P is an active bass-reflex sub that extends the low end all the way down to 25 Hz.

DYNAUDIO ACOUSTICS BM6A

The Dynaudio Acoustics BM6A incorporates a 6.7-inch molded polypropylene woofer and a 1.1-inch dome tweeter in an all-black cabinet with a rear-firing slotted port. High and low drivers are each powered by a 100W MOSFET amp. The active crossover, positioned at 2.2 kHz, is a fourth-order (24 dB per octave) design, which makes for a clean division of labor between the drivers.

The BM6A's front baffle is tapered around its perimeter to reduce diffraction effects. Two LEDs in the lower right corner indicate power/fault status and clipping. The clip indicator lights when the low-frequency amp clips. The BM6A and ADAM P11-A are the only monitors in the test bunch that provide a clip indicator on the front baffle. (The NHTPro A-20 has a clip indicator on its outboard power amp.)

Rear-panel controls on the BM6A include a level switch (which allows for either balanced +4 dBm or unbalanced −10 dBm operation), high-frequency (HF) trim, and low-frequency (LF) trim. The HF trim allows for up to 5 dB of attenuation on a high-frequency shelf filter positioned at 3 kHz. The LF trim allows for up to 5 dB of attenuation on a low-frequency shelf filter positioned at 100 Hz. In addition, as you turn the LF-trim level down, low-frequency extension is improved, thanks to a special equalizer in the LF-trim circuit that swaps bandwidth for power. The BM6A also has an electronic protection system that protects against both thermal overload and DC voltage, and it includes an optical limiter on the tweeter amp. Speaker input is on XLR connectors.

The BM6A's frequency response is rated 42 Hz to 21 kHz (±3 dB). For those needing more bass, Dynaudio Acoustics makes a subwoofer, dubbed Active Bass Extension System, that extends the BM6A's low-frequency response to 35 Hz.

GENELEC 1030A

The smallest monitor in the test bunch, the Genelec 1030A features a 6.5-inch woofer and a 0.75-inch metal dome tweeter. The tweeter, flanked on either side by vertical slotted ports (which the company believes exhibit fewer turbulence problems than circular ports), is mounted in Genelec's Directivity Control Waveguide (DCW), an acoustical

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device designed to match the tweeter's dispersion characteristics to those of the bass driver, thus improving stereo imaging, increasing driver efficiency, and reducing distortion and cabinet-edge diffraction, among other things.

The 1030A employs an 80W low-frequency amp and a 50W high-frequency amp. The active crossover is a fourth-order design set at 3.5 kHz—the highest crossover frequency in the bunch.

The 1030A's rear panel provides a balanced XLR input connector and adjacent input-sensitivity knob (±6 dBu, adjustable by screwdriver); a four-position Bass Rolloff control with decibel settings labeled –2, –4, –6, and –8; a four-position Bass Tilt control with settings labeled +2 (dB), –4, and –6, and Mute; and a four-position Treble Tilt control (shelf filter) with settings labeled +2 (dB), –4, –6, and Mute.

The frequency response of the 1030A is rated 55 Hz to 18 kHz (±2.5 dB). For those who require greater bass extension, Genelec recommends its 7060A or 7070A Active Subwoofers, which go down to 29 and 19 Hz, respectively, for use with the 1030A.

NHTPRO A-20

NHTPro takes a different approach to a powered monitor system. Rather than power amps inside speaker cabinets, the A-20 comprises a pair of speakers powered by a separate Control Amplifier. In addition, the A-20 employs a passive crossover (at 2.1 kHz), so although it qualifies as a powered monitor, it is not an active powered monitor (as are the rest of the monitors in the test group). Don't let the XLR connectors on the back of the cabinets mislead you: they are speaker level and intended to mate only with the control amp via the supplied low-capacitance speaker cables.

The A-20 features a 6.5-inch treated-paper woofer and 1-inch dome driver mounted in an acoustic-suspension (sealed) cabinet. The sleek, polished black cabinets have a distinctive, asymmetrical shape that necessitates dedicated left and right units; the front baffles are angled inward, which, according to NHTPro, not only facilitates speaker positioning and listener orientation, but also helps eliminate internal standing waves, among other things. With the backs of the cabinets perpendicular to the listener (or to the rear wall), the speakers are angled such that the listener is directly on axis when sitting in the sweet spot. Another distinctive feature is a strip of absorbent foam, intended to combat diffraction, attached to the front baffle on the outer side of either tweeter. A green LED indicates that the amp is turned on and that the system is wired correctly.

The A-20 Control Amplifier is a hefty, 34-pound, 2U box providing 250W per channel and sporting three five-position controls; a switchable "System Status" numerical LED readout, which shows average system SPL, incoming line voltage, or temperature of the output heat sink; and a headphone jack. (The A-20 is the only system in the group to offer headphone monitoring.) The three control knobs are labeled Sensitivity (input sensitivity), Boundary (low-frequency compensation), and Position (high-frequency compensation). Each step of the Boundary knob attenuates low frequencies by 1.5 dB using a 50 Hz shelf filter. Each step of the Position knob attenuates high frequencies by 0.75 dB using a 20 kHz shelf filter.

The A-20 control amp's rear panel provides both XLR and ¼-inch TRS input connectors, as well as XLR output connectors for the speaker cables. Should you decide to expand your NHTPro system to 5.1 surround, the company makes the C-20, a flat-faced version of the A-20, for the center channel. Low-bass duties (down to 25 Hz) can be handled by the NHTPro B-20 subwoofer.

WHY POWERED MONITORS?

Should you trade in your unpowered monitors for powered ones? Well, the perception of sound is a rather subjective experience, so powered monitors might not be everyone's cup of tea. After all, many accomplished engineers are extremely comfortable mixing on Yamaha NS-10Ms, whereas others cannot abide that monitor's accentuated midrange. Though you might be in a blissful relationship with a favored unpowered monitor, here's what you'll gain if you do decide to "plug in."

One advantage a good powered system offers is unity of design. Subtleties of cabinet design, crossover frequency, equalization, and every other factor known to science can be taken into account during the design stage of the system, and components can be selected that complement one another. For example, power amps can be exactly calibrated to specific drivers, and onboard equalization can be applied to flatten out and extend the system's frequency response. In an unpowered system, your power amp may not be a good match for your speakers; a powered system, on the other hand, ensures absolute harmony between the amps and drivers.

In addition, most powered monitors let you contour the speaker to your listening environment. Onboard frequency controls let you "goose" the high end or roll off the bass to match the idiosyncrasies of your room. Or, if you travel from place to place, you can tune the system to any number of different listening environments. All of this precise control over system design often translates into a superb, matched reference system that delivers exquisite frequency response, low distortion, and articulate stereo imaging.

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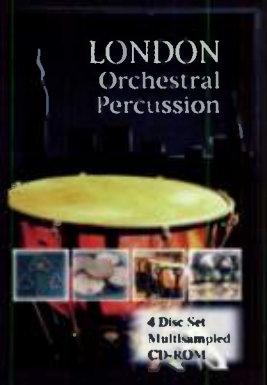

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to the San Francisco Symphony's Grammy-winning recording of Orff's *Carmina Burana*, and to various 24-bit recordings of individual instruments. The material was auditioned on each speaker in A/B/C tests against two higher-end monitors with which I am intimately familiar—the M&K 2510P and the Genelec 1031A—and then again in A/B comparison tests with each other.

Unlike the close-field, half-space monitoring environment that's typically found in small personal studios, the monitoring environment at my studio, Toys in the Attic, is essentially free-field and midfield. The speakers are six feet away from the mix position, each other, and the nearest wall, and it's more than ten feet from the speakers to the front wall. This setup not only minimizes the bass boost that results from speakers being positioned close to a boundary, but also allows more cubic volume in which bass frequencies can naturally develop. I'm certain that in a more typical small personal-studio kind of space, the low end of all these speakers would be perceived differently. It is always advisable to listen to speakers in your own monitoring environment before committing to them.

I started testing by auditioning each speaker with all of its controls set flat. Later, I did a second round of individual tests in which I attempted to optimize the sound of each monitor for the room using the available user-adjustment controls. In the process of comparing the monitors, I also gained very helpful insights by equalizing one speaker to sound as much as possible like the one to which I was comparing it. When performed on all the monitors, this "matching" procedure proved a very informative method of comparison.

The second pass was the ever-critical mix test. I did my best mix of the same song, which included drums, bass, vibes, vocals, and a half-dozen guitar tracks, on each set of monitors and printed it to hard disk. I then made a CD and a cassette-tape copy of the mixes so that I could audition them on a variety of different playback systems to determine how well they translated.

For the third pass, I ran a few tests and listened to some isolated sources. First, I recorded a sample of pink noise (played through a single monitor from each pair) from one meter at 85 dB/SPL into MOTU's Digital Performer. I then played each sample and viewed its frequency spectrum in Waves' PAZ Frequency plug-in.

Though I'm not really big on listening to test tones, they are good for revealing how a monitor's high and low frequencies roll off. For this part of the test, I calibrated a 1 kHz tone to 75 dB/SPL at the listening position (two meters from the speaker), and then played a sequence of tones from 30 Hz up to 15 kHz. None of these speakers is rated down to 30 Hz, of course; nonetheless, I was curious to see what, if anything, they could reproduce on the extreme low end.

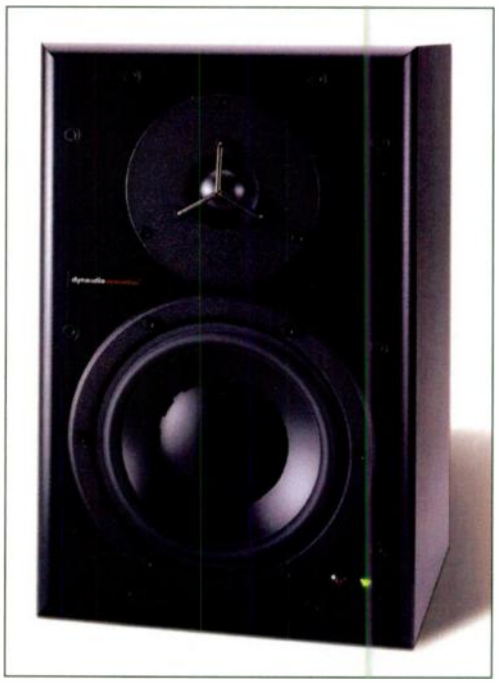
In addition to the test tones, I also listened to a large range of individual instruments, both from my own recordings and from vol. 2 of Lexicon's Dry Tracks CD series. Finally, I listened to several sound effects from my personal effects library—things I had recorded previously and was well familiar with. Those included field recordings of a building implosion (tons of low end on that one, not to mention multiple car alarms going off immediately after the building collapse and echoing from various points across a wide soundstage), a large-toothed saw ripping ferociously through a board, various metal hits and scrapes, a very squeaky mechanism, and some hysterical laughter.

SALIENT POINTS

Comparing five sets of monitors proved very enlightening. The most striking thing was that different monitors could sound good without sounding alike. What that suggests to me is that accuracy, as important as it may be, is ultimately trumped by the character of the sound.

It was interesting, too, how differently voiced each monitor was from the others. This was often highlighted by the choice of material. Take, for instance, Stinkeye's *Off the Street* album, which combines hammer dulcimer with other traditional stringed instruments such as mandolin and fiddle; the hammer dulcimer largely disappeared on the NHTPro A-20, betraying a dip in the high-mids. On the Dynaudio Acoustics BM6A, by comparison, the hammer dulcimer rang out clearly. On vocals, the BM6A reproduced less body than did the Genelec 1030A. But the 1030A's low end rolled off faster than the A-20's—and so on.

Another thing to keep in mind is that the maximum SPL limits of smaller drivers (such as those found in this test



The Dynaudio Acoustics BM6A exhibited an airy top end and impressive depth of field; overall it provided the best bass response (though not quite the lowest) of the monitors considered here.

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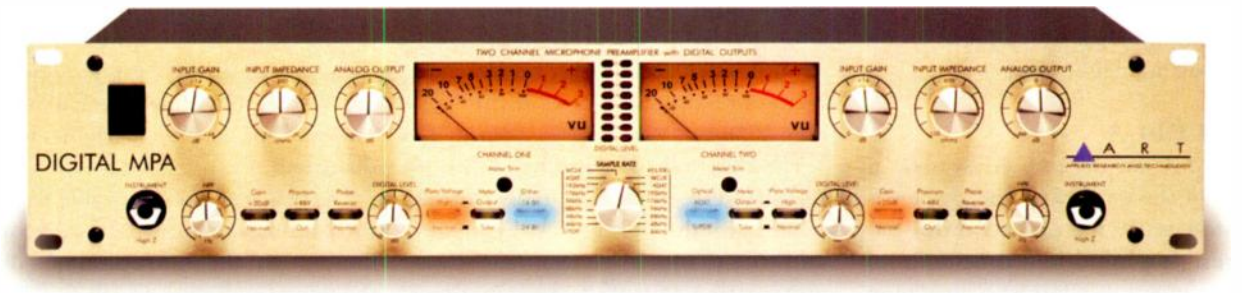

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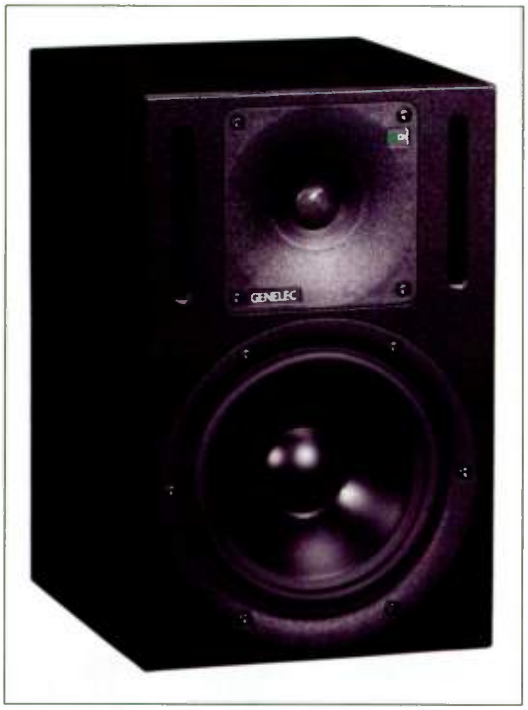
bunch) may not be sufficient for every application. Though each monitor I tested was reasonably loud when cranked, none was quite able to attain really loud, rock 'n' roll levels. Expect to be able to work at satisfying levels with any of these monitors—but if you need the full rock 'n' roll effect, consider buying bigger ones.

ADAM P11-A

The P11-A was the punchiest rock 'n' roller of the gang. Even at low levels, it could muster more attitude than the rest—an important consideration for apartment dwellers who must monitor at low levels but still want to hear some crunch from their Pods. At the same time, the P11-As were louder than the other monitors. They also produced a reasonably wide soundstage and sweet spot.



Though weakest on the low end, the Genelec 1030A provided the most accurate overall frequency response of the group, as well as the most open-sounding highs.

The P11-A's unique folded-ribbon tweeter is certainly a defining aspect of its sound. The tweeter did indeed exhibit exceptional transient response, and it seemed integral to the P11-A's overall crisp sound. Snare-drum hits were delivered with a particularly satisfying slap, and horn punches and bass-guitar-note attacks were crisp. The P11-A also provided great detail to all of the synthesized and acoustic percussion on Michael Shrieve and David Beal's *The Big Picture* album. Crunch guitars, too, sounded appropriately aggressive, though they lacked the raw and yet refined quality they had on the Genelec 1030A.

The close-miked recording of the saw translated in an exceptionally ripping manner on the P11-A—very aggressive and true to life. Then again, acoustic-guitar-string squeaks were sometimes prominent enough to distract.

While mixing on the P11-As, I used EQ to cut some high mids from a bright rhythm guitar that was really jumping out of the mix. To my surprise, this did not result in the guitar sounding dull when I played the mix back on other monitor systems.

The mix I did on the P11-As translated very well to other systems, and the CD version provided the punchiest kick-drum sound of the lot. The snare drum, which was more prominent in this mix than in any other (though not excessive), had nice body without sounding tubby; however, it did not exhibit as much snap as the snare drum in the BM6A mix.

Though the exceptional transient response clearly contributed to the P11-A's better-than-average imaging, high frequencies were not always pristine. Cymbals, for example, did not have the clarity they did on the Genelecs or the Dynaudios, and high harmonics in some vocals sounded a little fuzzy.

DYNAUDIO ACOUSTICS BM6A

The BM6As competed with the NHT-Pro A-20s for deepest low end of the bunch. The response sounded fairly even through the low range, but fell off sharply as volume was reduced—medium to loud listening levels had very full bass, but low listening levels lost the low end. The same was true of the very high end: the 15 kHz tone, for example, was clearly reproduced at higher monitoring levels but became barely audible at quiet ones.

The BM6A's high end was silky and clean. Cymbals had a nice ping, and the complex activity of inharmonic partials—something that is a challenge for mics and speakers to get right—was not distorted.

There was also a noticeable depth to the soundstage, especially on acoustic music. I got the impression of a dip in the upper midrange, which could make these monitors easy to listen to in long sessions but might also hide some details in that area. One reason I noticed the apparent dip was that the same bright rhythm guitar that had jumped out from the P11-A mix sat nicely in the BM6A mix without any EQ.

When mixing on the BM6As, the kick drum sounded really nice, especially considering that the monitor couldn't reproduce the lowest frequencies. I was able to get a pretty beefy kick with a nice snap to it. That translated excellently, leading to the best-defined kick drum sound of any of the cassette-tape mixes. I ultimately concluded that the mix done on the BM6As was overall the best of the batch in terms of translating to other playback systems.

I also found it easy to get a satisfying snare sound on the BM6As. Vocals, though, came out sounding a bit farther back in the BM6A mix than they did in some of the other mixes. And, as I mentioned, the bright rhythm guitar tracks sounded slightly mellow on the BM6As, which helped them sit well in the mix.

While mixing on the BM6As, I became very sensitive to the Peak LEDs, and I found it useful to know when I was hitting the monitors too hard.

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However, I couldn't always get the speakers quite as loud as I wanted—it's not difficult to overdrive these monitors with high-volume playback.

GENELEC 1030A

Though each of the other monitors exhibited a broader frequency range than the Genelec 1030A—more extended on the high end, low end, or both ends—to my ear the 1030A was still the flattest sounding of the group. It had the smoothest, most even-sounding midrange—especially nice for vocals—and also provided the cleanest reproduction of tough high-end sources such as cymbals, triangle, and vibraphone. The 1030A's presence allowed it to reproduce the crunch-guitar and wood-sawing recordings with authority and without distortion. Still, the 1030A's high-end response didn't extend as far as the Dynaudio BM6A's or the NHTPro A-20's.

The 1030A's weak suit is its low end, which extends down to only 55 Hz or so. A few extra hertz does make a difference on the low end, and the NHTPro A-20 and the Dynaudio BM6A both produced much lower frequencies. When mixing on the 1030As, I had a heck of a time getting a satisfying kick-drum sound, and I never felt I could wholly trust the kick sound I was hearing. This perception was confirmed during the test-tone section of my tests: of the five monitors, the 1030A produced the least of the 30 Hz tone.

The mix done on the 1030As exhibited the best definition on each instrument and also put the vocals the most forward. Still, the 1030A mix didn't pack quite the punch of the ADAM P11-A and Dynaudio Acoustics BM6A mixes. The 1030A is not the crankmeister of the crowd, either, but it is capable of outputting satisfying levels. I sometimes wondered, though, if I was pushing them a bit into overload without realizing it, as there is no peak indicator.

Classical recordings such as a Denon/Nippon Columbia recording of Mahler's Fourth Symphony and Antonin Kubalek's solo album of Schumann piano music showed—in a way that the pop material I auditioned did not—that the 1030A is capable of an admirably wide soundstage. Classical and jazz selections also demonstrated the 1030A's ability to accurately render delicate material. However, the 1030As' sweet spot was pretty tight—even slight head shifts caused noticeable movement in phantom center images.

None was quite able to attain really loud, rock 'n' roll levels.

NHTPRO A-20

The A-20 has a broad frequency response, which NHTPro informatively specs at two distances—1 meter and 2 meters. Naturally, the 2-meter distance (which is what I used for these tests) provides the more extended low-frequency response—in this instance, 45 Hz to 20 kHz (±2 dB).

Although my ears agreed with that spec, the response of the A-20s did not sound entirely even throughout the spectrum. Most noticeable was a mild dip in the upper midrange (at about 6 kHz, according to my EQ experiments). The low frequencies, though warm, full, and as deep as the BM6A's or even slightly deeper, did not sound ruler flat, either. However, the A-20 *was* the only speaker able to produce a clearly perceptible 30 Hz signal at the calibrated level. It was not loud, but it was there.

The low-end beef of the A-20 came across amply as I listened to the building implosion, the wood being sawed, and Los Lobos's *Kiko*, which has a very full bottom end. And even at low monitoring levels, the bass was decidedly more present on the A-20 than on the other speakers at the same level.

Despite my uncertainty about their flatness, the A-20s sounded excellent on a variety of material and were very pleasant to listen to, suggesting that they would be nonfatiguing during long sessions. In addition, it was easier to get good kick and snare drum sounds when mixing on the A-20s than on any of the other monitors. And the mix I did on the A-20s turned out to have the most shimmer on cymbals—the result of a touch of EQ I added above 12 kHz. However, the slight high-mid dip made rhythm guitars sound a bit dull and thus in need of brightening. Similarly, crunch guitars lacked "teeth."

These response characteristics are mild and broad, though; it would be easy to get accustomed to them. Given their beefy low end—enough to get you by if you can't get a subwoofer—the

The NHTPro A-20's distinctive design incorporates a separate power amp, a passive crossover, and sealed speaker cabinets. It put out the lowest bass of the bunch and proved very pleasant to listen to during long sessions.

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A-20s would be an excellent choice for studios that have to rely on small speakers as their sole monitors. I can also imagine clients really enjoying the sound of the A-20s.

The A-20 had a decently wide sweet spot, too. That meant I could reach for controls on the mixer without experiencing severe image shifts as my head moved to either side. However, image localization wasn't quite as precise as that exhibited by some of the other monitors.

The A-20 manual points out an advantage of having the control amp separate from the monitor speakers: rather than have to reach around behind the speakers to change settings, you can make parameter adjustments from the sweet spot, which is where their effect is best heard and where it counts. But that advantage is somewhat lost on me; I would tend to treat a rackmount power amp as a machine-room piece of gear, functionally available but visually—and thermally—isolated from the control-room area. To its credit, the A-20 control amp is designed without a fan, meaning quiet operation, and the unit runs fairly cool. That makes it especially suitable for personal-studio folks who must record and mix in the same room.

That said, I found the features on the A-20 control amp very useful, especially the Boundary and Position switches, which made it easy to optimize the A-20s for my space. In addition, the LED readouts—SPL, line voltage, and heat-sink temperature—allow you to monitor more than just the sound and could be helpful in tracking down studio glitches.

TANNOY SYSTEM 800A

The Tannoy System 800A's low-frequency response was respectable; it didn't top the A-20's or the BM6A's, but it was definitely better than the 1030A's. On the high end, I heard a particular contour that I associate with the "Tannoy sound." Adding 2 dB of high-end boost with the HF Control switch improved the sparkle somewhat, but it did not bring up the presence range. Likewise, the 15 kHz tone was noticeably less audible on the System 800As than on the rest of the monitors—I had to boost the level considerably before I could hear the tone clearly.

I also noticed some buildup in the low-midrange response down around 400 Hz. Thankfully, the murkiness yielded to a modest 1 dB cut.

The mix I did on the System 800As turned out the brightest of the five. It exhibited sibilance on the vocals and a noticeable hole in the midrange. But despite the hole, the mix had a very satisfying snare sound. The toms, however, did not sound round and full.

The System 800A proved very sensitive to positioning: with the drivers at exactly ear height, the high-frequency response became noticeably more articulated. The sweet spot was very sensitive to vertical movement, but held up nicely over a fairly wide range of lateral movement. Had I positioned the 800As horizontally, this perception might well have been reversed.

The Tannoy System 800A employs a dual-concentric driver (essentially, a tweeter mounted inside a woofer), which is said to improve time-coherency. The brightest monitor of the bunch, it exhibited a distinctive sweet spot: broad horizontally, but very sensitive to vertical movement.

Overall, I felt the least comfortable mixing on the System 800A. Not only did I have to do the most compensating for the sound, but I also had the least confidence in how the mix would translate.

HIGH FIVE

One thing this comparison test shows conclusively is that truly excellent professional monitoring is available from a number of midpriced (around $2,000 a pair) powered monitor systems.

For me, the most surprising discovery was how different each monitor sounded from the rest in terms of midrange response. From the slight aggressiveness of the ADAM P11-A to the soft upper mids of the NHTPro A-20, each monitor exhibited a distinct midrange character. There was considerable variation on the low end, as well, with the NHTPro providing the most bottom and the Genelec 1030A the least.

Though each of the monitors in the group had its strengths, I kept coming back to the Genelec 1030A and Dynaudio Acoustics BM6A. To my ear, the 1030A's frequency response was the most accurate overall, especially in the midrange. However, it was also the wimpiest on the low end. And though

its high-end response presumably tops out at 18 kHz, the 1030A also exhibited the cleanest, most open high end of the test group. While listening to a Phillips recording of Debussy's Nocturnes on the 1030As, I was able to pick out the sound of a musician quietly turning a page of sheet music.

The Dynaudio Acoustics BM6A was an excellent performer, too. It exhibited an airy top end and impressive depth of field. Though it couldn't go as deep on the low end as the NHTPro A-20, I felt that it provided the best bass response overall. In addition, the BM6A performed consistently well regardless of monitoring level, and it was able to get reasonably loud before starting to clip.

The NHTPro A-20s sounded most like the Genelec 1030As, the main differences being that the A-20s had a more extended low end and exhibited a broad, shallow dip in the high mids. I was impressed by the A-20's low fatigue factor—these monitors are very pleasing to listen to, and they sounded especially wonderful on classical and acoustic music. After learning the A-20's sonic idiosyncrasies, you should have no problem turning out great mixes that translate well to other playback systems.

On the other end of the spectrum was the ADAM P11-A, which takes a more in-your-face approach. This monitor exhibited a distinctly crisp high end, exceptional transient response, a wide sweet spot, good imaging, and attitude to spare. The loudest monitor of the five, the P11-A was also impressive for being able to muster punch and crunch at low levels. Thanks to its abundance of snap and bite, the P11-A seems especially well suited for music that benefits from a bit of edge.

Tannoy has built a loyal fan base over the years, and I'm sure there are many users who love and swear by the System 800A. However, in comparison to the other monitors, the System 800A's particular sonic signature and vertically tight sweet spot just didn't work well for my production style. It was a lot of work trying to "imagine" how my mixes would translate; I never quite trusted what the 800As were telling me. Also, there is another more pedestrian drawback with the System 800A: of the monitors I tested, it had the largest footprint, which might be an issue in some studios.

LISTEN UP

I hope this comparison test has provided a fair assessment of five mid-priced powered reference monitors. Having worked closely with each, I can all but guarantee you won't regret taking the plunge and dropping a couple of grand on monitors such as these. However, I would recommend strongly that you listen before you buy—after all, your sensibilities might be very different from mine. When it comes to investing in such a critical part of the studio signal chain, you should trust your own ears foremost.

Larry the O *is a musician, producer, engineer, and sound designer whose music and audio services company, Toys in the Attic, is based in the San Francisco Bay Area.*

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Emulating the Real Thing

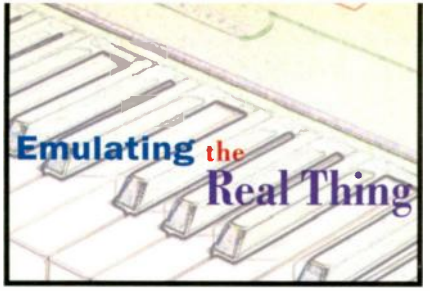
ILLUSTRATION BY LAURA WILLIAMS

Practicing what you learn by listening is the key to realistically synthesizing acoustic instruments.

By Chris Martirano

If you're a keyboardist, you're expected to be an arranger and an orchestrator who can work in a wide variety of styles. In the course of a day's work, you're often obliged to substitute for other players. So how good are your impersonation skills? Unless you're well prepared, you might become uncomfortable when a project requires an arrangement that includes acoustic instruments and it falls on you to become all the instrumentalists. Such undertakings can be daunting, even torturous, unless you're sure that you're up to the task. Whether you're doing high-profile project work, live gigs, or recording in a basement studio, successfully emulating acoustic instruments is all about the sounds and the presentation.

How convincing are your emulations? Instruments that play ROM- and RAM-based samples (including computer-based streaming-sample players) provide the flavor of the real thing, but depending on what you do with them, they can stop short of sounding realistic. The sounds are only half of the equation; your performance skills are the other half. I'm not talking about keyboard dexterity here, but rather your ability to translate your understanding of acoustic instruments into keyboard performances that sound like the real thing. You must learn to fool most of the people, most of the time.



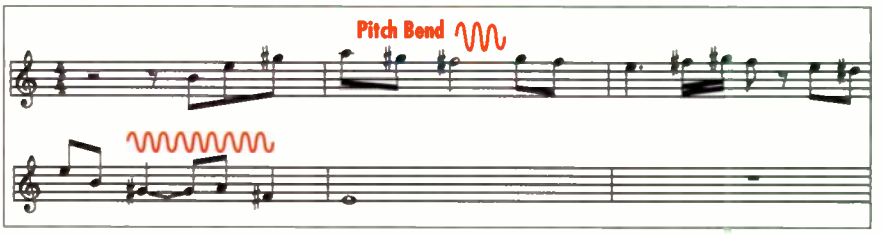


FIG. 2: By disabling Pitch Bend and enabling LFO modulation, the pitch wheel becomes the ideal controller for tremolo.

The programming capabilities of your synthesizer or sample-based instruments will vary. The more flexible the architecture, the more programming depth—and hence, the greater nuance—you can achieve. An elegant emulation is the product of the quality of your samples, your understanding of the acoustic instruments you're emulating, your performance skills and creativity, and the power of the architecture that allows you to shape your sound.

For the purposes of this article, acoustic instruments are defined as instruments that require no electricity to play. It's okay to stretch that notion to include some electric instruments such as electric guitar, bass guitar, and the entire family of instruments derived from their acoustic predecessors, such as electric violin, cello, or sitar.

LIBRARY SCIENCE

Begin by developing a systematic knowledge of your tools. It should be obvious that you must learn how to program your synths and samplers well enough to understand their capabilities and limitations. It's equally important, however, that you organize your sounds thoroughly enough to have lightning-fast access to them.

Creating and maintaining a customized set of acoustic solo and ensemble instruments is an absolute requirement. By investing the time it takes to lay the foundation, you'll have a valuable resource to build upon. Constructing a well-defined library of instrumental sounds will reduce the overall patch-tweaking process for all your subsequent sessions. In the long run, adequate preparation will save you time and money.

Even if you have a pricey ROM-based workstation, the latest sampler, an extensive soundware library, and advanced sound-modeling software and you spend tons of time tweaking sounds, nothing substitutes for talent. The performance talent must still come from the musician who uses those tools. Part of applying that talent is learning to effectively shape sounds in real time, just as musicians have been doing for hundreds of years.

Well-designed electronic musical instruments offer sound-shaping capabilities that allow you not only to duplicate the performance gestures of acoustic instruments but also to bring out your individual personality by expressing your own musical voice. Some of the most important tools for musical expression are real-time controllers such as pitch benders, mod wheels, ribbon controllers, breath controllers, continuous-control pedals, and footswitches. Once you learn to use them, you can apply MIDI-controller techniques to most programmable sample players, samplers, and synthesizers, whether they're based on hardware or software.

SAMPLE ABUSE

Have you ever been in a music store's keyboard department and seen a customer dial up an acoustic-guitar program, depress the sustain pedal, play a few left-handed chords and right-handed blues licks, and remark, "Yuck! That's a guitar? That's awful." And have you seen a customer try to romance a lyrical solo out of a stock sax patch, only to quack away like a wounded duck or a bad harmonica? Is it really the sample's fault? Players are much too quick to blame the instrument or the samples.

The plain truth is that even a great sample that's played poorly usually sounds bad. Conversely, a poor sample played well sounds acceptable (though not necessarily good) to many listeners. You've probably scrolled through a synthesizer's stock solo-acoustic-instrument patches and been uninspired. Finding an electronic instrument that can easily take the place of real acoustic players is difficult, but not impossible.

FOCUS ON THE BASICS

Obviously the quality of the samples matters, but the performance matters even more. What techniques will generate the most realism? A significant portion of the illusion comes from first doing the brain work and then mimicking musical gestures repeatedly—in a word, practicing. A solid understanding of how real instruments perform is necessary before you can apply any synthesis concepts or techniques effectively. Some useful considerations can help you as you approach creating and performing elegant, convincing emulations.

To understand what's necessary to successfully emulate an acoustic instrument, bear in mind this useful sequence of steps: absorb, analyze, re-create, and practice. Absorption is all about listening and learning from what you hear. Analysis is the intellectual process of identifying the components

FIG. 1: In this example, Pitch Bend is applied to a sustained saxophone note that breaks into vibrato.

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PETER HAMILTON, Producer, Engineer, Studio Owner

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that make an acoustic performance come to life. Re-creation brings those components to life using electronic instruments. And practice, to paraphrase the old adage, is what makes your emulations perfect.

An important step is learning to listen analytically, even surgically, with an ear bent toward reconstructing a particular instrument you hear; that's especially true with ensemble music. To emulate an instrument, you need to learn and practice its characteristic nuances. Then, the real magic comes from tweaking the raw materials at hand to suit your needs in a particular situation to reconstruct those nuances and subtleties.

It's impossible to overemphasize that listening to the real thing is a prerequisite for emulating it. Listening is an ongoing process for any electronic musician who wants to progress and evolve better programming and performance skills.

Consider any acoustic instrument from three different perspectives: how the sound is produced (whether it's blown, bowed, plucked, or struck), its changes in timbre and loudness, and the kinds of modulation a player employs. Compare the acoustic player's techniques to a synthesist's techniques. When a solo flutist performs a musical passage, for example, notice the constant variations in tone color (timbre), vibrato (modulation), and dynamics (amplitude). Pay attention to how the player controls the instrument's loudness and timbre while breathing life and emotion into a performance. Contrast that vision with the straight playback of a static sample, and you'll see a vast difference.

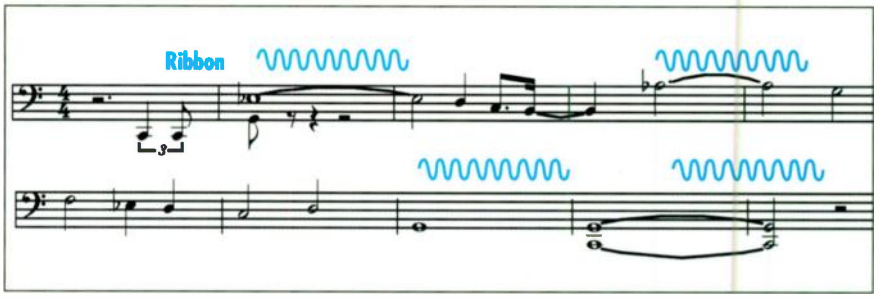

FIG. 4: The most natural vibrato and tremolo are achieved by rolling your finger on the ribbon controller.

To get a clearer picture, consider the flute's performance characteristics. When a flute is blown easily and softly, it produces a warm tone with a subtle attack transient; conversely, when it's blown sharply and forcefully, it yields a brighter, thinner tone with a sharper, more noticeable transient. Apply those observations to your programming, and as you listen to the real instrument, think about all the variables of its sound. Does it have a wide dynamic range? What happens to the transients as they change from almost nonexistent to the sharpest, shrillest extreme? Try to visualize an acoustic instrument from a simplified perspective, and then work to the more complex as time (and your equipment) permits.

That kind of analytical thinking must be practiced as well. Applying such thinking when you program synth and sampler patches will really pay off. Programs should be designed to respond to musical performance gestures; controllers should be programmed to allow a reasonable range of hands-on control across a wide range of musical passages and styles. Practicing controller movements in tandem with note performances is the key to achieving a greater degree of realism.

IDENTIFY THE COMPONENTS

Music moves in real time and in dynamic space. Musical performance, and especially improvisation, has extensive physical requirements. If a musical phrase contains 32nd notes played staccato at a dynamic of *ppp* immediately followed by some legato half notes with the dynamics gradually building to *ff* and ending on a final *sfz*, you should be thinking, "How can my synth patches allow me to produce that much variation on the fly?"

The key is advance preparation; you need to methodically organize various articulations—legato, staccato, marcato, and so on—into separate programs that you can access quickly. Better still, build a minimum set of versatile, pliable programs that allow you to perform a range of expressions. Without adequate preparation, the number of program changes and the speed that such changes might require in live performance would present daunting challenges.

To successfully analyze musical performance, it's important that you draw parallels between a real instrument's capabilities and your synth's programmable parameters and real-time-controller capabilities. Then, dig a bit deeper. What do the transients sound like as they respond to your playing across a wide dynamic range? What does the body (which equals the tone minus the transients)

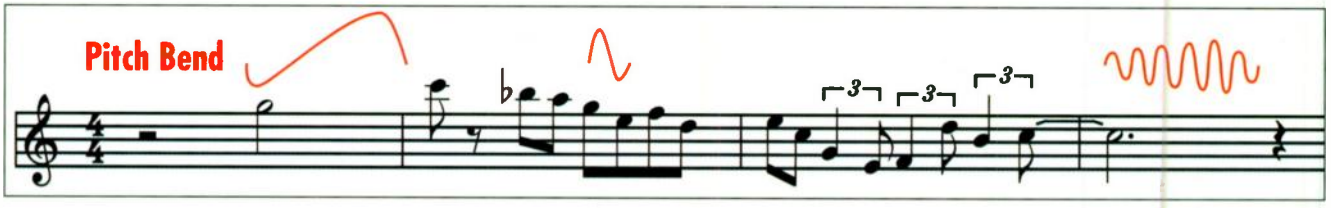

FIG. 3: Nothing beats a ribbon for realistically controlling Pitch Bend.

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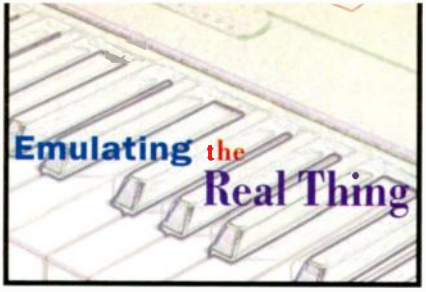

of a sustained tone sound like when played *ppp* and increasing to *fff*? How does the acoustic sound change when a note is released, either with an immediate stop or by fading out? Does the instrument's body resonate a few milliseconds after the performer stops playing? How would you express the sound you hear in terms of waveforms, filters, envelopes, and modulation settings? How would you best control the sound given your selection of physical controllers? In other words, how will you synthesize the sound?

Consider that a jazz tenor-saxophonist performing bebop has a different musical vocabulary than a classical (yes, I did say classical) sax player or someone performing 1950s doo-wop tunes. Sax players scoop up to certain notes, the final note's pitch might drop off at the end of a phrase, or the player can nail a note's pitch dead on. You also have all those "false" fingered notes with their peculiar timbres to contend with.

To accurately emulate any instrumental performance, you should study the instrument, the style, and the players that inspire you, as well as any particular aspects you want to capture. You need to carefully analyze the player's tone, phrasing, and nuances of articulation such as vibrato and dynamics. The player's approach can change depending on his or her musical style, knowledge of theory, emotional state (mood), and performance level (experience). Variations in tone can come from other factors, too, such as differences in instrument construction and design.

RE-CREATE TO EMULATE

Most keyboards ship with a collection of programs that include acoustic-instrument programs, but they often don't sound very convincing out of the box. A little tweaking can dramatically improve their playability and realism. Customize the programs by assigning additional controllers to appropriate parameters for hands-on real-time control. Seize any opportunity to shape timbre, amplitude, and modulation characteristics in real time.

Using keyboard Velocity with an assortment of controllers, you can control the dynamic range of the filter and amplitude simultaneously and in varying amounts. The end result is a program that responds more like an acoustic instrument. Well-crafted programs allow for plenty of variation to provide musical depth and to fuel a player's spontaneous creativity. Don't underestimate the playing skills you need to master in order to deliver a realistic emulation from a synthesized model. A player should understand the real instrument as thoroughly as possible; good keyboard chops just aren't enough.

Ultimately, deciding which controllers to use and what parameters they should control will determine how realistically you can shape your sounds. Your goal is to find the easiest and most natural way to play and manipulate sounds in real time. Performance gestures that require awkward movements will be a hindrance to coordination and interrupt the flow. Try to use the most likely physical controller whenever possible. For example, you'll probably want to use a breath controller when you're emulating a wind or brass instrument and a ribbon controller when you're emulating a fretless stringed instrument or adding vibrato to a violin.

Adding spice to an evolving emulation can increase its realism, but what kind of spice? For a flute, it might be adding an overblown harmonic that's introduced at the highest Velocity levels, or adding a bit more *chiff* when you move the modulation wheel forward. Perhaps you can enhance realism by adding a bit of wind noise modulated by amplitude and filter envelopes that respond to Velocity. The key is to experiment and discover what works.

PRACTICE AND POLISH

Once a particular technique is learned, it must be practiced. To perfect your results, it is essential that you practice

GOING ELECTRIC

Let's examine everyone's favorite: the electric lead guitar. When you consider the electric guitar's dynamic, timbral, performance, and modulation characteristics and capabilities, you realize that emulation is a staggering undertaking.

To illustrate, I'll explain how to emulate a distorted rock guitar with wah-wah. Begin by layering a few sampled articulations such as picked notes, mutes, harmonics, and other goodies you might have available. (If you're using a sampler, you might be able to throw in a few chunks, chords, and dives, as well.) If you can assign Velocity or the mod wheel to crossfade from mutes to picked notes, the transition will be much smoother. To cross-switch between the samples using Velocity, I suggest assigning soft Velocity values (say, 1 through 60) for mutes, medium (61 through 118) for sustained notes, and full on (119 through 127) for harmonics.

One of my favorite tricks is to layer different feedback samples. I layer two heavily distorted sine waves—one tuned 19 semitones higher than the fundamental pitch and another tuned 24 semitones higher. By using Aftertouch to crossfade between the two harmonics, you can control the balance between the sustained guitar tone and the harmonics, making it possible to fade from the fundamental to a harmonic and then up to the next harmonic.

Next, add distortion and effects to taste. To provide a wah-wah effect, assign a control pedal or the mod wheel to control a resonant lowpass filter. Use the pitch wheel for vibrato and the ribbon for trills, bends, and whammy-bar dives. Some synths provide independent note bending, so you can bend one note up as other notes sustain, unaffected by Pitch Bend messages. That ability can help you emulate stringed instruments such as fiddles, pedal steel guitar, and Dobro, and even ethnic instruments such as koto.

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performance gestures, controller moves, and patch-change timings. Be careful that you don't overuse your real-time controllers, however, or you risk producing sonic caricatures. Work to refine your movements; that refinement is what often makes the greatest difference in the end result. Practicing your controller moves will go a long way toward improving realism. The extra work is always worth the effort.

The degree of realism you achieve is directly related to several factors, including how much you listen to music in the style you're trying to emulate and how much you practice the musical gestures that define that style. Equally important is the quality of the samples and the variety of articulations you have at your disposal. Other issues are the limitations of your synth or sampler and your skill as a synth programmer.

Working with a variety of sampled articulations is generally better than having a single articulation. With good programming, you might be able to squeeze enough variation from a single articulation, but the more sampled articulations you have at the beginning, the better your end result will be. Doing the extra programming work ahead of time will pay off in the long run.

Successfully programming controllable crossfades and cross-switches is a special challenge. Good results largely depend on the flexibility of the synth or sampler and how well the samples are sonically matched across articulations and dynamics. Imagine being able to play a single program and articulate a wide range of phrasings from legato *ppp* to a legato crescendo and a presto staccato *ff* passage in real time and doing it convincingly. Well-crafted programs can increase your freedom in performance.

MODULATION CONTROLLERS

What follows are a few controller tricks that can help you program your emulations for greater realism. Although synthesizers and samplers don't all offer the same controllers or level of programmability, you can adapt these techniques to whatever programmable controls your instrument has to offer.

You can apply many of these concepts and settings to a variety of emulations in the same instrument family, such as double reeds, flute and piccolo, trumpet and cornet, and solo strings. For illustration purposes, I'll try to suggest a few emulative articulations.

The key is to experiment and discover what works.

Many instruments within a family will require a similar set of controllers. For example, certain controllers and modulation routings are most useful for emulating a wind instrument. Breath control works quite well for controlling amplitude, highpass-filter cutoff, and the attack, decay, and release times of the amplitude and filter envelopes. In reasonable amounts, keyboard Velocity works best for controlling amplitude-envelope parameters. If your synth has a ribbon controller, use it to control pitch for manual vibrato. To simulate the timbral changes that accompany vibrato, route the ribbon to modulate filter cutoff.

Personalize your vibrato. It always amazes me how many people can instantly identify a particular artist by his or her tone and vibrato. Many guitar, string, and horn players strive to develop signature vibratos, just as vocalists do. Instead of using a mod wheel or Aftertouch to control vibrato depth, try using your pitch bender or ribbon controller to create your own signature vibrato. By rocking the pitch wheel up and down (or joystick left and right) or wiggling your finger on the ribbon, you can control depth and rate with a single controller in one smooth motion. That technique has a threefold benefit: it promotes spontaneity and individual style, it produces a more realistic result, and it allows seamless integration of pitch bend and vibrato (see **Fig. 1**).

EM WEB CLIPS

Tremolo control. Similar techniques work just as well on tremolo. Consider a flute's modulation aspects, for instance. Flute players can play sustained tones without modulation until they want to add tremolo. Then, they increase the depth and character of tremolo in real time. Most synths allow you to patch a controller to adjust tremolo depth and speed. The mod wheel, breath controller, and control pedals are all good choices for varying LFO depth and rate. Such an approach yields far more realism than programming an envelope generator with predetermined delay, attack, and decay times. For even better results and to take the technique a step further, try controlling amplitude with a spring-loaded pitch wheel or joystick (with Pitch Bend disabled) to create an even

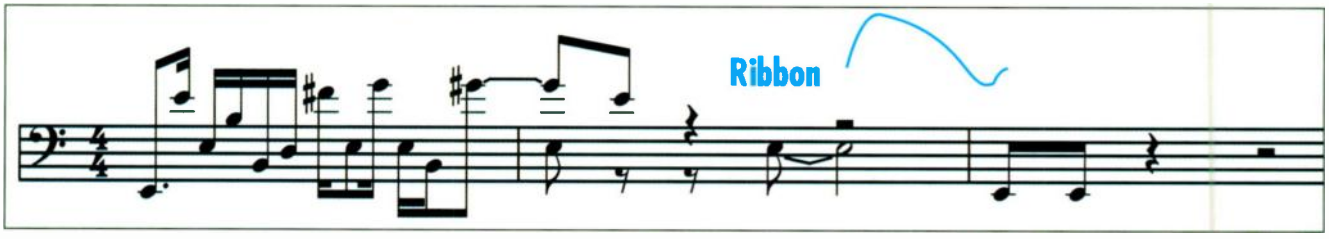

FIG. 5: In this example, the ribbon is used for sliding and trilling an electric bass sound.

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more natural tremolo (see **Fig. 2**).

If you can patch the pitch wheel to control both amplitude and pitch, you can produce an effect in which you control a very slight amount of Pitch Bend and a wide amount of amplitude change from a single source. And if your synth lets you change your pitch wheel from bipolar to unipolar, you can get identical results when you push up or pull down the pitch wheel.

Use your ribbon. Point your browser at the **EM** Web site (www.emusician.com)and listen to my trumpet emulation, which takes full advantage of the ribbon controller patched to Pitch Bend and amplitude (see **Fig. 3**). That technique works quite well for simulating horn slurs and natural vibrato, and it's great for horn shakes. Velocity controls the amplitude envelope to deliver better control of dynamic shaping, and hence, more realism. (Kurzweil's V.A.S.T. engine offers FUNs that let you quantize the output of controllers such as the ribbon, which works great for horn falls or guitar-fret finger slides.)

If your keyboard has a ribbon controller, you can achieve the most natural vibratos by rolling (rather than dragging) your finger from side to side. The faster and more exaggerated the rolling action, the faster and deeper the vibrato or tremolo (see **Fig. 4**).

The ribbon is also ideal for trilling in legato or as an ideal controller when you're emulating a fretless instrument sliding or slurring notes (see **Fig. 5**).

Using controllers to shape envelopes. Consider the ideal flute emulation; the amplitude and timbre can change dramatically. A real flutist controls modulation by means of flutter-tonguing and changing tremolo from narrow and fast to slow and deep. How can a synthesist gain more of that sort of control and range in real time? If you learn to use your controllers effectively, you can deliver good performances by controlling dynamics, timbre, and modulation.

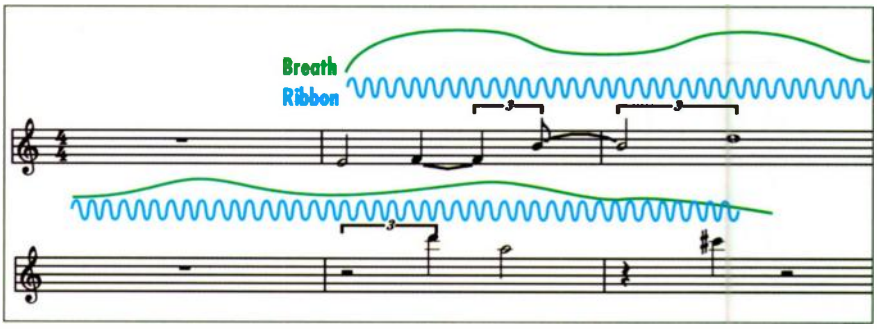

FIG. 6: A breath controller adds realism to any wind-instrument emulation.

One technique is to use keyboard Velocity to modulate the amplitude envelope. If your synthesizer or sampler lets you patch keyboard Velocity to the amplitude envelope's attack time, adjust it so that a soft key strike produces a slow attack (say, 2 seconds) and a hard key strike causes an immediate spike (the minimum attack setting). Adjust the amplitude scaling to taste; a wise range is less than 50 dB. Use the same technique to adjust releases, too; the slower you release a key, the longer the release time, and the quicker you release a key, the shorter the release time. Consider the emulated instrument's timbre as it changes across its full dynamic range and adjust accordingly.

Another useful technique is to route keyboard Velocity to control the filter's cutoff and envelope modulation. If your synth has a highpass filter, patch the lower Velocities to lower filter cutoff (to add more warmth) and the higher Velocities to raise filter cutoff (to thin out the tone by removing some of the fundamental). A resonant highpass filter can work miracles with the right modulation.

By the way, a synth that offers a mono legato mode can help players with fat fingers to avoid those occasional, accidental ghost notes. Nothing blows a solo woodwind emulation faster than two tones sounding simultaneously.

Practice breath control. Using a breath controller in combination with a well-programmed patch can produce amazing results. Patching breath to simultaneously control amplitude envelope, filter envelope, amplitude crossfading or cross-switching points, and vibrato depth and rate provides tons of control from a single source (see **Fig. 6**). After all, real brass and woodwind players control their instruments by means of breath control. So work on your cyclic breathing, and whatever you do, don't hyperventilate!

ONCE MORE, WITH FEELING

Certain considerations become obvious as you investigate emulating a particular instrument. For example, a six-string acoustic guitar can only play six notes at a time, and the lowest note you can normally play is E2. A solo woodwind instrument can play only one note at a time with no overlap; consequently, you should program the envelope so that it doesn't retrigger with each new note. Avoid playing any accidental grace notes, too, or you might spoil the illusion.

Obviously, I've just scratched the surface here. Your studies can extend more deeply as your time and gear allow. I hope that these ideas start you thinking about what you can do to go beyond factory patches. The more you know about the original instruments, their note ranges, and their performance limitations, the more realistically you'll be able to emulate them.

Chris Martirano *was director of product development for Kurzweil Music Systems for over 12 years. He has worked with synthesizers since the early 1970s and takes after his world-renowned uncle, Salvatore Martirano.*

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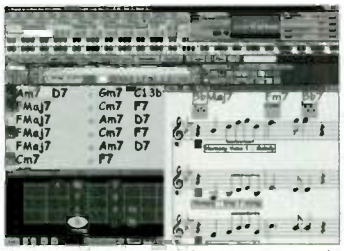

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By Erik Hawkins

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Until very recently, if you wanted to use the recording and composing tools found in your home studio, you needed to be at home. The idea that you could write and record music sitting in your car, at the beach, at your favorite cafe, commuting to and from work, waiting for a flight, or perched atop some distant mountain was pretty preposterous. But with today's powerful laptop computers, incredible digital audio programs, excellent virtual instruments, and abundant laptop-compatible recording gear, locations like these can be the norm during a productive day of composing.

That is not to say that a good laptop music system can, or should, entirely replace your home studio. There are a few areas in which the home studio will always have the advantage, namely, hardware (such as a big mixing board and analog sound modules) and superior recording isolation (as in a vocal booth). But when you are writing the initial parts to a song, these conveniences aren't crucial. The virtual mixers found in most digital audio sequencers offer much of the power of the best hardware consoles; current virtual synths and samplers sound nearly as good as their real-world counterparts; line instruments (like guitar or bass) can be recorded directly into your laptop's audio interface at rates as high as 24-bit, 96 kHz; and scratch vocal tracks can be recorded just about anywhere. Once a song's basic elements are laid down, it's a piece of cake to transfer them to your home studio as audio and MIDI files for final production and mixdown.

In this article I will discuss systems that go from simple to complex and range in price from a few hundred to thousands of dollars, not including the laptop (see the table "Interfaces and Controllers" for features and prices of the audio hardware mentioned). You can write tracks with your laptop and a single good music program, of course, but without a controller and an audio interface, your recording choices will be limited. Finding the right peripherals to go with your laptop and software is the trick to building a system that is as powerful as it is portable. The endgame is to put a system together that, far from frustrating your writing efforts, enables and inspires them.

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POWERBOOK PASSIONS

The core of this system is your laptop, so make sure it has a fast CPU (see the sidebar "Suggested Laptops" for recommended computers) and lots of RAM (256 MB at the very least). The internal hard drive should be as big as possible—20 GB is an acceptable minimum size. A large screen (15 inches, for example) is also important. Yes, that can add significantly to the laptop's cost and weight, but if you plan on using a multiwindowed digital audio sequencer for many hours at a stretch, a good-size screen will make the experience much more pleasant.

Make sure that your laptop's expansion ports include USB and FireWire; a PC CardBus Slot is also good. Several portable keyboard controllers are USB based, as are a number of MIDI and basic audio interfaces. More professional audio interfaces, which typically offer many simultaneous channels of I/O and feature XLR mic inputs with phantom power, employ FireWire (IEEE 1394). For adding more storage, such as Zip or hard drives, USB and FireWire ports are also key. For an even more extensive system, you can use full-size PCI cards with your laptop by adding an expansion chassis that connects to the PC CardBus Slot. Finally, having an onboard CD writer is very convenient for making backups and transfers and, of course, burning reference audio CDs.

AUDIO ACCESS

There are numerous choices in sound cards these days, but for ease of use, compact size, and all-around compatibility, nothing beats a USB audio interface. These little boxes are the perfect laptop companions because most are equipped with a headphone output and can draw power directly from the USB port. Their I/O configurations vary by model, but there are bandwidth limitations to USB, and most of them can't handle more than six total channels of simultaneous recording and playback. When you are working alone, however, that is usually adequate.

When you want to record several instruments at the same time or send more than six simultaneous tracks of audio to an external console for mixing, you'll need to step up to a multi-I/O FireWire interface. MOTU makes a couple of great units, the 828 and 896. Both of these offer up to 18 simultaneous inputs and outputs (8 analog, 8 ADAT optical, and 2 digital), high-quality converters, headphone outputs, and XLR microphone inputs with phantom power. The downside is that they require an external power source. If there is an AC outlet available, you're in business; otherwise, you'll need some sort of portable power supply (I'll cover some of the possible solutions in a minute).

If you want to use a PCI card in your laptop studio, Mobility Electronics' Magma series offers some good choices. These PCI Card expansion chassis plug in to your laptop's PC CardBus Slot and come in a variety of configurations, including 1-, 2-, and 4-slot models (see the sidebar "Magma PC CardBus Slot Chassis for PCI Cards"). The 2-slot box is available in AC- and DC-power models, and the 1-slot units will run on DC with an optional power cable. The DC-power options will let you run the boxes from a car battery (I will discuss remote power supplies shortly). Any of these would allow you to use a Digidesign Digi 001 system with your rig, for example, or add extra processing power with a dedicated DSP board such as the Universal Audio UAD-1 Powered Plug-Ins bundle. You could even run Pro Tools TDM (I haven't personally tried such a TDM setup, but I've seen Magma demonstrate it).

RME also offers a CardBus solution that consists of a PC CardBus card and the half-rackspace Multiface breakout box (reviewed in the April 2002 **EM**). The breakout box connects to the PC CardBus card with a standard FireWire cable (a PCI interface is also available). Just keep in mind that anything attached to a PC CardBus card, whether it's a fully loaded expansion chassis or simply an I/O box, will likely require AC power.

Because laptops aren't equipped with dual processors yet and can't reach the full processing potential of desktop computers, it's especially crucial that your audio interface's driver be as efficient as possible. An interface that's the same brand as your digital audio sequencer (for example, Steinberg's Cubase SX with an AudioLink 96 Mobile card and Multiset interface or

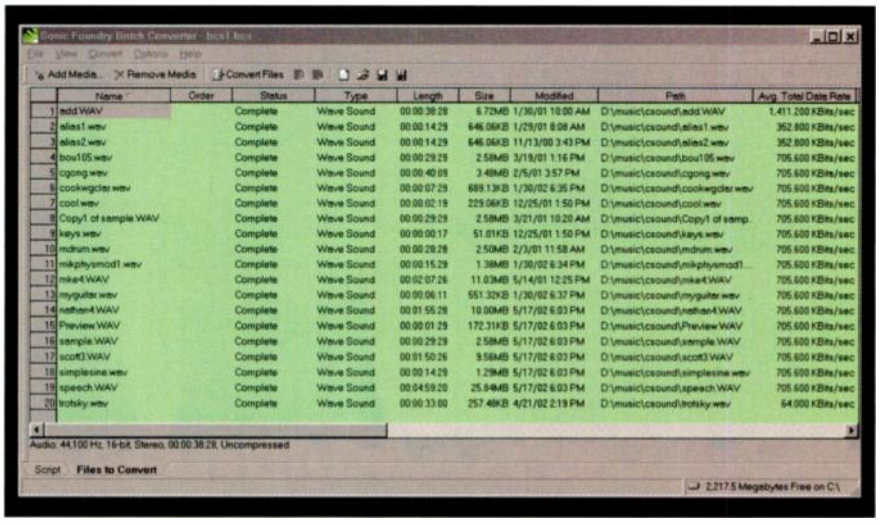

FIG. 1: Sonic Foundry's Batch Converter (Win) allows you to change the format of a large number of files at once. Because it supports DirectX plug-ins, you can also process numerous files within a single session. Access conversion and processing parameters by clicking the Script tab, shown at the bottom-left of the screen.

Who Says Size Matters?

Active Near Field Reference Monitor - Magnetically Shielded - Bi-Amped - 1" Silk Dome Tweeter - 4" Woven Kevlar - H 9.25" x W 6" x D 7.75"

Actual Size 1:1 ratio

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www.krksys.com

Digidesign's Pro Tools LE, which is included with its new Mbox audio interface) is often a good bet. If such a combination isn't an option for you, almost every digital audio sequencer will work with an audio interface that has an "enhanced" audio protocol, such as ASIO or WDM. However, it's important to note that not all audio drivers are built alike, and a poorly written driver will drain your laptop's processing resources, leaving you with less power and, sometimes, an unstable system. To avoid this pitfall, use only audio interfaces that are recommended by the manufacturer of your digital audio sequencer.

LISTEN HERE

When composing in a public place, headphones are the obvious choice for monitoring your laptop's audio. Because most pro headphones now include adapters for both ¼-inch and minijack, and most audio interfaces employ one of these types of headphone jacks, your regular studio headphones may work. However, if your headphones aren't designed with such an adapter and you're thinking that an aftermarket adapter will get the job done, a word of warning: most compact aftermarket adapters (especially going from ¼-inch to minijack) add too much weight to the headphone's plug and, over time, can cause your audio interface's headphone jack to short out. If you must get an adapter, try to find one that's part of an extension cable—the type with lightweight molded plastic ends—to avoid overstressing the headphone jack.

If you must buy a new pair of headphones for the road, I suggest getting a pair with a fold-up design (many Sony models, such as the venerable MDR-V6, incorporate this feature). Though the ultimate test of a pair of headphones is sound quality and comfort, compact size is an important consideration in terms of convenience.

ERIK HAWKINS

Small enough to fit on a hotel-room bed, this setup is composed of a Tascam US-224 audio interface that doubles as a control surface, an M-Audio Oxygen 8 keyboard controller, and a mini USB port that the Logic Platinum copy-protection dongle plugs in to.

Always keep a pair of headphones handy, but know also that there are other possible monitoring options. Small, shielded self-amped speakers designed to be used with desktop computers work well if you're in a space where you can make noise (they're also a nice break from headphones and a great way to share your music with friends). There are many such speakers available, but for carrying and setup ease, stick with models that are lightweight and battery powered, if possible. The smaller these speakers are, the worse they usually sound, so consider finding a pair with a separate subwoofer for better bottom end. Most models get their input directly from the analog output of your audio interface (usually through a minijack), but USB models offer the advantage of a digital connection for improved fidelity (dependent, of course, on the quality of the speakers' built-in D/A converters). For example, check out the USB-gear Tornado USB Sub-Woofer System, which retails for about $79.

Cassette adapters that are made to plug portable CD players in to your car's tape deck will let you turn your car's stereo into a monitoring system. I always keep one of these adapters stashed in my laptop's bag for the times when I find myself waiting in my car—if your stereo sounds decent, it's like having your own private studio on wheels. Having a few different types of cables in your bag for plugging in to different systems is also a good idea. For example, any home stereo system can be used for monitoring if the proper connections are made. The cabling you need to carry depends on your audio interface, but it will probably be a Y-cable with a stereo ¼-inch or minijack that splits out to two RCA ends.

UNDER CONTROL

A new breed of USB-based keyboard controllers has sprung up in recent times (see the article "Surfin' USB" in the September 2002 **EM**). These compact, lightweight keyboards can draw their power right from your laptop's USB port, making them wonderfully carefree. Good examples are Edirol's 49-key PC-300 and M-Audio's 25-key Oxygen 8. Because they don't have the keyboard range of a full-size unit, octave up/down buttons are provided to

MAGMA PC CARDBUS SLOT CHASSIS FOR PCI CARDS

See www.magma.com for details on these and other models.

CB1H
1-slot CardBus-to-PCI expansion system (half-length) $945

CB1F
1-slot CardBus-to-PCI expansion system (full-length) $995

CB2
2-slot CardBus-to-PCI expansion system (full-length) $895

live

The end of sequencing as you know it.

Live 2's revolutionary concept of elastic audio sequencing lets you record, import, arrange and process multiple audio clips and loops into complete songs regardless of their pitch or tempo—all in real time while the music continues. You can even change tempo and pitch independently after the fact. And Live 2 is so simple to use that these are the only two screens you'll ever see.

Start your loops and sessions at any tempo, then change tempo later without affecting pitch—even as playback continues. The music never stops as you play, record, resample and process your audio.

Browse and audition audio clips or even entire songs from your hard disk via the private headphone send, then drag-and-drop them into your session—all while the music keeps playing. All clips automatically stretch to play in sync with the song.

Real-time quantization insures that loops are always triggered in sync. Live's proprietary real-time elastic audio algorithms insure optimal fidelity for all types of source material.

Transpose and detune clips in real time without affecting their tempo.

Trigger clips using the mouse, keyboard or MIDI notes. Operate all effect and mixer parameters via any MIDI controller.

Each row of clips is a scene—much like a song section. Copy and drag clips to create and modify scenes while playback continues. Trigger all clips in a scene simultaneously or independently for break-down passages.

Control up to four effect send channels for each track.

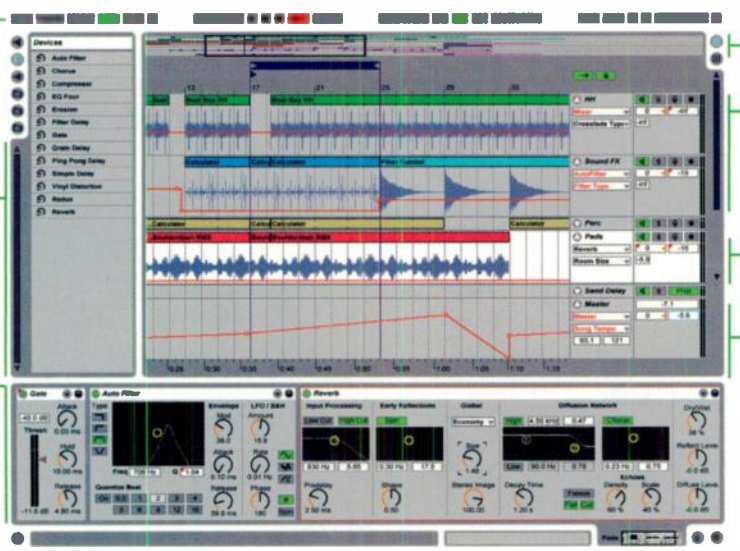
Access multiple inputs and outputs on your ASIO or CoreAudio interface. Connect Live to ReWire master or slave programs to exchange audio and sync.

Change the playback region, length and downbeat of looping clips or one-shots—all while the music continues.

Change tempo during or even after recording, including tapping to sync Live to musicians or the DJ. Elastic audio means that all audio stretches to change tempo and pitch independently anytime you desire anytime you desire.

Live comes with a range of high-impact effects such as reverb, filter delay, ping pong delay, erosion, gate, grain delay, EQ and many more. Add your favorite VST effects as well.

Drag-and-drop internal and VST effects into chains for tracks, sends and master in real time. All effect and mixer parameters are fully automated.



Your entire arrangement is displayed in an overview for quick navigation.

Live captures every action during your jams so you can improvise with total freedom, then edit to perfection later. Edit clips and breakpoint envelopes, add and remove material. Render your work after it's finished.

Record unlimited takes on unlimited tracks. Linear tracks can span looping sections.

Scale tempo over time to conform scores to film and TV.

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—Charlie Clouser, former keyboardist, Nine Inch Nails; composer, Fox TV's "Fastlane"

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INTERFACES AND CONTROLLERS

	MODEL	INTERFACE TYPE	POWER	SAMPLING RATES	MAXIMUM SAMPLING RESOLUTION	MIC PRE	KEYBOARD
AUDIO INTERFACES							
DIGIDESIGN	Mbox	USB	USB	44.1, 48 kHz	24-bit	(2)	n/a
M-AUDIO	Audio Duo	USB	9 VAC wall wart	11–96 kHz	24-bit	(2)	n/a
M-AUDIO	Quattro	USB	9 VAC wall wart	11–96 kHz	24-bit	(2)*	n/a
MOTU	828	FireWire	internal	44.1, 48 kHz	24-bit	(2)	n/a
MOTU	896	FireWire	internal	44.1, 48, 88.2, 96 kHz	24-bit	(8)	n/a
RME	Multiface	PC CardBus or PCI	12 VAC wall (PC CardBus) internal (PCI)	32–96 kHz	24-bit	no	n/a
STEINBERG	Nuendo AudioLink 96 Mobile card/Multiset interface	PC CardBus or PCI	12 VAC wall (PC CardBus) internal (PCI)	32–96 kHz	24-bit	no	n/a
TASCAM	US-224	USB	USB	44.1, 48 kHz	24-bit	no	n/a
USB CONTROLLERS							
EDIROL	PC-300	n/a	USB or wall wart	n/a	n/a	n/a	49 notes
M-AUDIO	Oxygen 8	n/a	USB adapter, (6) AA batteries or wall wart	n/a	n/a	n/a	25 notes
USB MIDI INTERFACES							
EDIROL	UM-1S	USB	n/a	n/a	n/a	n/a	n/a
EDIROL	UM-2	USB	n/a	n/a	n/a	n/a	n/a
MOTU	MTP AV	internal	n/a	n/a	n/a	n/a	n/a

*Available with the Omni I/O optional breakout box.

REAL-TIME CONTROLLERS	ANALOG INPUTS	ANALOG OUTPUTS	DIGITAL I/O	MIDI I/O	ADDITIONAL I/O	PRICE
n/a	(2) balanced/ unbalanced ¼" TRS/XLR Neutrik combo connectors	(2) ¼" balanced/ unbalanced TRS; (1) ⅛" headphone; (1) ¼" headphone	(1 pr.) S/PDIF on RCA connectors	no	(2) ¼" TRS analog inserts	$495.00
n/a	(2) balanced XLR mic; (2) balanced ¼" TRS*	(2) ¼" unbalanced; (1) ¼" headphone	(1 pr.) S/PDIF on RCA connectors	no	n/a	$349.95
n/a	(4) balanced/ unbalanced ¼" TRS	(4) ¼" balanced/ unbalanced TRS; (2) ¼" headphone*	n/a	yes	n/a	$349.95
n/a	(2) balanced/ unbalanced ¼" TRS/ XLR Neutrik combo connectors (6) balanced/ unbalanced ¼" TRS	(8) ¼"; (2) ¼" monitor out; (1) ¼" headphone	(1 pr.) optical S/PDIF/ ADAT optical	no	ADAT sync in; foot-switch input	$795.00
n/a	(8) balanced/ unbalanced ¼" TRS/ XLR Neutrik combo connectors	(8) balanced XLR; (2) balanced XLR monitor out; (1) ¼" headphone	(1 pr.) AES/EBU on XLR connectors; ADAT optical	no	word-clock I/O on BNC connectors; ADAT sync in; footswitch input	$1,295.00
n/a	(8) ¼" balanced/ unbalanced TRS	(8) ¼" balanced/ unbalanced TRS; (1) ¼" headphone	(1 pr.) S/PDIF on RCA connectors; (1) S/PDIF /ADAT optical	yes	word-clock I/O on BNC connectors; ADAT sync in	$1,305.00 (PC CardBus interface) or $1,235.00 (PCI interface)
n/a	(8) ¼" balanced/ unbalanced TRS	(8) ¼" balanced/ unbalanced TRS; (1) ¼" headphone	(1 pr.) S/PDIF on RCA connectors; (1) S/PDIF /ADAT optical	yes	word-clock I/O on BNC connectors; ADAT sync in	$1,300.00 (PC CardBus interface) or $1,230.00 (PCI interface)
n/a	(2) balanced XLR mic; (2) ¼" balanced line/ unbalanced TRS guitar; (2) unbalanced RCA	(1) unbalanced RCA; (1) ¼" headphone	(1 pr.) S/PDIF on RCA connectors	yes	n/a	$375.00
(1) assignable slider; Pitch-Bend/ Mod Wheel combo lever	n/a	n/a	n/a	n/a	n/a	$199.00
(1) assignable slider; (8) assignable knobs; Pitch-Bend wheel, Mod Wheel	n/a	n/a	n/a	n/a	n/a	$179.00
n/a	n/a	n/a	n/a	(1) In, (1) Out	n/a	$39.00
n/a	n/a	n/a	n/a	(2) In, (2) Out	n/a	$79.00
n/a	n/a	n/a	n/a	(8) MIDI In; (8) MIDI Out	(1) SMPTE ¼" in; (1) SMPTE ¼" out; word-clock out (BNC); video in (BNC); ADAT 9-pin D-sync out; (2) footpedal inputs; Mac serial port; Network port	$595.00

give you access to different octave ranges. The Oxygen 8, despite its diminutive size, also sports eight assignable knobs for tweaking plug-ins and soft synths.

If you'd rather use your favorite MIDI instrument, like a guitar controller or drum pads, you'll need a USB MIDI interface to make the connection with your laptop. When you're working solo, a single MIDI port (In and Out) is usually fine. Edirol's donglelike UM-1S interface is an inexpensive and convenient solution. Interfaces such as this don't usually require external power, though your connected MIDI controller certainly will. Some USB audio interfaces also have a MIDI port, like Tascam's US-224 and M-Audio's Quattro. If you're using an audio interface with a built-in MIDI port, you probably won't need a separate MIDI interface.

For situations in which you need more MIDI ports (for example, to record several MIDI inputs at the same time), multiport USB MIDI interfaces are available. One tried-and-true unit is MOTU's MTP AV, which has eight ports, programmable presets, professional synchronization features, and four control knobs that can be used to tweak plug-ins. However, even though these interfaces are USB, they generally need AC power.

PLENTY OF PROGRAMS

For the most part, the software you use on your desktop computer will also work on your laptop. That includes all the top digital audio sequencers. If you use the Pro Tools LE or TDM versions in your studio and aren't interested in the PC CardBus Slot setup I discussed earlier, Pro Tools Free Session files can be interchanged between the versions (as long as your computer platforms are the same—for example, an Apple PowerBook to an Apple G4 desktop). It's a good idea to work with the same digital audio sequencer in your home studio and on your laptop. That guarantees easy file transfers between your systems.

Some digital audio sequencers, such as Cakewalk's Sonar, come with their own arsenal of virtual instruments, but the really killer instruments usually need to be purchased separately. No matter what kind of music you write, you will most likely need a sampler or sample-playback instrument and a drum machine. Good soft samplers include Steinberg's HALion, Native Instruments' Kontakt, and Emagic's EXS24 for Logic; IK Multimedia's SampleTank is a wonderful sample-playback instrument. All these instruments read Akai-

formatted sound libraries, so there are lots of sounds available. Native Instruments Battery is a powerful drum machine with a lot of realistic-sounding kits, as is Steinberg's LM-4 MarkII. Waldorf's Attack is perfect for electronic drum sounds. Soft synths are largely a matter of taste, and luckily there are plenty to choose from. Native Instruments makes several great instruments, including some very cool re-creations of vintage models. If you're not familiar with virtual instruments, exploring this company's offerings is a good place to start.

A dedicated audio editor lets you tweak samples and manipulate audio in ways that may not be possible in your digital audio sequencer and is a handy application on the road. If the editor includes a batch converter, you can quickly convert handfuls of files from one format to another. For example, if you have a bunch of AIFF drum hits but your drum machine only reads WAV files, a batch converter can solve this file-format problem in a snap. Examples of audio editors that include a batch converter are BIAS Peak and TC Works Spark on the Mac, and Steinberg WaveLab on the PC. Sonic Foundry's Sound Forge 6.0 bundle (Win) also includes Batch Converter 5.0, a standalone utility (see **Fig. 1**).

Though most laptops that have an onboard CD burner also come with burning software, those stock programs aren't always the most flexible. For example, the ability to adjust pause times between audio tracks is an amenity that is often missing from basic consumer-oriented programs. Roxio's Toast Platinum (Mac) gives you a choice of various preset pause times and can write different CD-ROM formats (like ISO9660, Mac Volume, or custom hybrids). If you want to create custom pause times and write actual crossfades between your tracks, check out Roxio's Toast with Jam bundle (Mac) or Sonic Foundry's recently rereleased CD Architect (Win). PC users can often find excellent CD-burning features directly in their audio editors—both WaveLab and Magix's Samplitude Producer offer professional-quality CD-authoring options, for example.

Most applications allow for multiple installations from their original CD-ROM, with copy protection using serial code, dongle, or CD-ROM authentication. Only software that employs challenge-and-response copy protection to authorize a single hard drive is problematic when it comes to running multiple installations. For these types of programs, you will need to call (or e-mail) the manufacturer and ask for a second response code. In the worst case, you may need to purchase a second response (prices vary but are usually less than the original application). When you hit the road, remember to bring the CD-ROMs for programs that perform random CD-ROM spot-checks and your copy-protection dongles. There's nothing worse than sitting down to write music and realizing that you can't boot up a program because you're missing its authorization gadget.

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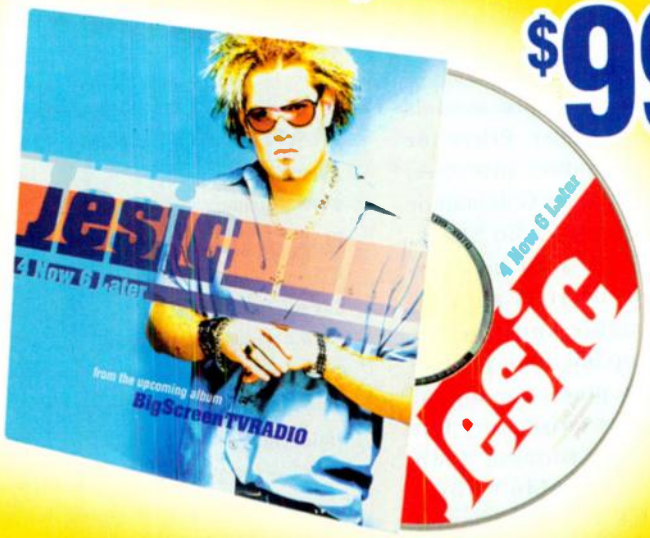

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POWER TO GO

Though it's really convenient to use peripherals that get their power from your computer's USB bus, sometimes you need to use a piece of gear that requires outside power. Also, laptop batteries usually only last a few hours, so finding an outside power source to extend battery life is always a plus. Several companies make adapters for plugging your laptop in to a car's cigarette-lighter socket or the EmPower DC-power ports used on many commercial passenger jets. These units, like the ones made by SmartDisk, usually cost between $50 and $70.

Another possible solution is to get a power inverter to turn your car's cigarette lighter into a multiport AC-power receptacle (standard models usually sport two sockets). Prices for consumer-oriented power inverters, such as the Powermate by Coleman or similar units found at Radio Shack, start at around $100. Most inexpensive adapters and inverters are convenient and portable and fine for running your laptop but don't provide audiophile-quality power for digital recording. If that is satisfactory but you're worried about running down your car battery (I wouldn't worry about a jet plane's battery), use the adapter or inverter with an emergency-jumper battery pack (for example, Southern Equipment's 3in1 Power Station, available at Costco). You can pick these up at most automotive repair stores starting around $70. The RME Web site also has a few suggestions on portable battery packs suitable for running notebooks.

If you plan on making digital recordings that you would like to be "keepers," then you need audiophile-quality power to ensure clean recordings. Such power is available in units that are rated as providing "pure sine-wave power." Portable inverters of this class can cost thousands of dollars, so a more economical solution is to use an uninterruptible power supply (UPS) that puts out pure sine-wave power. A decent-size UPS will run your gear from its internal battery for several hours (how long depends on the gear you have connected and the size of the UPS). The OPTI-UPS PS Series models by Airblade Alternative Power Systems (AAPS) start at $241; you can purchase them online at www.aapspower.com. The company's owner suggests that you charge your UPS fully at an AC outlet prior to hitting the road so that you'll be ready to record when you get to your destination. And, if you're on location and need to extend the UPS's battery life, AAPS offers solar panels that will work for this task. (Incidentally, if you're into solar power, AAPS has a very cool laptop-battery-charging solar kit, SunWise, which retails for $360.)

SYSTEM CHECK

Most of the same rules that apply to setting up your desktop computer also apply to setting up your laptop. For example, if you own a Mac laptop, when you install an application, make sure to perform the installation with a minimum of extensions running in order to avoid extension conflicts. Windows users should make sure all other programs are closed before installing an application. Laptops of all varieties (and some desktops) are typically set, by default, to go to sleep after about 10 minutes of inactivity to conserve power. That is fine if you're running a word processor, but it's not what you want when you're working with a digital audio sequencer. A computer that falls asleep in the middle of a session can upset your writing flow, may result in lost USB communications, and can crash when you try to wake it up. Try resetting your system's sleep preferences to a longer duration

MANUFACTURER URLs

AVammo
www.avammo.com/hush.html

BIAS
www.bias-inc.com

Cakewalk
www.cakewalk.com

Coleman
www.colemanpowermate.com

Digidesign
www.digidesign.com

Edirol
www.edirol.com

Emagic
www.emagic.de

IK Multimedia
www.ikmultimedia.com

London Fog
www.londonfog.com

Magix
www.magix.net

M-Audio
www.m-audio.com

Mobility Electronics
www.magma.com

MOTU
www.motu.com

Native Instruments
www.native-instruments.com

PowerQuest
www.powerquest.com

RME
www.rme-audio.com

Roxio
www.roxio.com

SmartDisk
www.smartdisk.com

Sonic Foundry
www.sonicfoundry.com

Sony
www.sony.com

Steinberg
www.us.steinberg.net

Tascam
www.tascam.com

TC Works
www.tcworks.de

Universal Audio
www.uaudio.com

USBgear
www.usbgear.com

Waldorf
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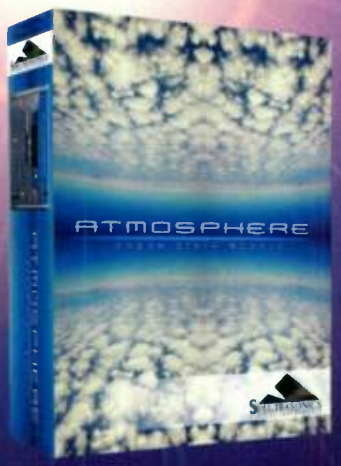

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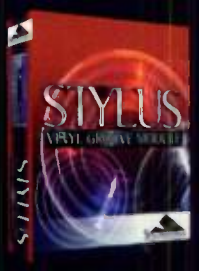

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(say, 30 minutes) or turning them off entirely. You'll burn up more battery power running your laptop in this mode, but it beats having to reboot your entire system.

For storing audio files, it's always a good idea to have a hard drive that is separate from your system drive. This prevents the mixing of audio files and application resources that can result in a badly fragmented drive and lead to poor drive performance and system crashes. Connecting an external FireWire or USB drive to your laptop is one solution, but it's one more item to pack. If you do go with an external drive, however, make sure it is self-powered, like the HUSH 5400 series drives from AVammo, which store from 20 to 60 GB.

A more elegant solution is to split your system drive into two partitions, one for your system and program files and the other for audio files. This may, at first, seem like an inefficient way to use your system drive, but in the long run, it will help optimize your digital audio sequencer's performance and keep your files organized. Unless you use custom software such as PowerQuest's Partition Magic (Win), partitioning a drive must be done at the formatting stage, so make sure to partition your system drive before you start installing software. And choose your partition sizes carefully, because once they are set, you typically can't change them without reformatting (allow a minimum of 10 GB for your system and programs' partition).

ERIK HAVIKINS

This hardcore MOTU setup includes an 828 FireWire audio interface and an MTP AV MIDI interface with Digital Performer 3. An extra tube-based preamp is also a key part of the setup.

Most laptops come standard with two USB ports, but with so many USB peripherals to plug in (the keyboard controller, audio interface, and copy-protection dongles, and so on), two ports are sometimes not enough. Fortunately, USB hubs are inexpensive and easy to find. When choosing a hub, find one that can draw its power right from your computer's USB port. Some audio interfaces must be connected directly to the computer's first USB port and will not work plugged in to a hub. In these instances, connect the hub to

SUGGESTED LAPTOPS

The computers listed below are stock configurations and can be purchased as they appear, directly from the manufacturer or an authorized dealer. Prices are current as of this writing. For most models, you will probably want to add RAM, which will increase the total cost. For more suggestions on notebooks suitable for audio applications (especially audio recording) and other related tips, visit www.rme-audio.com and check out the Tech Info page.

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Apple Titanium PowerBook
PowerPC G4/800 MHz
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30 GB Ultra ATA drive
14.1" screen
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(2) USB
(1) FireWire
$1,799

PC
IBM Thinkpad A Series
Pentium 4/1.6 GHz
256 MB of system RAM
40 GB Ultra ATA drive
15" screen
Combo drive (DVD-ROM/CD-RW)
(2) USB
(1) PC CardBus slot
$2,499

your computer's second USB port and use it exclusively with devices that don't need much power (such as copy-protection dongles and battery-driven controllers).

Don't be cheap when choosing a case for your laptop. After spending so much money on the computer and many hours setting it up, you need to protect your investment. A little tumble in a cheap and poorly designed bag can be a costly accident that may have been easily avoided by spending a few extra bucks on a well-designed bag. Good computer stores sell backpacks that are specially designed for laptops and have plenty of pockets for cables, headphones, CDs, and small interfaces. You could also go with a more traditional, over-the-shoulder soft case. London Fog makes bags with a removable, soft, padded envelope that the laptop fits into. When the envelope is stowed in the main bag, there is a good amount of cushioning around your computer. Whatever style you choose, make sure it provides ample protection but isn't so heavy that it becomes a pain to carry when it's loaded with gear.

ON THE ROAD

No matter what type of system you decide to put together, remember that portability and ease of use are key factors. You don't want a system that is a big hassle to pack and painfully heavy to carry, nor do you want a setup that isn't powerful enough to get the job done. To make life easy on myself, I have assembled two separate setups for my laptop. One consists of a small USB audio interface and keyboard controller, which I grab when I want to travel light. The second is a 3-space rackmount system containing a mic preamp, a multiport MIDI interface, and a FireWire audio interface. I bring this setup with me when I plan to do multitrack recording and I know that there will be an external power source at my destination.

A compact and easy-to-use system can inspire you to compose and record music whenever you have time and wherever you are, instead of just when you make it into the studio. There's also the added bonus that composing in different locations can be a very enjoyable change of pace and an inspiration of its own. The portable rigs that I built have been some of the best investments I've ever made in terms of my productivity. They are not meant to replace my home studio (though the power is certainly there); they are simply another way to keep the music flowing. If daily life is eating up your every free moment and you would give anything to steal away for an hour or two of composing, you are probably a good candidate for a laptop-based writing and recording setup.

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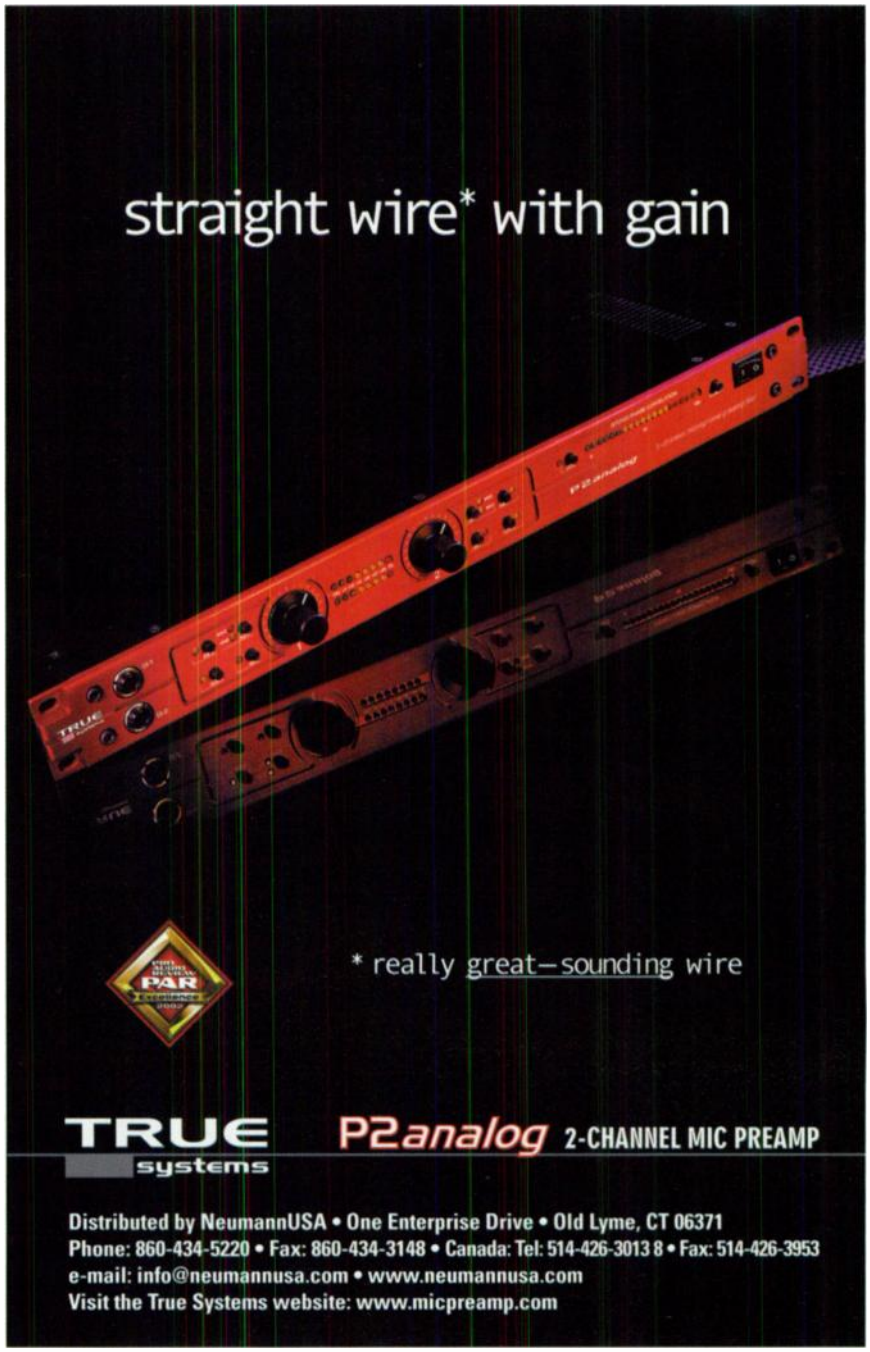

Outside Storage

Find a home for all your laptop audio tracks.

By Brian Smithers

It wasn't so long ago that I was considered a freak for making a notebook computer the center of my studio. Compared to the awe-inspiring Pentium 60 desktops of the day, notebooks were slow and limited. Audio hardware for laptops came in two types: vaporware and buyer-beware. Worst of all, recording to a 400 MB hard drive gave new meaning to the term "cramped quarters."

DMITRY PANICH

Now that using notebooks for audio production is commonplace, all those problems have been resolved, right? Not exactly. There are indeed a number of appealing audio interfaces on the market, and notebook processors have advanced to the point of being more than adequate for almost any audio task. Storage, however, is a different issue.

With very few exceptions, notebooks are equipped with only one hard drive. That simple fact is bad news for laptop audio engineers for three reasons. First, using a dedicated audio drive that is separate from the system drive is a simple and cost-effective way to get more tracks out of your computer. That's because the drive reading and writing audio data is unimpeded by requests to deliver OS or program files. Second, a single drive gets cluttered and cramped too quickly, especially when a typical 20 GB notebook drive shares its space with the operating system, programs, libraries of samples and loops, and so forth. The third reason has to do with drive speed: most laptop drives spin at a measly 4,200 rpm, barely more than half the speed of a typical 7,200 rpm desktop drive. (For reliable audio performance, 7,200 rpm is the minimum acceptable speed.)

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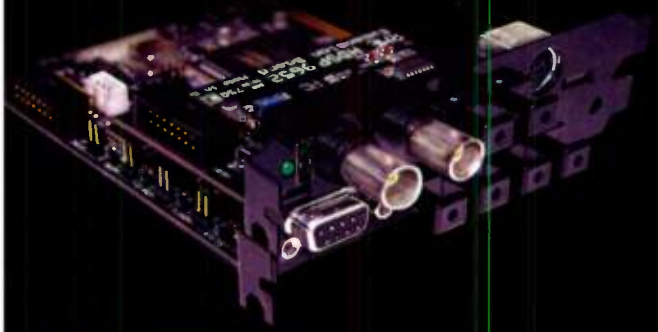

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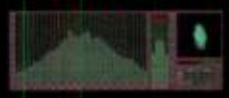

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LIGHT MY FIRE

As you can see, it's best to have a dedicated audio drive for your notebook–one that's big enough and fast enough to hold your dream sessions. Because there's no room inside your notebook to install such a drive, your only option is to connect an external drive. There are a few different ways to accomplish that, but let's start with the one that's capturing all the attention of late: FireWire.

Properly known as IEEE 1394, FireWire combines a data pathway capable of moving 50 MB per second (400 Mbps) with Plug-and-Play connectivity and hot-swappability. Theoretically, you can daisy-chain a large number of devices on a single FireWire port, but because they all share the same bandwidth, there's a practical limit to how many devices you would want to chain.

For a notebook equipped with at least one IEEE 1394 port, attaching an external FireWire drive (see **Fig. 1**) and hitting the Record button is about all there is to it. Most current FireWire drives use 7,200 rpm IDE drives, offering plenty of speed at a reasonable price.

FIG. 1: Glyph Technologies' line of FireWire drives includes the extraquiet Companion drive, which is designed to match Digidesign's Mbox audio interface.

One thing to watch out for is that not all IEEE 1394 connections are created equal. It's less of an issue with more recent devices, but early implementations of the protocol often operated at less than the full bandwidth. For example, according to Jim Cooper of MOTU, "Older iMacs and Blue G3s were equipped with 200 Mbps [FireWire] buses, as are several PCI and CardBus [FireWire interfaces]. Buyers should always check to make sure that any FireWire expansion products they are thinking about purchasing offer 400 Mbps bandwidth."

FIG. 2: WiebeTech makes the utilitarian DriveDock line of FireWire adapters, allowing you to hook up off-the-shelf bare drives to an IEEE 1394 connection.

MOTU's 896 FireWire audio interfaces feature pass-through ports that allow users to chain multiple interfaces and FireWire hard drives, and MOTU's 828s can be chained to drives that have a pass-through port (or you can use a powered hub). "Our experience is that one FireWire hard drive, in terms of bandwidth, equals one 828. So you could have three 828s and one FireWire drive, for example," according to Cooper. When using the 896's higher sampling rates, of course, track count is cut by about half.

Gordon Lyon, Digidesign's Product Manager for Storage and Compatibility, states that good indicators of a FireWire drive's suitability for audio include 7,200 rpm rotation speed, 100 MHz ATA bus, and the Oxford 911 chip. Not surprisingly, one drive matching that description is Digidesign's own DigiDrive FireWire 80, which is capable of being daisy-chained to a Digi 002 FireWire interface without compromising performance. Oxford Semiconductor's 911 chip seems to be a common denominator for many of the FireWire drives being sold for DAW use. (The truly power-mad will no doubt be excited to know that Oxford has announced the 922 chip, supporting the next generation of double-speed FireWire devices.)

Operating-system support for FireWire drives is respectable on both Macs and PCs, but the vendors with whom I spoke generally recommended using the latest versions of the operating systems. As always, it's a good idea to check your DAW manufacturer's online tech notes or compatibility documents before parting with your hard-earned cash. Notebooks with 4-pin FireWire connections will need an adapter cable to connect to a drive, which uses a 6-pin connection.

How fast is fast? The bottom line, of course, is how many tracks you can expect to record and play back with a FireWire hard drive. As with most computer-performance questions, the answer is, "It depends." There are so many variables involved that hard numbers are hard to come by. Processor speed, driver design, choice of software, bit depth, sampling rate, background applications, and other factors all have to be taken into account.

The good news is that the numbers I've heard are all pretty encouraging. I've heard numerous reports from users of getting 64 or more tracks of 24-bit, 44.1 kHz audio playback from a single FireWire drive attached to a reasonably powerful notebook computer. The most conservative numbers come from Digidesign, whose systems support up to 24 tracks of 24-bit, 48 kHz audio per FireWire drive.

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FIG. 3: Trek's ThumbDrive is one of the many solid-state USB storage devices to hit the market recently. Although its speed isn't up to the needs of multitrack audio recording, its convenience for storing samples and song ideas is undeniable.

rates its 80 GB Companion FireWire drive for 48 tracks of playback with no edits or 48 tracks of recording at 24-bit, 48 kHz resolution. At 96 kHz, those numbers drop to 40 tracks, but with two edits per second across all tracks the numbers drop by about half. That's not unique to FireWire drives, but because they spin at 7,200 rpm they are more sensitive to edit density than are the 10,000 rpm drives typically used in SCSI configurations. (According to Glyph, these results are based on Digidesign's own torture test, which stresses the drives far beyond typical recording, mixing, and editing use.)

The most optimistic numbers I've seen claim 120 tracks of 24-bit, 44.1 kHz audio with an edit density of two edits per second. At a 192 kHz sampling rate, the highest numbers are 24 tracks for a single drive. For the most up-to-date information, be sure to check the vendors' Web sites (see the sidebar "Checking the Specs"). As they say, your mileage may vary.

While most FireWire drive vendors are touting their well-insulated noise-suppressed external drives, a company called WiebeTech is taking the opposite approach with its DriveDock line of FireWire bridge modules (see **Fig. 2**). The DriveDock attaches on one side to an IEEE 1394 cable and on the other side to a naked 3.5-inch hard drive (or CD or DVD drive). What this setup lacks in sex appeal and noise-proofing it makes up for in convenience, price, and flexibility. You could literally have a single DriveDock and a bag full of hard drives and swap out the drives from project to project. The DriveDock requires an AC adapter, but its sibling the Super DriveDock is bus powered.

EXPRESS BUS

USB 1.1 drives have quite appropriately been dismissed as inadequate for digital-audio recording. With a maximum data rate of 12 Mbps (compared to IEEE 1394's 400 Mbps), USB could under ideal circumstances deliver a few tracks of 24-bit, 44.1 recording or playback. Most modern notebooks would do much better using their internal drives.

USB 2.0 increases the stakes to 480 Mbps (maximum burst rate), surpassing (in theory) the performance of current FireWire devices. (USB was not designed to handle large blocks of streaming data, such as digital audio, as efficiently as FireWire does, so it demands more processing overhead for any given audio command.) While some manufacturers are taking a wait-and-see attitude, Cakewalk's Vice President of Engineering Ron Kuper says, "I think USB 2.0 has a strong future for audio." With USB being ubiquitous on Macs and PCs and FireWire still optional on PCs, there has been a lot more development in audio devices for USB than for FireWire. Although Apple is bullish on FireWire, "Intel and Microsoft are strongly behind USB 2.0, and USB is cheaper, so the average PC user is way more likely to see an integrated USB solution on their motherboard," says Kuper.

Microsoft has delivered native USB 2.0 support in its first Service Pack to Windows XP. (Unlike FireWire, USB 2.0 wasn't ready when XP was first released.) Eighty percent of PCs shipped in 2003 are expected to have integrated USB 2.0 support. (Meanwhile, Apple says it is "watching" USB 2.0.) Numerous USB 2.0 CD-R and hard-drive products are already available, but none of the audio-centric drive vendors has taken the plunge yet. A number of the USB 2.0 drives that are currently available feature dual support for either USB 2.0 or FireWire, raising some enticing possibilities. Track count for USB 2.0 drives could be as good as FireWire drives as long as the device has a 7,200 rpm rotation speed.

CHECKING THE SPECS

For current specs and up-to-date information on external drives, check out the vendors' Web sites.

AVammo, Inc.
www.avammo.com
compact FireWire drives

Digidesign, Inc.
www.digidesign.com
DigiDrive FireWire 80; Digidesign's compatibility documents, though intended for Pro Tools systems, are a useful reference for anyone designing a DAW system

Glyph Technologies, Inc.
www.glyphtech.com
FireWire and SCSI external drives

Magma
www.magma.com
PCI expansion chassis

Pacific Pro Audio
www.pacificproaudio.com
fast and quiet FireWire drives (among other things)

Trek 2000 International Ltd.
www.thumbdrive.com
Trek's tiny little storage devices

WiebeTech
www.wiebetech.com
DriveDock FireWire adapters

Another interesting development in USB storage is the appearance of several models of key-chain USB devices such as the ThumbDrive from Trek (see **Fig. 3**). These solid-state storage devices come in sizes from 16 MB all the way up to 1 GB. Although they're not fast enough to record and play back multitrack audio, they are a convenient way to carry around lots of small- to medium-size files that might come in handy. You could keep favorite loops or drum replacement samples, test tones, plug-in presets, song ideas, or anything else to which transfer speed isn't critical.

BY ANY OTHER NAME

The best performance in notebook hard drives is still found in SCSI devices. CardBus-to-SCSI adapters open the world of SCSI performance to the mobile engineer, but in general the cost is higher than with FireWire. That's partly due to the fact that FireWire ports are built in to many notebooks, whereas built-in SCSI ports are quite rare. Therefore, for starters you would have to purchase the adapter. The rest of the story is that the cost of SCSI hard drives is higher than that of ATA drives, so you get hit coming and going. Still, if performance is your top priority, SCSI is the way to go. Another option to consider is that Magma's CardBus-to-PCI expansion chassis is available with SCSI support built in.

The storage options for notebook-lugging musicians have never been better. You can have any or all of the things you desire in external storage: convenience, affordability, speed, noise-suppression, capacity, and compatibility. I still wouldn't turn up my nose at a hot-swappable SCSI-160 drive bay in my next notebook, but at least now I don't have to hold my breath.

Brian Smithers *is working on retrofitting his calendar with support for FireWire drives to increase its storage capacity. In his spare time he teaches at Full Sail Real World Education in Winter Park, Florida.*

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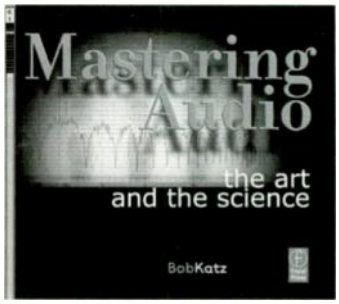

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Keepin' It Real

The art of creating natural effects for your productions.

By Sean Carberry

Recently I was wandering around Boston Symphony Hall working on a radio project, and as I listened to the luscious reverb of that room, I began thinking about how far we've come since the hall opened in 1900. In those days, an orchestra simply went on stage and played. There were no microphones, no P.A. system, no gimmicks—just acoustic instruments in a beautiful-sounding space. More than 100 years since its coronation, Symphony Hall still reigns as one of the best-sounding orchestral settings in the world.

MIKE CRUZ

Nowadays, of course, even the most humble recording studio is equipped with one or more boxes (or plug-ins) designed to digitally re-create the spacious soundscapes of symphony halls and other sonic environments. Thanks to digital reverb, making a violin recorded in your bedroom sound as though it had been played in a concert hall is as easy as turning a knob.

Yet for all its wonders, digital reverb is not indispensable, nor is it always the best way to impart a convincing sense of space to your recordings. Does anyone really think that, for example, Miles Davis's *Kind of Blue* would sound better if PCM70s had existed in 1959? Would Led Zeppelin's "When the Levee Breaks" still hold up today as a zenith of rock drum tones had the kit been close-miked and swathed in digital reverb? I think not.

The fact is, people were making amazing-sounding recordings long before the advent of reverb units (whether digital or analog). And they often did so simply by capturing the natural reverberations of the recording space—if they incorporated reverb into their recordings at all. There's no rule, after all, that says you must use reverb in a recording. Further, if you do use reverb, nothing says that it has to come from a binary box. Instead, you can go straight

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to the source and use real reverberation—something that happens, to some degree, in every 3-D space (excepting anechoic ones).

What it boils down to is this: why use approximations of room sounds when you have the real thing at hand? Even for the personal-studio recordist who has limited access to reverberant spaces, plenty of other natural ways exist to imbue your recordings with a sense of space. In this article I'll describe techniques for creating "reverb-in-a-box" by capturing and manufacturing musical reflections and other substitutes that you can use in your recordings. Getting a handle on these techniques will quite likely improve your productions and enhance your understanding of acoustics and the recording process. As a side benefit, your proficiency in manipulating artificial reverb will probably increase—assuming that you ever need to use it again!

BOUNCING OFF THE WALLS

The easiest natural way to give a lush sense of space to a recording is to record in a lush-sounding room. I have done the majority of my recording in medium-size (semilush) studios—sometimes they have been large enough to create the right reverb for a recording, and sometimes they haven't.

Generally, the best rig for capturing real reverb consists of a stereo pair of ambient (room) mics. If the room is large and echoey, you can put the mics up almost anywhere and be in business. In less reverberant spaces, though, it pays to walk around the room and listen for "sweet spots" while the music is playing. Just as there is a sweet spot where the instrument sounds best in the room—which is the first thing you should determine—there are also sweet spots in the room where the natural reverberation is most apparent or best complements the sound. Every room is different, so listen carefully both with your ears and with the mics you choose for the application.

If the room is neither big nor live enough to give you the depth of reverberation you desire, try compressing the ambient microphones. A good squashing can bring up room reflections considerably. (For that application, I especially like photo-optical compressors such as the UREI 1176 and the original Joemeek SC2.) That is a standard approach, especially for drums—slam the room mics, bring them up in the mix, and voilà: big, live drums with no need for artificial enhancement. (You can hear an audio example of this on the EMWEB CLIPS song "Across the River" by David Johnston at www.emusician.com.)

Need more reverb still? Look for ways to increase the reflectivity of the room. Raise the piano lid, put some sheets of plywood on the floor or along the walls, turn the extra guitar amps around, or what have you. You can also get more adventurous with the room mics: aim them at a mirror or window instead of at the drums, or put them close to the ceiling or floor, depending on which is more reflective.

If you still can't summon enough life from the space, it's time to get radical. A trick that works in some cases is to create reverberation with long tubes. Try surrounding the drums with a couple of aluminum clothes-dryer exhaust tubes, positioning one end of each tube close to the kit and the other away from it (see **Fig. 1**). Make a few bends and curls in the tubes, and place mics at the ends farthest from the drums. That typically yields a rather lo-fi sound, but it will definitely add depth and reflection to the drum sound. Other tricks include lining the floor with spare cymbals (creates more reflections); putting a room mic in an adjacent garage, stairwell (see **Fig. 2**), or other reverberant space (with the door between the two areas open); and even positioning a room mic inside an open trash can (metal ones sound quite different than plastic ones, by the way). In short, think outside the box—or house.

SEAN CARBERRY

FIG. 1: Aluminum exhaust tubing makes for a cool reverb "chamber" on drums. Shown are two eight-foot tubes miked with a pair of Neumann KM 84s. You can tape several such tubes together to add even more depth to the sound.

LET IT BLEED

Another classic technique is to record live without isolation—what might be

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FIG. 2: Take advantage of distance whenever possible. The studio Rear Window in Brookline, Massachusetts, has a load-in door at the top of the stairs in the main room. I often position a room mic there, pointed at the door (which is closed) to capture the maximum ambient sound in the room. During mixdown, I compress the signal and add some tape predelay to increase the apparent size of the space.

called a Daniel Lanois approach, in today's parlance. Tear down the gobos, open the doors to the iso booths, and let the sound bleed. Allow the guitar-amp mic to pick up the drums. Let room mics capture the instruments from every corner of the studio (or house).

I've recorded several albums with blues bands that love the "old school" blues sound—the sound of a band, minimally miked, playing live in a large room. This works best with bands that can play well and that don't have to rely on punch-ins or overdubs. Granted, it's not hard to simulate this sound with the assistance of digital reverb—but what *can't* be simulated is the *vibe* you get from recording this way.

When recording the band Two Bones and a Pick at Rear Window Studios in Brookline, Massachusetts, I placed the drums in the main room along with an AKG The Tube mic positioned three feet in front of the kit and about knee-high. For overheads I used an Audio-Technica AT 4051 and a Shure 520D Green Bullet. I put the guitar amp in a large isolation booth and miked it with a Neumann U 47 placed three feet in front of the amp and a Neumann KM 88, in omni mode, hanging from the booth's 14-foot ceiling. That setup allowed me to use the door as a balance control to adjust how much bleed I wanted between the two rooms.

I positioned the bass amp in the main room with the drums, isolated slightly with gobos. I put the keyboard player, who alternated between piano and Hammond B-3, in the same room. If a song called for horns, I scattered the horn players all around the studio. Finally, I used an Audio-Technica ATM33a small-diaphragm condenser, suspended from the 14-foot ceiling of the main room, to pick up the entire band.

The challenge in this kind of multi-mic setup is the phase check; with all that bleed, it can take a while to sort out phase anomalies between the mics. But once you work that out, your mix is close to finished. I managed to record and mix the Two Bones and a Pick album *Butter Up and Go* in just three ten-hour sessions, largely because we got a great sound, and vibe, on tape from the git-go.

A ROOM OF ONE'S OWN

When recording the rock group 3Ball at Room 9 from Outer Space in Boston, I decided to take more of a Tom Petty/Rick Rubin approach. I had been listening to and loving Petty's album *Echo*, which, though recorded entirely without artificial reverb, sounds great—clear, punchy, and very rock 'n' roll. So I set myself the challenge of recording the whole production without using electronic effects.

First, I set up the drums in the main room and made sure the studio was as reverberant as possible. For room mics I set up a pair of AKG 414 TLIIs in a Blumlein array. I ran the mics through a Vintech 1272 preamp and a Tube Tech LC2B stereo compressor, then applied a healthy dose of compression. Another factor in the drum sound that helped me sidestep effects boxes was that the drummer used a very open-tuned snare drum with a long sustain.

For the guitar tracks, a quirk at the studio—the door to the bathroom is accessible only from inside the iso booth—allowed me to exploit the sonic relationship between the iso booth and the bathroom. First, I set up a Marshall half-stack in the booth and close-miked it with a Royer R-121 ribbon mic. Then I positioned a Neumann KM 86, set to omni pattern, inside the bathroom, and I strapped the bathroom door open with a bungee cord. By panning those two signals apart in the mix, I achieved a wide, live, rather Stonesey sound that proved to be perfect for the project. The only trick was remembering to mute the KM 86 when someone had to use the bathroom!

I used the studio's main room again, in a separate session, to overdub all the saxophone tracks for the 3Ball album. For the close mic, I chose a Lawson L47MP large-diaphragm tube condenser. The room mic was an Audio-Technica ATM33a suspended from the ceiling. By recording the saxes in the same room that I cut the drums in, I got a cohesive sound that really glued the tracks together. That's a great benefit of using real room reverb—it makes everyone sound as though they are in the same room (which they are, just not at the same time). I also cut the backing vocals in the main room, using a Soundelux U95 large-diaphragm condenser set to omni mode so as to

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capture maximum room reverberation. You can hear an excerpt from one of the songs, "Be Alright," at www.emusician.com. EMWEB CLIPS

ECHO YOUR CONCERNS

A common way to add depth and dimension to tracks without using artificial effects is to use double-tracking. The subtle chorusing effect that results from the slight differences between double-tracked parts not only thickens the sound but can also provide an illusion of space, especially if you cut multiple "doubles" and pan them out in the mix.

Of course, even with every effort made to create and capture natural reflections during the recording stage, it's often necessary to add more effects during mixdown. One thing I often use is analog delay, which can fatten a vocal track without making it sound "soupy" or obviously processed. Fortunately, devices are still around that can be enlisted for delay duties—specifically, 2-track reel-to-reel decks (see the sidebar "Delay Tactics"). Tape delay, as the technique is called, can work wonders on vocals, creating subtle doubling, rich "slapback," and even longer delays.

Another way to maximize the natural reverb of your live space is to use some predelay. On some of the 3Ball songs, I employed this type of predelay on the sax room mic, which had the effect of lengthening the overall decay time and thus increasing the apparent room size. (For the 3Ball vocal tracks I used short delays, generally low in the mix and with only a single repeat.)

CHAMBER OF HOLLERS

It wasn't long ago that "artificial" reverb meant a reverb chamber, not a binary box. People still tell stories about revered reverb chambers that sounded so good that any song run through them was guaranteed to be a hit. Some studios have reverb chambers, but they are few and far between.

When working at a studio that doesn't have a reverb chamber, I often set up a makeshift one in the main tracking room (which is usually outfitted with speakers). It's simple to configure—just feed an aux send to the speakers, set up a stereo mic pair in the room, and bring the mic signals back in on separate channels. I generally prefer ribbon mics for this application, because they smooth out the sound and minimize high-frequency detail.

A nice advantage of using the tracking room as a reverb chamber is consistency of sound: because it's the same room that you cut the other tracks in, you can add ambience yet maintain the sonic character of the overall recording. Of course, nothing says that you have to use the same reverb sound on every instrument in a mix. I've set up makeshift reverb chambers in main rooms, console rooms, iso booths, stairwells, and many other spaces, including what is typically the most reflective space in any house—the bathroom.

A bathroom reverb chamber is easy to set up and typically sounds great (see **Fig. 3**). Simply put a speaker or guitar amp in the bathroom and position a mic a reasonable distance away, preferably in the most reflective area (usually the tub or shower). Experiment with the placement of mic and speaker to get the right level of reverb. Try opening and closing the shower curtain or door to change the decay. Just make sure not to turn on the shower while the mic is inside!

You can use this same setup in any reflective space, of course—kitchen, hallway, garage, laundry chute, or what have you. Thankfully, using a reverb chamber is a fairly low-volume operation, which means you won't have to torture your neighbors with vocals blasting through the apartment as you mix at 3:00 a.m.

DELAY TACTICS

Before the advent of digital audio technology, delay was generated by feeding the signal to the record head of an extra tape machine and then returning the signal from the machine's play head. Because the tape passes over the record head before the play head, there is a short time delay between the two signals. The length of the delay, which can be derived by dividing the distance between the record and play heads by the tape speed, is typically short.

Setting up a tape delay requires a tape deck with three heads (erase head, record/sync head, and play/reproduce head). First, use an aux send to bus out the signal to the input of one track of the 2-track deck. Enable Record on the 2-track deck and route the output from the deck's play (or "repro") head into another channel of your multitrack recorder. That will give you a single, short repeat.

If the deck has a tape-speed control or, better yet, a variable-speed control, you can use that to alter the length of the delay. In addition, you can create multiple repeats by bringing up the aux send on the return channel, which creates feedback.

You can generate longer delay times by using two (or more) tape machines. One machine is used to provide a feed of tape, and the second machine is used to gather the tape onto its take-up reel. The tape passes over the heads of both machines, but only the second machine plays back the signal. The signal from its play head is returned to the record head of the first machine, resulting in a delayed repeat of the signal (when it passes again over the play head of the second machine).

It's also possible to create tape predelay. First, use a prefader aux send to bus out the signal to the 2-track deck. Enable Record on the 2-track deck and route the output from the deck's play head onto another channel of your multitrack recorder. Now mute the direct source so that only the delayed signal is returning to your mix.

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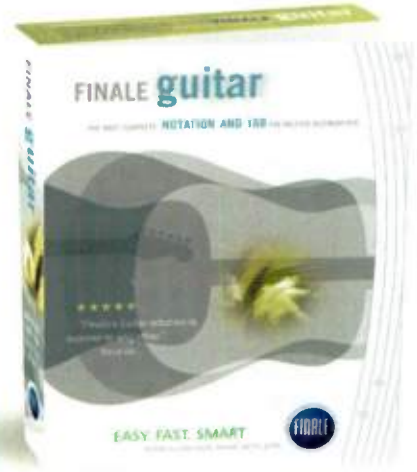

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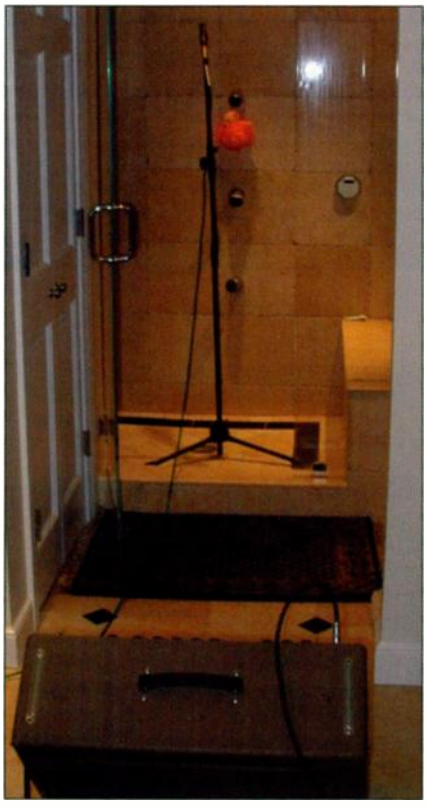
ODDBALL CHAMBERS

Reverb chambers can also be "constructed" from various common household items and spaces, often for little or no money. Of course, you're still using the same basic elements—a speaker, a mic, and some sort of reverberant space. The cool thing is that the spaces don't have to be large to create spacious sounds—they just need to produce a healthy dose of reflections and a sufficiently long decay time. Both the speaker and mic you select will color the reverb sound, so choose wisely.

Spin cycle. A washer or dryer can make a distinctive-sounding reverb chamber. The dryer is usually the better choice, because it's larger and all metal inside. Put a small speaker inside the dryer and position a microphone at the opening. You can also close the door partially and point the mic at the back of the door. Experiment. Like anything, this space sounds great sometimes and like complete garbage other times.



SEAN CARBERRY

FIG. 3: The dream personal-studio bathroom: this glass-and-tile shower has a decay time of a little more than a second. The guitar amp is about six feet from the shower door; the microphone, a Neumann KM 140, is aimed up at the shower ceiling.

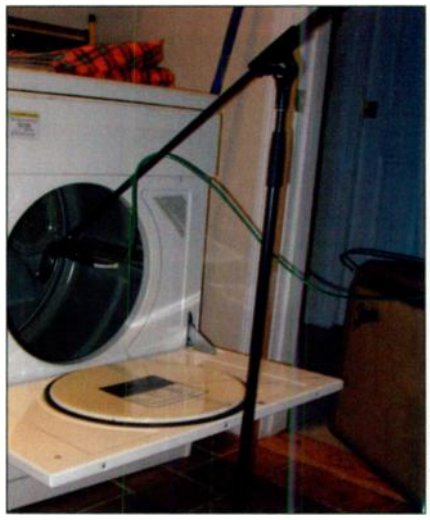
That and other "oddball" chambers can also be used as direct reverb sources (as opposed to using an aux send feeding a speaker). For example, a mic inside a dryer can be used to capture a reverberated sound from a nearby saxophone, guitar amp, or whatever (see **Fig. 4**). This technique tends to work best with louder sound sources—a vocalist standing next to a dryer might not generate enough level to stir up much reverberation inside the chamber (hence the focus here on the more versatile aux-send/speaker setup).

Totally tubular. Acquire a long section of rain-gutter downspout. Put a speaker at one end and a mic inside the other. Experiment by putting a blanket on top of the spout, which will dampen its resonant frequency and change the character of the internal reflections ringing through. This kind of chamber can also be made from a length of PVC pipe, a heating duct, or any other long, tubelike item with a reflective "finish" inside.

Grate sound. Many older homes and apartments have big, metal heater grates (the wall type) mounted in one or more of the rooms. First, sing into the heater grate to see if it reverberates nicely—some sound really good, sort of like a plate reverb. If you like the sound, bring in a small speaker and mic and have a go at it.

Heating up. If you're looking to make something a bit more permanent, go out and find an old hot-water heater. Install a speaker inside on one end and drill a hole or two at the other end so you can insert the mic(s). Hot-water heaters make great reverb tanks, and you'll also be doing your part to recycle.

Instrumental. I once used a 1936 Gibson L5 archtop acoustic guitar as a reverb chamber. It was hanging on the wall in a recording room, and, as the band played, the guitar put out a piano-like resonance. I miked it and captured a warm, woody reverb that added a nice spice to the mix. Keep your ears open—you never know what might produce a usable reverberation.



SEAN CARBERRY

FIG. 4: A bathroom isn't the only echoey space found in the average home. You can also use smaller, more unusual spaces to configure reverb chambers. For this application, I would actually move the amp down the hall to add more "distance" to the sound before it enters the dryer. I positioned it closer here only so it would be visible in the photograph.

DARKER DOES IT

Here's a final bit of advice that applies to mixing with any reverb, whether real or artificial: keep an ear on the high-frequency content. Too much high end competes with other sounds in the mix and also highlights the less appealing qualities of the reverb sound, whether acoustic or digital. Most great reverb sounds don't have a lot of high-frequency information (which is why, when creating acoustic reverb, I go for darker-sounding mics).

In general, you can safely roll off frequencies above 3 kHz and still maintain a rich sense of space. Besides, most of the time you want the reverb to be sensed more than heard. Keep things subtle, regardless of the source, and, as always, trust your ears.

Sean Carberry *is Technical Director of National Public Radio's* The Connection *and a reluctant freelance recording engineer in Boston.*

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For Love and Profit

Model your band's partnership agreement after a prenuptial contract.

By Michael A. Aczon

How many times have you heard someone say, "Being in a band is like being married"? Different personalities spending hours together in close quarters can bring about artistic relationships that are meaningful beyond compare. Unfortunately, it can also add up to disaster. Band implosion—whether it happens to the highly publicized multi-Platinum act or to the local high school trio from down the block—is a reminder that even the most solid relationships can be challenged.

As with planning a marriage, establishing ground rules for running your band's business in the early stages of your commitment can help you avoid serious problems down the road. One of the most effective tools that family lawyers use to strengthen the bond between couples is the *prenuptial agreement,* which is a precommitment road map of the legal boundaries of a relationship. The analogous document for a band would be a *partnership agreement* or similar document. Using a prenup as a model, I'll discuss some of the issues that you may want to put in writing before "walking down the aisle" with your bandmates.

JACK DESROCHER

COMMUNITY PROPERTY

One issue that I often encounter in band disputes has to do with the ownership of property. Such property comes in various forms and values.

When it comes to gear, you should distinguish what is owned by each individual from what is owned by the band as a whole. Instruments owned by band members before they joined the band are easily characterized as *separate property,* with each instrument being the property of the respective

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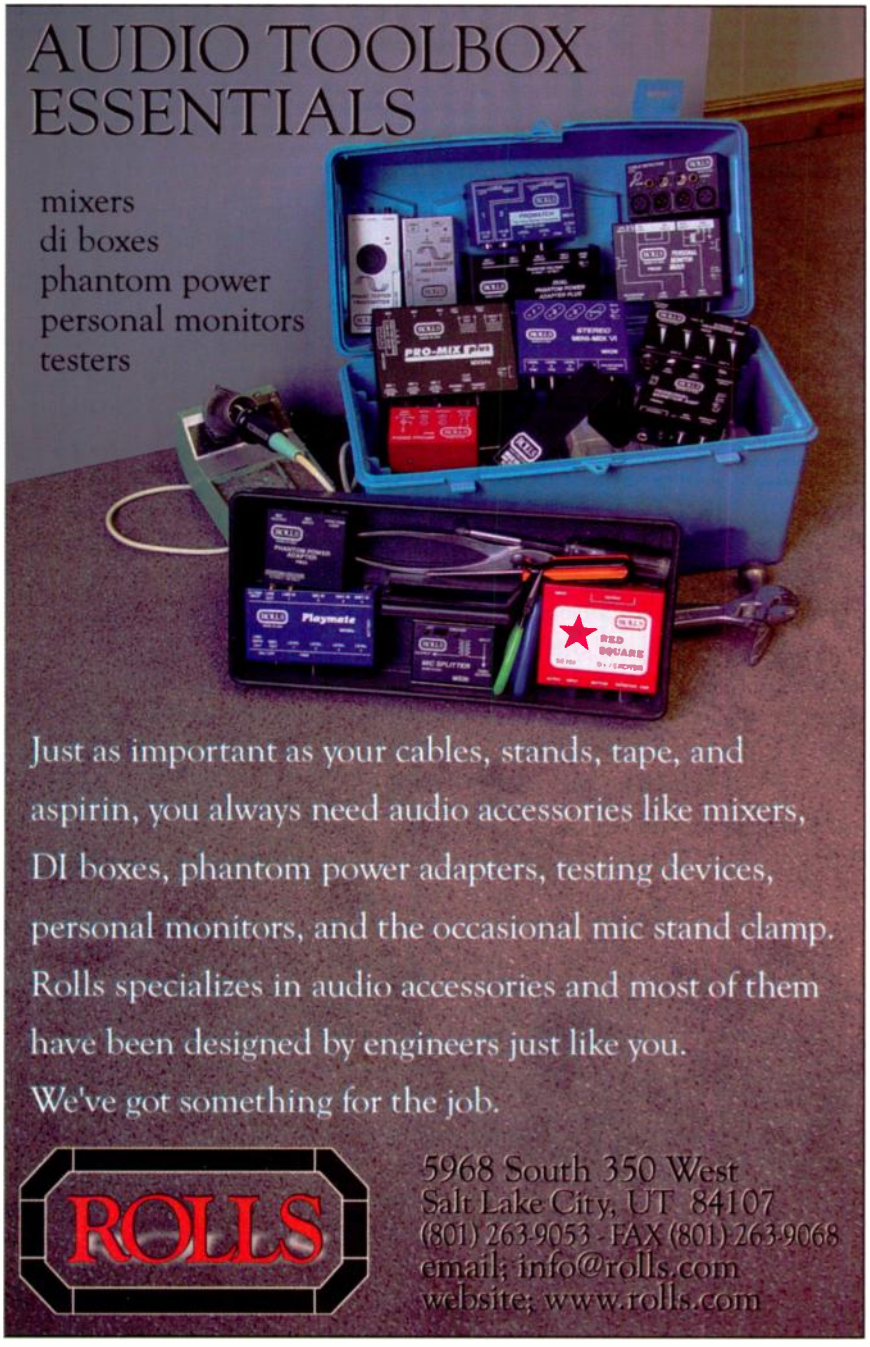
musician. As bands get bigger and more successful, the collective purchase of equipment, such as a P.A. system or recording gear is usually treated as *community property,* which is co-owned by all the members of the band.

If gear is purchased with band funds but is used by an individual, the situation becomes trickier and requires clarification. Is the keyboard that the band pitched in to buy owned by the band or the keyboard player? What about that Portastudio the band bought to record itself at gigs that grew into a full-blown studio located in a home that only one band member has full access to?

Band agreements can establish a policy and procedure for "borrowing" from band funds for gear. If an instrument or a piece of gear doesn't benefit the entire band because it is used by only one member, the band could own it until fully paid for by the individual person. Consequently, the band can sell the gear or instrument if the band needs cash or if the member later leaves. Some bands even have their members sign promissory notes that accrue interest to underscore the fact that borrowing from the band is just like borrowing from a bank.

When it comes to studio time, some bands pay the member providing the service in cash as though they were using a third-party studio, especially if the member with the studio built and paid for it himself. If the band has contributed equipment for the studio, however, one solution is to develop a credit system that allows the members a certain amount of free recording time. In addition, if the person housing the studio uses it for outside projects, the parties need to figure out how much money is owed to the other band members who share ownership of the gear. It is crucial to account for "spec" producer fees or royalties when arranging these kinds of agreements with each other early on in your careers.



PATERNITY ISSUES

If issues about equipment can lead to squabbles between band members, issues over song copyrights can escalate into all-out war. Some of the most publicized band battles have been about questions stemming from what constitutes a writing contribution, who owns and controls a song, and how royalties should be divided.

One issue is how to handle songs that were written by band members before they joined the group. Say, for example, that a member wrote a song called "The Hit" three years before the band was formed. The band then records the song and includes it on a demo along with a number of other songs written by the whole group. "The Hit" catches the ear of a record-label executive, and the band is signed to a record deal. "The Hit" is released as the first single and catapults the band into stardom. Several million sales later, the band members ask whether "The Hit" made the band a success or the band made "The Hit" a success. And what is the band's musical contribution to the song's worth with regard to royalties? Clarifying each

CONTRACT TALKS

If you and your bandmates are considering drafting a partnership agreement yourselves, you should certainly do a little homework. Author Michael Aczon recommends the following texts and CD-ROMs as good resources. Contacting an experienced entertainment lawyer to review the agreement that you put together is also a good idea.

—*Mary Cosola*

Automated Contracts for the Music Industry (CD-ROM), by Jonathan Earp (Entertainment Publishers, Inc., 2001).

Entertainment Industry Contracts (book or CD-ROM), Donald C. Farber, general editor, (Matthew Bender, 2002).

Note: the above book is a professional legal reference and is therefore quite expensive. You may want to try to find it at a legal library instead of purchasing it.

Music Law: How to Run Your Band's Business, by Richard Stim (2nd edition, Nolo Press, 2002).

The Partnership Book, by Denis Clifford and Ralph Warner (6th edition, Nolo Press, 2001).

member's contribution to each song at the outset helps make these situations easier to navigate.

Another variation on this theme is when a band's singer—who plays no musical instruments—comes to a rehearsal with a roughly recorded version of a song in which he has primitively accompanied himself on the piano. The band likes the song, then works it up to fit their instrumentation and style, leaving the basic melody and lyrics intact except for three words that were changed with the singer's blessings. Do the actions of the band in making the song its own result in the members getting a songwriting credit or merely an arranging credit? If considered as writers, are their contributions equal in value with the singer's contribution, or are they of lesser value?

The band's prenuptial can range from each songwriter retaining the rights to his or her contributions to a "one for all, all for one" approach to songwriting and eventual royalties. A common middle ground is for each writer to retain his or her writer's share of the compositions while sharing all or part of the publisher's share of the composition with a publishing company owned by the band. Regardless of how a band chooses to deal with this issue, the important thing is to deal with it openly and to document it.

PRIOR ACTS

Prior commitments are a challenge to every relationship, and bands are no exception. Those can range from the simple, easy-to-fix situations to the

complex, impossible ones. When entering into a new band situation, be sure to find out if any member has unfinished business that needs to be cleaned up before moving forward. If a prospective member still has gigs to do with his previous band, make sure that you don't have scheduling conflicts or that you can get subs to fill in. Sometimes prior commitments can be substantial and far-reaching, resulting in paying out significant amounts of money to rectify a situation. For example, if a band member was an involved party in a previous record deal, management deal, or studio spec deal, he or she may still owe services, royalties, or rights to another party. You can imagine how rude a surprise it would be for a band to sign a record deal only to find out that its lead singer still owes two records to another label.

Even more complex are legal issues stemming from personal actions that could affect a band. What happens, for example, when a member dies, files for bankruptcy, gets divorced, or doesn't pay his taxes? If the band doesn't take steps to keep outside parties and activities separate from the band, these third parties can potentially step in as "partners" of the rest of the band, insisting on making business decisions to protect their legal interests.

Let's face it, no one starting a band wants to consider things like death, divorce, and calamity in their lives. But, at the risk of sounding like an insurance salesman, there comes a time when you must talk about it. I suggest that bands take a business day to explore honestly a number of "What if?" scenarios with each other. Doing so can be quite creative and revealing for all. After a variety of situations are discussed, the band can then decide on the issues presented and draft into the band partnership agreement who they want involved in the business of the band and to what extent that involvement should be. For example, band members often want the right to pass their share of band profits on to their spouses or children through their wills, but with only the remaining members being allowed to participate in the carrying on of the business.

EXTRA CREDIT

Loaning a band member three bucks for a train ride home is quite different from pulling out a charge card to pay for $10,000 in travel expenses for your tour. Letting a fellow band member sleep on the floor of your apartment after a gig is very different from letting the entire band move in for six months to use your home as a base of operations and lock out your recording studio. The resulting legal issues, however, are still the same: someone owes someone else money or the equivalent of money.

Be they large or small, policies need to be set up early on regarding loans made to the band or band members by individual members. It is important to establish what is expected as financial and sweat equity contributions from each band member. Once that is agreed on, the band can determine how much money and which services go beyond the limitations of band responsibility, and should therefore be paid back.

▼ Prior commitments are a challenge to every relationship, and bands are no exception.

With cash, that is relatively easy to do with a simple I.O.U. or promissory note from the lending party to the borrowing one, which sets out the amount of the loan, the interest (if any), and the length of time that the borrowing party has to pay back the loan. Things get a little trickier when a band member with established credit borrows money on behalf of the band from a bank or by using a credit card. If the band should spend the money and then kick the band member out without assuming the responsibility of the loan, the ousted band member is potentially on the

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hook to repay the loan all by himself. Terms and conditions for spending limits, how and when loan money is spent, and repayment of loans made by or on behalf of the whole band should be documented in writing.

In kind loans, or loans that are for services rather than cash, are even trickier. When providing services, individual members need to evaluate what their services are worth. That can apply to Web design, graphic design, or a recording studio. If a band members happens to provide one of these services, should she be expected to "take one for the group" and give these services away as a freebie or is she entitled to receive fair compensation for these services? If the band is unable to pay for the services as they are provided, how should the account be kept and repaid in the future? These issues need to be discussed in advance, written up, documented, and then signed by all band members.

STEPPING OUT

Many band lineups change over time for a variety of reasons. Whether that process is disruptive or not depends heavily on how well the band planned for it early in their careers. Procedures for firing, resigning, initiating buyouts, and handling other restructuring issues are all crucial in making personnel changes as smooth as possible.

Some high-profile bands have planned so well for their solo careers that they designed their band agreements to allow for entering into an artist deal as a group on one label with the intention of pursuing solo careers or having production relationships on separate labels as solo artists.

HAPPILY EVER AFTER

This prenuptial checklist is meant to make you think about your band's business relationship as well as its artistic one. As with marriage, not every challenge that you and your musical mates encounter means you have to break up—especially if you do your work in the beginning. A solid prenuptial framework can be crafted by being candid with each other about your individual personal and artistic goals, anticipating the possible scenarios that can result from the group efforts, and thinking of creative solutions. Documenting this framework with the help of an entertainment lawyer or other music-business professional, if necessary, can help you avoid a number of unnecessary legal and emotional problems down the road.

EM *contributor and entertainment lawyer* **Michael A. Aczon** *started a band with a singer named Karen in 1979, and they have been enjoying music together as husband and wife since 1982. They live with their children, Lauren and Evan, in Northern California.*

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PROPELLERHEAD

REASON 2.0 (MAC/WIN)

A must-have upgrade from the king of the rack.

By Len Sasso

With the release of Reason version 2.0, Propellerhead Software has fulfilled a number of feature requests and added two excellent sound modules to their flagship product. You'll find a detailed review of Reason 1.0 in the July 2001 issue of EM (available online at www.emusician.com). Here I'll concentrate on what's changed and take a detailed look at the new Malström synthesizer and NN-XT sampler modules. But first, a brief overview for those who've not yet been exposed to Reason.

Reason is a standalone soft-synth workstation consisting of an endless virtual rack into which you insert sound-generating and effects-processing modules (see Fig. 1). Its six sound generators include two synthesizers, two sample players, a REX-file player, and a drum machine with a built-in pattern sequencer. DSP effects include reverb, delay, chorus, phaser, distortion, enveloped filtering, compression, and parametric EQ. A 14-by-2 mixer and a 32-step pattern sequencer round out Reason's complement of modules. You can have as many copies as you want of any module, limited only by your computer's processing power and memory.

FIG. 1: Reason's virtual rack holds as many sound modules as your CPU and RAM will support. The rack shown here contains a 14×2 mixer at the top, two half-rack effects modules below it, one of each of Reason's sound-generator modules, and a pattern sequencer (middle, with notes displayed in red). Reason's built-in MIDI sequencer and its transport live at the bottom of the rack, but the sequencer can be torn off, resized, and relocated.

PLUG THIS IN

If I could only take one DSP effects box with me to the moon, it would have to be the Kurzweil KSP8."
Alan Howarth, Engineer, Composer

"I really like the KSP8 and from the minute I hooked it up it has become a vital part of my mixing session."
Michael Wagener, Double Trouble Productions, Inc.

"The KSP8s routing flexibility and parallel processing capabilities were ideal for the situation. We also used one to process Mike Garson's main piano sound. Using the same sound source through a combination of subtle distortion, EQ, and ambience effects we were able to get piano sounds that had quite radically different character. For many songs, instead of changing patches on his keyboard, Mike's just changing to a different KSP8 chain program."
Tony Widoff, Programmer: David Bowie *Heathen* Tour

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Reason's signal flow is completely customizable by means of its virtual patch cables (see the sidebar "Back of the Rack"), although in most cases the correct cable connections are made automatically as modules are inserted into the rack. There are also extensive opportunities for controller patching. That, for example, allows LFO, envelope, and gate signals from one module to control parameters of another.

Reason includes a well-endowed MIDI track sequencer that is not as full-featured as most of the standalone software sequencers on the market but does offer the features necessary to get the job done. Reason's sequencer is built in to the rack but, as of version 2.0, can also be "torn off," allowing it to be resized and even moved to another monitor. The sequencer offers an Arrange view for grouping and arranging regions. There's also an Edit view with separate lanes for various data types including notes, controllers, pattern changes, and REX-file slices. Reason's sequencer does not record or play back audio tracks, however.

Reason does not host or operate as a plug-in in any format, but it does offer MIDI and audio connectivity using Propellerhead's ReWire protocol. ReWire is supported by a number of commercial products including the major digital audio sequencers. When used in that way, Reason appears as an audio input to the other ReWire application (called the Master), receives MIDI input from that application, and synchronizes to the Master's transport clock and tempo.

Reason is very CPU efficient and will run well on low-end processors. On the other hand, it supports the latest operating systems: Windows XP and Mac OS X. For this review, I ran it without problems on a Mac G4/800 MHz Titanium PowerBook using both OS 9.2.2 and X 10.2.

WITHOUT FURTHER ADO

Let's start with a look at what's changed and what hasn't. Two sound generators have been added, the Malström Graintable synthesizer and the NN-XT multisample player, which significantly extends Reason's synthesis and multisample-playback power (I'll cover Malström and NN-XT in separate sections). Both Reason sample players (NN19 and NN-XT) can now import SoundFont multisample presets and, like the Re-Drum drum machine, can also load individual SoundFont samples. Most LFOs will now sync to song tempo. And finally, some welcome new tools have been added to the sequencer.

Reason's included sample content has been nearly doubled with the addition of the 500 MB Orkester sound bank of multisampled orchestral instruments for NN-XT. The Orkester library is organized in four sections: brass, woodwinds, strings, and percussion. Each section contains a full complement of instruments in its category, and the woodwind and string sections also contain layered combinations that really show off NN-XT at its best. If you are already a Reason user, the Orkester library alone justifies the cost of the upgrade.

In addition to the tear-off feature previously mentioned, Reason's main sequencer has been enhanced with eraser, magnifier, line (for controller entry), and hand tools. The hand tool is especially welcome in Edit view because it individually scrolls lanes within the same track. Each tool has a modifier-key alternative, which changes the selected tool to another tool (for example, from the Pencil tool to the Selection tool). Unfortunately, there are no key commands for selecting tools. When the sequencer is torn off, it contains its own transport, identical to the one at the bottom of the rack. That gives you instant access to the transport controls from either the sequencer or the rack, but for those who find dual controls confusing or space consuming, either transport can be minimized.

One thing that hasn't changed in Reason 2.0 is Propellerhead's incredible attention to detail. That has always been obvious in the front- and back-panel graphics as well as many features of the user interface. Propellerhead's desire to avoid features that impede the work flow without significantly adding to Reason's functionality is also reflected in a number of design decisions. The Matrix Pattern Sequencer provides an example.

Matrix is a 32-step pattern sequencer with separate note, gate, and controller lanes. The note lane is not polyphonic, and because you can only plug one Matrix in to any Reason sound generator, you're restricted to monophonic patterns. There are a number of user-interface complexities involved in making a pattern sequencer polyphonic—for example, you must consider whether to provide separate Velocity lanes and allow for separate note lengths. On the other hand, there's a simple way to use Matrix to generate polyphonic parts by copying Matrix patterns to sequencer tracks. That keeps the Matrix simple for the most common pattern-sequencing jobs, which are monophonic, while providing a viable work-around for creating polyphonic patterns.

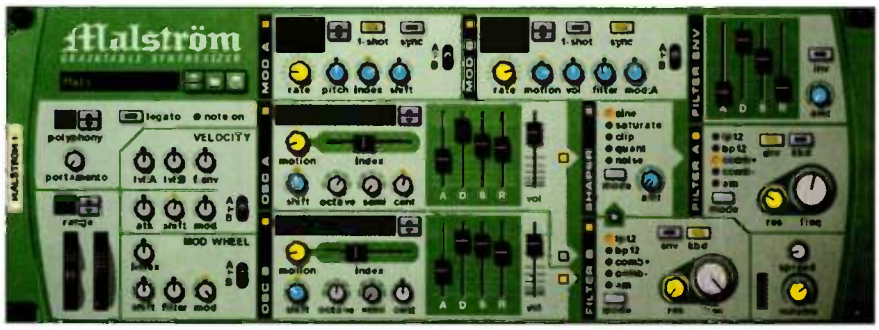

FIG. 2: Malström is Reason's most advanced synthesizer. It combines granular and wavetable methods in a system called Graintable synthesis. Dual, multimode filters, two multiwaveform LFO-like modulators, and a waveshaper round out Malström. Powerful signal- and control-routing options make Malström a very versatile synth.

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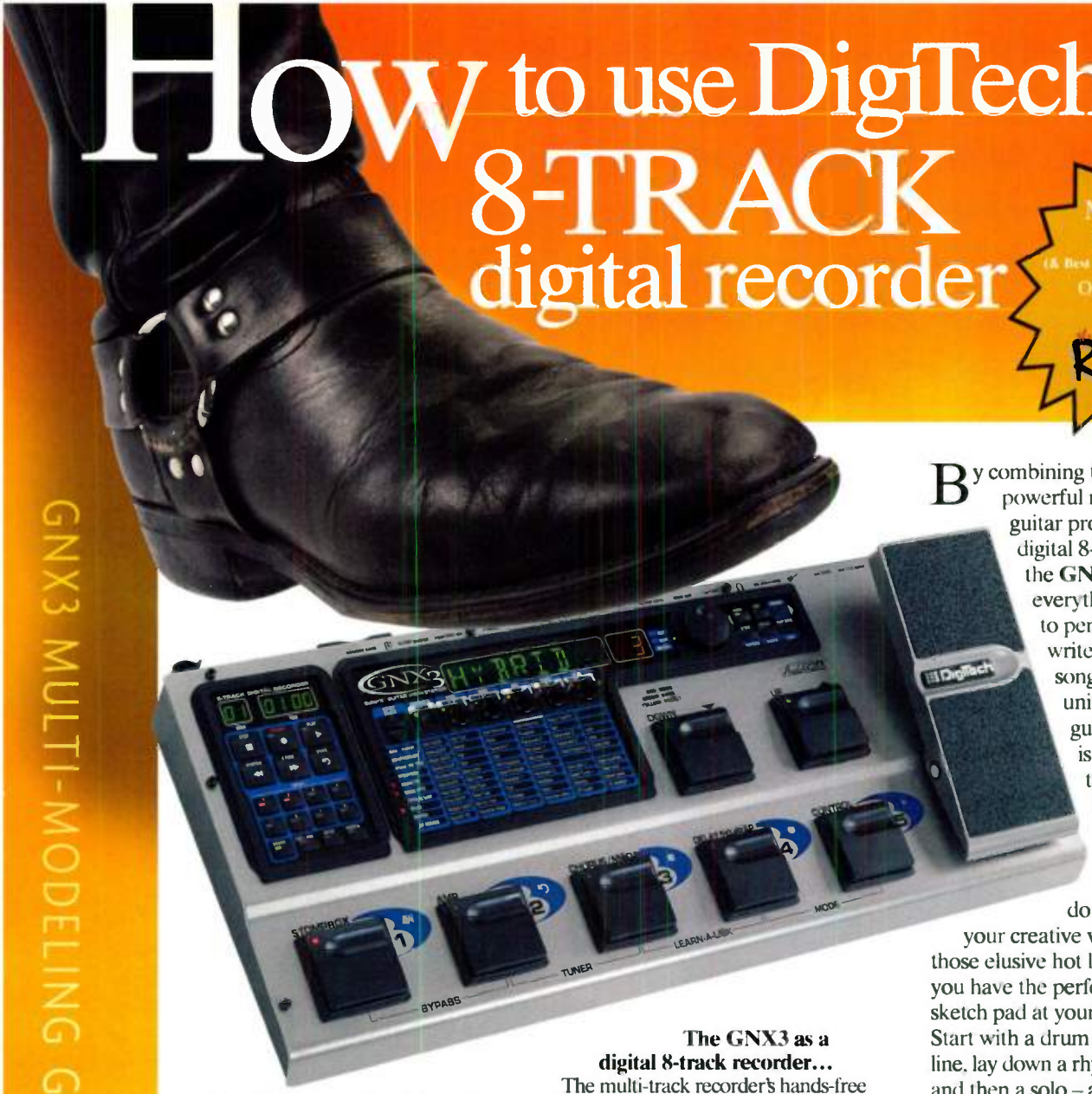

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Still absent from Reason 2.0 are MIDI output, ReWire mixing (allowing Reason to act as a ReWire mixer for your digital audio sequencer or standalone soft synths), support for third-party plug-ins, tempo and meter changes in the sequencer, program-change automation, and arpeggiation. I'd especially like to see CV and Gate mixing (which would allow one source to control several destinations and vice versa).

MALSTRÖM CHRONICLES

Malström, Reason's new high-end synthesizer (see **Fig. 2**), uses a wavetable approach to granular synthesis called Graintable synthesis. (A Graintable is a wavetable made of small slices or

BACK OF THE RACK

The back of Reason's virtual rack offers a wide variety of audio and control-voltage routing options. Although Reason's automatic cabling allows you to avoid the back of the rack altogether, you're missing out if you don't poke around there once in a while. You can use the Options menu or the Tab key to flip between the front and back of the rack.

Each Reason module has back-panel input and output jacks for two kinds of signals: audio and control voltage. Jacks for audio signals are larger. You connect modules by drawing cables between inputs and outputs of the same type. If jacks or their labels become obscured by cables, you can suppress the cable display from the Options menu or by pressing Command + L (Control + L on the PC). When cables are hidden, the holes for connected jacks are filled in, and you can still make connections by click-holding on a jack until a context menu appears containing all possible destinations.

When you insert a module into a Reason rack, automatic audio connections are made in the most logical way (that is, sound generators are patched to an output or mixer channel, and effects are patched as inserts or sends depending on their position in the rack). The quickest way to glean Reason's logic is to start with an empty rack, flip around to the back, insert a Mixer module, and then insert sound-generator and effects modules at different locations. You'll quickly see that Reason does exactly what you would do—unless, of course, you want something different. Modifications to the audio signal path will mostly involve inserting effects and modifying mixer configurations (for example, chaining two mixers to gain more channels). Most of the real fun is in control-signal patching.

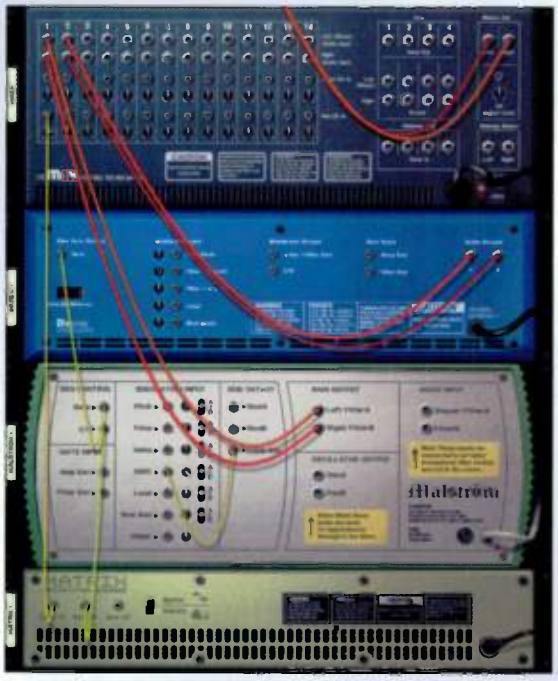

FIG. A: The back of Reason's virtual rack provides patch points for audio and control signals for each module. Here gates from the Dr.Rex REX-file player are cabled to trigger the Malström synthesizer. Notes from the Matrix Pattern Sequencer control Malström's pitch, while its controller lane (Curve CV output) automates the pan position of Malström's Mixer channel.

Reason distinguishes three kinds of control-voltage signals (all labeled "CV"): Gate, Note, and Curve. Although you can connect any CV output to any CV input, Gate CVs are intended for triggering notes, Note CVs are intended for controlling pitch, and Control CVs are intended for modulating parameters such as filter cutoff and pan position. The most obvious use for CV patching is to enable the Matrix Pattern Sequencer to play a sound generator. When you create a Matrix Pattern Sequencer below a sound generator, its Note CV and Gate CV signals are cabled to play the sound generator. But most sound generators have CV outputs from their various modulators, and those provide lots of creative modulation opportunities.

Fig. A and the MP3 file CVrex, available online, illustrate a simple but effective use of CV patching. Two sound generators are used: Dr.Rex plays a seven-slice percussion loop, and Malström plays a chime sound. The REX slices are played by Reason's sequencer, and the sequence has been altered so that not every slice is played in each measure. Dr.Rex's Slice Gate Output is patched to Malström's Gate input. Malström's playback is thereby triggered in sync with the REX-file slices. Malström's Filter Envelope is patched to the oscillators' Shift input, causing the timbre of the chime to change according to the envelope pattern. The oscillators' pitch is controlled by the Matrix Pattern Sequencer's Note CV. Finally, the Mixer pan position for the Malström channel is controlled by the Matrix Pattern Sequencer's Curve CV. The Dr.Rex slices play alone for the first eight measures of the MP3 example, with Malström coming in at measure nine.

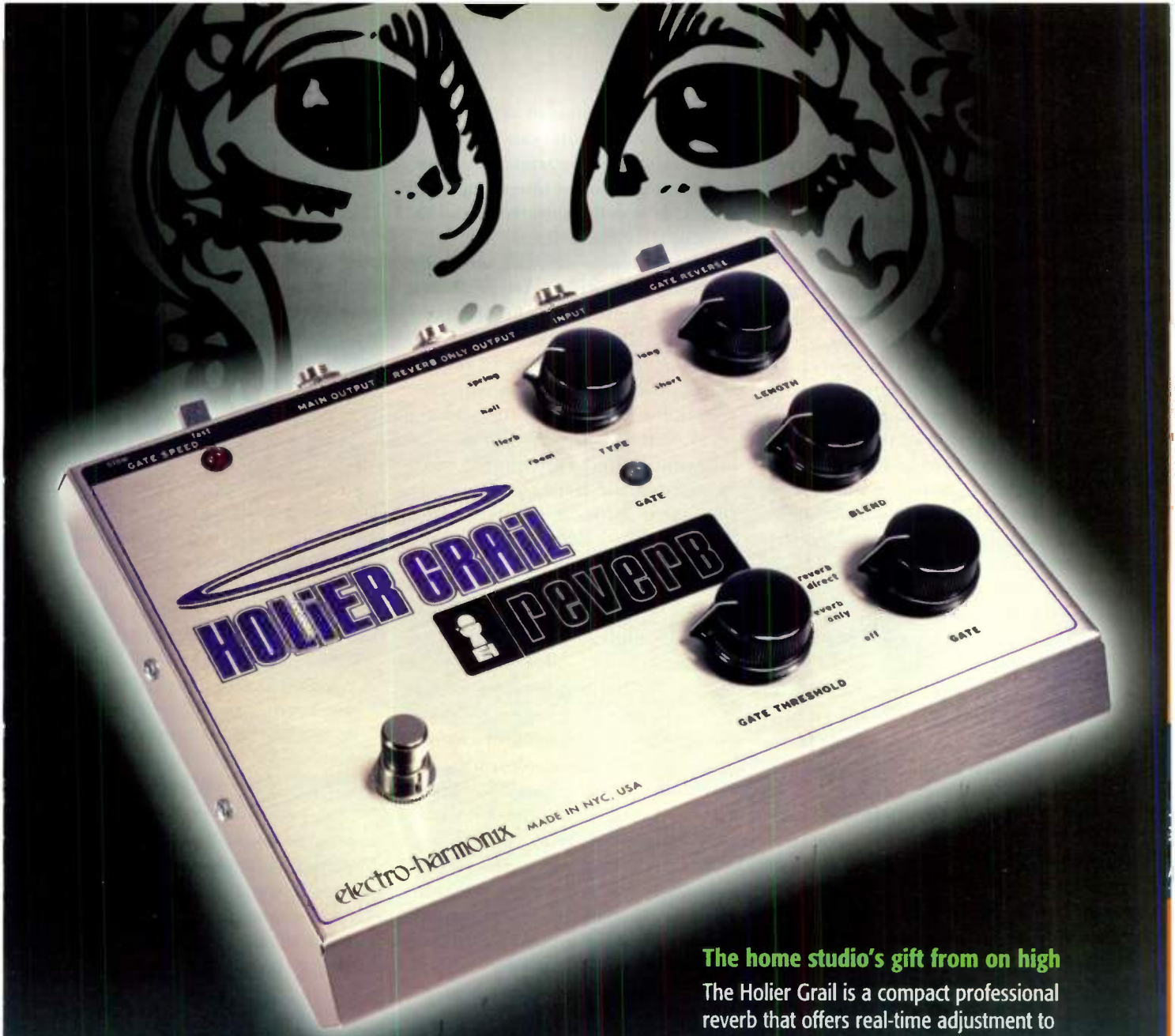

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FIG. 3: NN-XT is Reason's new high-end multisample player. A combination of layering and Velocity crossfading options provide for complex ensembles, a number of which are included in the new 500 MB, Orkester library. All synthesizer and sample-playback parameters can be set on a per-sample basis.

is modulated by the incoming signal. Comb filtering, especially with a little modulation on the filter frequency, is great for phasing and flanging effects. AM produces bell-like, clangorous sounds.

Malström features two signal paths, labeled A and B. Both begin with Oscillator A and Oscillator B, the Graintable oscillators just described. Path A proceeds through the Shaper to Filter A and then to Output A. Path B passes through Filter B to Output B. The output knob (labeled Spread) controls whether Outputs A and B are mixed and sent to both stereo outputs or are spread between them.

Two factors make that seemingly simple signal routing a bit more complex: some cross-routing options are available, and when the Shaper or a filter is turned off, signals pass through it unchanged. The cross-routings include Filter B into the Shaper (instead of to Output B) and Oscillator A into Filter B (possibly in addition to Filter A). Routing Filter B into the Shaper and then turning both of them off, for example, allows the oscillators to be mixed and processed by Filter A alone. The system can be a little confusing at first, but it pays big sonic dividends.

For modulation, Malström has two multiwaveform LFO-style modulators, each with 32 waveforms. Included are the usual single cycles, a number of unusual shapes, and a variety of stepped waveforms for producing arpeggiator-like effects. The modulators can be configured either to loop or to play once and can sync to tempo when looping. The modulators have different destination options, and a switch on their outputs allows them to be routed to those destinations in the A signal path, the B signal path, or both. For example, Mod A can affect the Index of either or both oscillators while Mod B affects their Motion. The patches in Malström's Rhythmic bank illustrate the power of the Modulators. In a nice twist, Mod B can be routed to control Mod A's amount. Both modulators have back-panel CV outputs, which allows them to be used with other Reason modules.

Malström has three ADSR envelopes; one for each oscillator and one shared by the two filters. The filter ADSR can be back-panel routed to a variety of other parameters. There is no envelope on the output; level is controlled solely by the oscillator envelopes. Having a single envelope generator for all modulation purposes seems a bit stingy, but the flexibility of the Modulators more than makes up for it. Flexible modulation routing for MIDI Mod Wheel (CC 01) and Velocity is also provided.

THE NNEXT SAMPLER

Reason 2.0's other major addition is the NN-XT multisample player (see **Fig. 3**). It offers a number of enhancements over its little brother, NN19, including many of the features found in high-end hardware and software multisample players. (Because NN19 is simpler, however, it is more CPU efficient.) Like NN19, NN-XT can import REX files, which allows processing (including separate outputs) of individual REX-file slices.

First and foremost, NN-XT supports layering of samples; you can map different samples to overlapping regions of notes (in other words, key zones). That allows you to construct instrument ensembles in a single NN-XT multisample (the Orkester library contains a number of NN-XT presets combining orchestral instruments). Each sample also has its own Velocity range, which means that you can use layering to create Velocity-switched or crossfaded multisamples. That makes for very realistic instrument emulations because, for example, you could have loud samples triggered by high-Velocity notes and soft samples triggered by low-Velocity notes. The MP3 file BC is a synthesized Bach chorale that uses NN-XT and the Orkester library, with a little help from a REX drum-loop and some Malström filter processing.

The other big enhancement NN-XT offers is an extensive set of individual sample-playback parameters. Those include sample and loop start and end

Minimum System Requirements

Reason 2.0

MAC: PPC 604/166; 64 MB RAM; OS 9.0

PC: Pentium II/233; 64 MB RAM; Windows 98/2000/ME/XP

points; loop mode (forward, forward-reverse, and so on), root key, tuning, and key range; Velocity and crossfade ranges; and audio output (eight stereo outs are provided on the NN-XT back panel). Beyond that, all synthesis parameters—filter, envelope, and LFO settings, for example—can be set individually for each sample.

Like NN19, NN-XT has a standard subtractive-synth output stage consisting of a multimode filter and amplifier, but again, the settings are on an individual sample basis. The filter and amplifier envelopes have six stages: Delay, Attack, Hold, Decay, Sustain, and Release. The filter envelope can also be applied to pitch. NN-XT's two LFOs—a multiwaveform and a triangle wave—can be key and tempo synchronized. LFO destinations are pitch, pan, level, and filter cutoff.

A flexible modulation-routing scheme allows Pitch Bend, Velocity, Mod Wheel, and one other external controller (Breath, Expression, or Aftertouch) to be routed to a variety of synth parameters. All modulation settings are on a per-sample basis, which can lead to some very unique patches. Try different Pitch Bend amounts for different sample groups, for example.

REASON ENOUGH

If you're already a Reason user, the upgrade decision is practically a no-brainer. Any one of the major enhancements—Malström, NN-XT, and the Orkester library—is easily worth the $89 upgrade price, and whatever your musical style may be, at least one of those is going to be a useful addition.

If you're new to desktop music-making, Reason is an excellent place to begin. It provides you with considerable sequencing power as well as software instruments and effects processors in all the major categories. Together with the huge sound library, that makes it a bargain, even at $399.

If, on the other hand, you have a fully equipped digital audio studio including a professional-level sequencer, lots of instrument and effects plug-ins, and an extensive sound library, Reason may not add a lot to your kit. One important consideration is how well ReWire is implemented by your sequencer, because that will affect how easily Reason integrates into your studio. But for generating tracks, especially in styles that emphasize loops, Reason is hard to beat.

Len Sasso *can be contacted through his Web site at www.swiftkick.com.*

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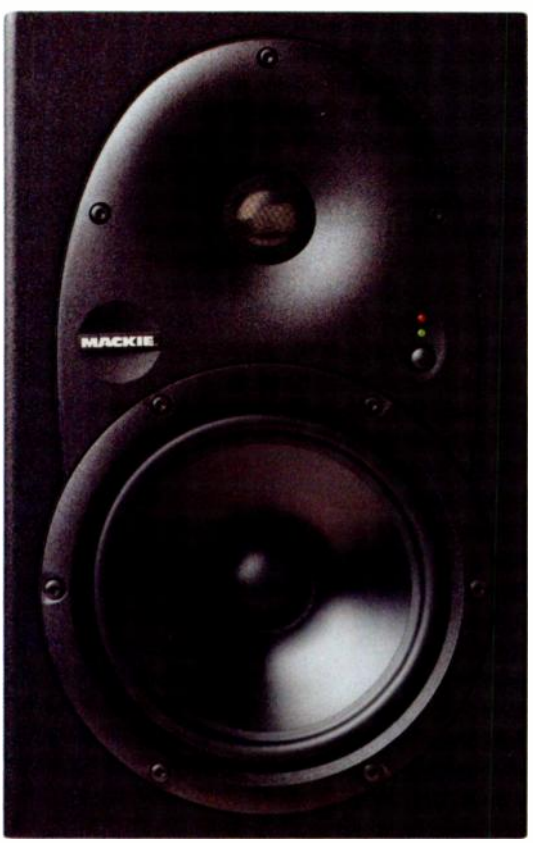
HR624

A new generation of powered monitors in Mackie tradition.

By Rob Shrock

Mackie's HR624 powered studio monitors build on the success of the company's HR824 monitors, which were immediately successful due to their accurate response, wide dispersion, and affordability. The HR624 is smaller, designed primarily for use with a subwoofer and in multichannel monitoring setups. But don't let the smaller size fool you—the HR624 also delivers great sound in a standalone stereo setup.



The HR624 is small, sounds great, and was designed for use with a subwoofer in multichannel monitoring setups.

The HR624 is not simply a smaller version of its predecessor: it has been modified to optimize its sound quality. One of the benefits gained from the new design is a more accurate transient response. Also, the cabinet is not being pushed to the limit to reproduce low frequencies. Overall, this yields a more accurate midrange response; inaccurate midrange response was one of the few criticisms I had of the original HR824. When used without a subwoofer, the HR624 still disperses a smooth, accurate frequency response from top to bottom. However, the bass frequencies obviously don't dive as low as the original HR824.

Mackie provides several options for customizing the monitor's response in order to complement the monitor's location in your listening environment. A three-position switch allows you to tailor the bass response by cutting either 2 dB (which helps if your monitors are against a wall) or 4 dB (which helps if your monitors are in the corners of your room) at 400 Hz and below. The low-frequency rolloff filter can be switched to 49 Hz (normal) or 80 Hz (THX mode). Additionally, the three-position high-frequency switch allows you to boost or cut the treble response by 2 dB at 10 kHz.

The HR624 has XLR, ¼-inch, and RCA inputs to accommodate a wide variety of setups, and the input sensitivity control allows you to tweak the basic volume response of the monitors to your liking. I wish that the input sensitivity pot were notched and better marked—that would make it easier to match levels between speakers.

An auto-on power mode allows the HR624 to sleep when it is idle for more than eight minutes. That conserves power and reduces heat buildup in your room. The amplifier wakes up when audio signals are detected at the input.

PRODUCT SUMMARY

Mackie Designs
HR624 High-Resolution Active Studio Monitor
powered monitor
$599
HRS120 Active Studio Subwoofer
subwoofer
$1,499

FEATURES	4.5
EASE OF USE	4.5
AUDIO QUALITY	4.5
VALUE	4.5

RATING PRODUCTS FROM 1 TO 5

PROS: Smooth, balanced frequency response. Excellent transient response. Wide sweet spot. Response can be tailored to your environment. Great value.

CONS: Additional bass-management system required for using HRS120 subwoofer in 5.1 surround setup. Subwoofer is expensive compared to the satellites.

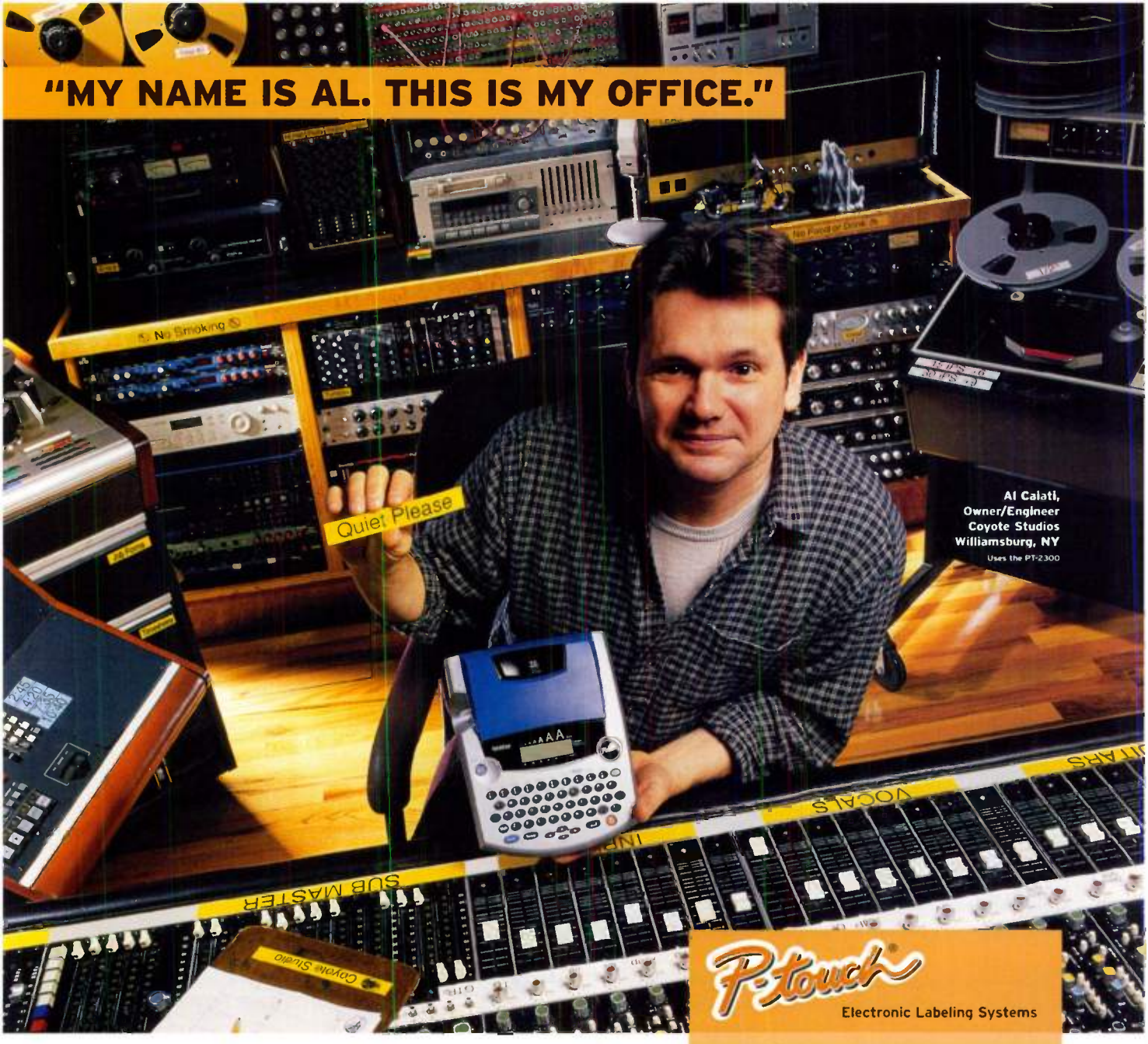
Manufacturer
Mackie Designs, Inc.
tel. (800) 898-3211 or (425) 487-4333
e-mail sales@mackie.com
Web www.mackie.com

YOUR HARSHEST CRITIC

As I mentioned before, the HR624 provides a smooth frequency response from top to bottom. According to the response graph in the manual, the HR624 is nearly ruler-flat from 60 Hz to 20 kHz, and the manufacturer says it tests each speaker to make sure it has an accurate response before shipping. The goal is to make it possible for any two HR624s to be put together for critical monitoring without the user having to spend time searching for a matched pair.

Specs aside, the HR624 sounds great. With new monitors, I typically begin by listening to a wide variety of very familiar prerecorded material. I was very happy with my findings, as all of the material that was well recorded sounded excellent on the HR624s. But what I loved about the HR624s was that the marginally recorded material did *not* sound great—exactly what I want from a set of monitors.

"MY NAME IS AL. THIS IS MY OFFICE."



Al Calati,
Owner/Engineer
Coyote Studios
Williamsburg, NY
Uses the PT-2300

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- **"Fluorescent" tapes:** Eye catching, bright labels for easy color-coding and visibility
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Monitors that make everything sound great are not what you want in the studio. You need to hear the flaws, frequency imbalances, compression artifacts, and so on without a speaker covering up these sins. As it turns out, the HR624 is not a forgiving monitor.

For example, I rushed out to buy the new album from a very successful crossover country artist I work with occasionally, but I was disappointed as soon as I heard the CD. The HR624s revealed just how overcompressed either the mixing or the mastering was, which killed all the vocal dynamics that I know this artist has.

Further listening tests revealed more of the same: if a record was well recorded and mixed, the HR624s sounded stunning. On the flip side, I easily heard bad balances; overuse of de-essing, compression and EQ; and sloppy editing on a number of commercial CD releases. I'm sure they sound fine on the radio or on car speakers, but the HR624s revealed flaws I had never heard before on these familiar recordings.

When put to the test on my own material, the HR624s were equally brutal. True to form, the good stuff sounded good and the bad stuff sounded bad. Over the course of a few projects with quick deadlines, I had an initial tendency to rely on my older, more familiar monitors, working on the Mackies only occasionally. It was a little disconcerting at times: I would be quite happy with the way a mix was progressing on my other sets of monitors, but when I would pop the mix over to the HR624s, my heart would sink. The mix would pretty much stink, and I knew that I still had a lot of work ahead.

As I became comfortable with the HR624s and started to rely on them more, my mixes got better. The tradeoff was that I had to work a little longer and harder to get them right, but I never experienced a situation where mixes that sounded good on the HR624s did not sound good on other monitors. In fact, I found that minor tweaks that were necessary while listening to the HR624s were sometimes largely unnoticeable on other speakers. Again, that's the way I like it.

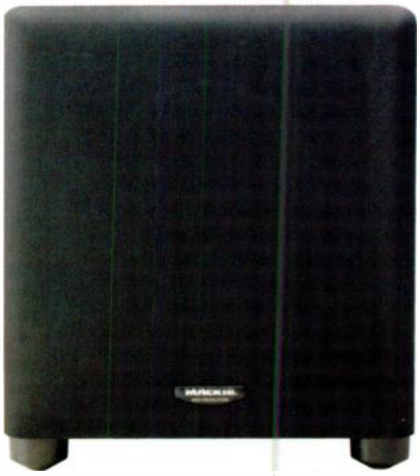

FIG. 1: The HRS120 subwoofer complements the HR624 and includes a built-in active crossover system.

I've now settled into a critical-mixing system using the HR624s, an alternate set of midfields, a pair of Apple powered speakers, and a mono cube. When I get a mix that sounds good on all four setups, I know I have a mix that will translate well pretty much everywhere.

ADDING THE LOWS

The HRS120 subwoofer rounds out the bottom end for those who need the extended low frequencies or are mixing 5.1 surround material (see **Fig. 1**). The HRS120 is a beast, weighing in at just under 100 pounds. But with its monster size comes monster sound—the HRS120 totally rocks with the HRS624s.

Setting up the HRS120 with a stereo setup is a breeze because it has built-in stereo bass management. Just send your mix to the subwoofer, which uses a built-in active crossover to split the signal. The outputs from the subwoofer are then sent to the inputs of the satellites, and the frequency response is spread between the speakers and subwoofer appropriately. In this

HR624 Specifications

AUDIO	
Frequency Response	52 Hz–20 kHz (±1.5 dB)
High-Frequency Equalization	±2 dB shelving @ 10 kHz
Low-Frequency Equalization	80 Hz/49 Hz second-order Butterworth, switchable
Acoustic Space	EQ 3-position switch: –4 dB or –2 dB @ 400 Hz (and below) or flat
Peak Output	112 dB @ 1m
Residual Noise	< 8 dB @ 1m
AMPLIFIERS	
Power Rating (@ 1 kHz with 1% THD)	40W (HF amplifier); 100W (LF amplifier)
Signal-to-Noise Ratio	> 93 dB unweighted (HF); > 101 dB unweighted (LF)
Input Impedance	20 kΩ balanced; 10 kΩ unbalanced
Total Harmonic Distortion	< 0.035%
Power Consumption	12W standby; 20W idle; 105W loud program
SPEAKERS	
High-Frequency Driver	1" aluminum dome
Low-Frequency Driver	6.7" mineral-filled polypropylene cone
Input Connectors	XLR; ¼" TRS; RCA
CROSSOVER	
Crossover Slope	24 dB/octave @ 3 kHz, active
ENCLOSURE	
Material	0.625" MDF with 1.000" MDF front panel
Dimensions	8.25" (W) × 13.00" (H) × 12.50" (D)
Weight	25 lb.

HRS120 Specifications

AUDIO	
Frequency Response	21 Hz–150 Hz (±1.5 dB)
Low-Frequency Cutoff	–3 dB @ 19 Hz
Subsonic Filter	flat @ 15 Hz; 18 dB/octave
Peak Output	100 dB @ 1m
AMPLIFIER	
Power Rating	400W, 8Ω load (500W peak)
Signal-to-Noise Ratio	> 107 db @ 350W into 8Ω
SPEAKER	
Low-Frequency Driver	12" RCF Precision
Input Connectors	balanced combo (XLR and ¼-inch TRS); RCA
CROSSOVER	
Crossover	24 dB/octave, 55 Hz–110 Hz
ENCLOSURE	
Material	0.750" MDF with 1.125" MDF top panel
Dimensions	18.0" (W) × 21.0" (H) × 21.3" (D)
Weight	94 lb.

configuration, the HRS120 and the HR624s are perfectly suited for each other, and I would have no problem at all mixing a record with this setup alone.

I managed to borrow an SUV and haul five HR624s and an HR120 down to the studio and set up a temporary 5.1 system using Digital Performer and a MOTU 1224 to route the multichannel mix appropriately. Here I ran into a problem: the built-in crossover of the subwoofer only supports two channels. If you plan on building a 5.1 mixing setup, you will need to purchase an additional bass-management solution for controlling the crossovers between the five satellite speakers and the subwoofer.

For my testing, I initially ran the front-left and -right speakers through the HRS120 crossover and connected the center and rear speakers directly to the MOTU audio interface. That gave me a great sense of what the surround system is like, which is stellar. However, I suspected that running just the front speakers through the crossover would introduce misalignments in timing, so I decided to wire all the satellite speakers directly from the audio interface. The result was, I felt, a more cohesive sound.

Of course, that didn't give me a proper bass-management solution: all I could do to tame the overall response was tweak the low-frequency filters on the individual satellites and the response of the subwoofer. Still, the Mackie system sounded great in this context, and I would not hesitate to rely on it for a surround mix.

SOUND FOUNDATION

Mackie has yet another winner on its hands. I have come to depend on the HR624s as a dose of sobering medicine with my mixes. When a mix sounds great on the HR624s, it's usually a good sign. When it sounds bad, it's time to roll up my sleeves and keep working.

As a standalone set of stereo speakers, the HR624s are great. Add the HRS120 subwoofer and you have a fully professional mixing setup. Add three more speakers, and you have a fantastic surround-mixing environment.

Producer **Rob Shrock** *has worked with Burt Bacharach, Elvis Costello, Dionne Warwick, George Duke, Leann Rimes, Faith Hill, Isaac Hayes, Wynonna Judd, Sheryl Crow, David Foster, Stevie Wonder and a host of others. He currently serves on the Board of Governors for NARAS.*

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BITHEADZ

UNITY SESSION 3.0.4 (MAC)

Multiple music-making modules in a powerful package.

By Jeffrey Paul Burger

BitHeadz created quite a stir several years ago when it introduced its versatile Retro AS-1 software synthesizer and its powerful Unity DS-1 software sampler. Now BitHeadz has combined updated versions of those instruments with its new physical-modeling technology to form its latest product: Unity Session. As an added benefit, the package includes a large library of sounds, loops, and samples, making Unity Session highly useful right from the start.

PERFORMANCE ART

BitHeadz has chosen to optimize performance and polyphony by implementing Unity Session's audio engine at the system level, with the interface running at the application level. Many of the improvements to the program involve exponentially increasing performance by exploiting the latest computers' processing power to the greatest extent possible. BitHeadz has focused on the Mac G4 processor and OS X with the first release of Unity Session (though the software will run on a G3 with Mac OS 8.6). BitHeadz plans to release a Windows XP version in early 2003. Until then, the most recent offerings for Windows users are version 2.1 of the separate Unity DS-1 and Retro AS-1.

BitHeadz has embraced the G4 in part because the G4's Velocity Engine (aka Altivec) dramatically speeds up the floating-point processes inherent to digital audio. The stereo polyphony count is substantially higher on a G4 than on a G3 of the same clock speed, yielding a maximum of 128 notes with 32-bit internal processing on a single processor.

The company has also embraced the multiprocessor support in OS 9 and OS X. The use of two G4 processors could double the maximum stereo polyphony to a stunning 256 notes, depending on the program and on the number of enabled MIDI and audio effects. With either a single or dual processor, the difference between the software's potential and reality is based on processor speed. On my test machine, an 800 MHz PowerBook running Mac OS 9.2.2, I was able to achieve 62-note polyphony with DS-1. Switching to AS-1 synthesis reduced my polyphony considerably, to 16 notes. Effects can further reduce CPU availability and, with it, polyphony.

Minimum System Requirements

Unity Session 3.0.4

G3/366; 128 MB RAM; OS 8.6 or higher (including OS X); 2 GB hard-disk space

Although you can run Unity Session on earlier Mac OS versions, BitHeadz was one of the first software manufacturers to provide OS X support. In fact, the entire Unity engine has been rewritten to get as much juice as possible from OS X. That includes faster processing and file access, protected memory, and OS X's built-in support for audio and MIDI. In addition to eliminating third-party MIDI protocols like OMS and FreeMIDI, OS X's CoreMIDI theoretically reduces MIDI latency to less than 1 ms—a significant improvement over the 5 to 7 ms delay typical of OS 9. (Unity Session supports 8 ports for 128 MIDI channels under both OS 9 and OS X.) OS X's Audio Objects also eliminate dependency on third-party audio routing protocols such as RTAS, MAS, and VST.

ARE YOU BEING SERVED?

The original Unity and Retro relied on a Unity Engine extension that integrated into the system in much the same way that QuickTime does. Unity Session replaces the original Unity Engine with Unity Server, a system-level processing component that automatically launches anytime a service is required by either Unity Session or another program, such as a sequencer. Everything else in Unity Session is a plug-in to Unity Server.

Unity Session supports up to 24-bit, 96 kHz audio and delivers true stereo oscillators (up to three per synth), thereby eliminating the complications inherent in syncing two mono oscillators to achieve two channels. The oscillators also let you apply and read splice points in loops much like BitHeadz Phrazer, letting you change tempo and synchronize to MIDI clock without changing pitch.

FIG. 1: Unity Mixer can be expanded to 128 channels and includes access to audio and MIDI effects. In this example, Channel 1 has an in-line Arpeggiator Chord MIDI effect, audio Chorus, and Shelf EQ. The master channel has an in-line MIDI Transpose effect and an audio Reverb send.

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Unfortunately, Unity Session can't read REX or REX2 files, though BitHeadz says it's had enough requests to warrant adding that feature to the update list.

Unity Session can access as much RAM as your computer can hold—typically a lot more than hardware samplers can handle. It is also capable of streaming samples from disk, though you'll take a performance hit when compared with loading samples into memory. You determine what is streamed and what is loaded by setting a threshold sample size in Unity Server. Any sample smaller than the threshold value loads automatically into RAM, while anything larger is streamed from disk. Incidentally, BitHeadz recommends using, at minimum, a G4 with 512 MB of RAM if you're running a sequencer on the same machine.

Unity Server can also record its own output back to disk. Among other things, that means you can trigger multiple channels live from a sequencer and sample the result as a form of resampling.

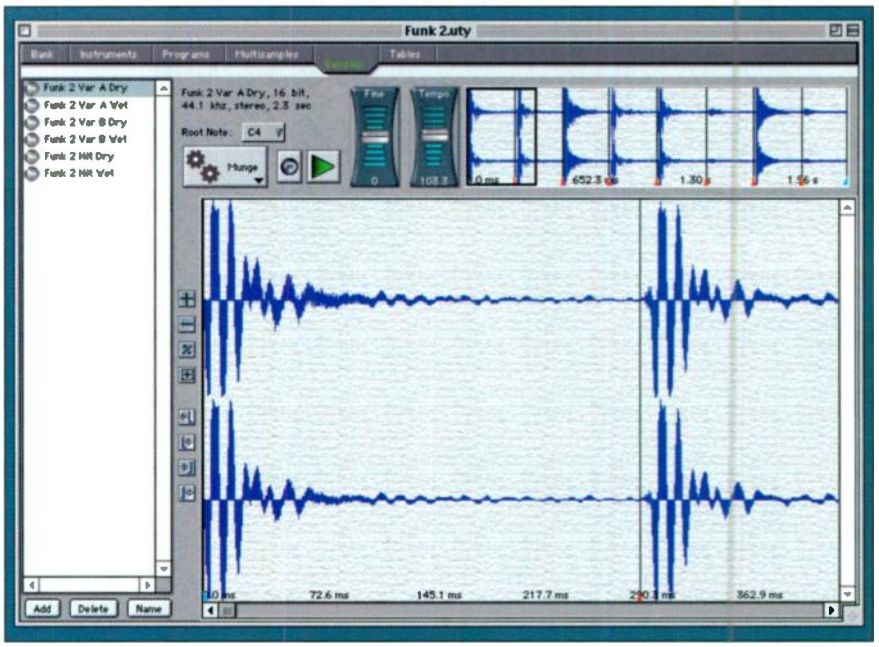

FIG. 3: Unity Editor supports slice-and-dice loop editing that lets you change the playback tempo independent of the pitch.

PLUGGED IN

As mentioned, the architecture for the new Unity Server (and Unity Session itself) is based completely on the concept of plug-ins. Unity DS-1 and Retro AS-1 are now plug-ins; they are joined by new sound-generation sources such as physical-modeling modules. (As of this writing, BitHeadz has several new modules in the works, including VectorSynth, Electric Piano, FM-1, and WaveSequencer.) What were once built-in audio effects and MIDI effects are now plug-ins. A few additions bring the count to 25 audio effects and 9 MIDI effects. Unity Session's MIDI effects include some interesting tools, a programmable arpeggiator among them. In general, the audio effects are passable, but not exceptional.

Real-time translators for non-native sample formats are another class of plug-ins. The current crop allows Unity Session to read an impressive variety of formats, including Giga, Akai, Roland, SampleCell, Sound Designer, AIFF, WAV, SoundFont 2.0, DLS, and CD-audio.

Unity Session's plug-in architecture allows both BitHeadz and third-party developers to create software expansion modules that capitalize on the refined Unity Server and expand Unity Session functionality in myriad ways. One significant benefit is the ability to use the different types of sound sources and effects simultaneously. That paves the way for a new hierarchical class in Unity Session: the Instrument. Unity Session Instruments store the split/layer relationships of multiple Programs. Programs are comprised of a sound module type, parameter settings, modulation tables, and in the case of sample-based Programs, samples and multisamples.

Once appearing on a single screen, Unity Control Panel now has nine tabs that divide the basic controls into

FIG. 2: The Multisamples page in Unity Editor lets you assign samples to individual keys or ranges of keys with as many as four layers of Velocity-switching.

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panes dedicated to configuration, bank locations, audio, MIDI, plug-ins, and so forth. The Configuration pane, for example, is where you set up and manage master parameters, such as the number of voices, CPU usage, buffer allocations, master tuning, and sample rate.

MODULE MAKEUP

Unity Server can handle everything that another application needs from Unity Session, so you never have to actually launch a BitHeadz application to access basic Unity Session audio playback from a sequencer. You can, however, unleash a great deal more potential by getting into the individual Unity Session applications. Like the original versions of Unity and Retro, Unity Session divides its functions into various modules so that processing overhead is not usurped by a single program having to do everything at once. There are four separate applications in Unity Session: Unity Mixer, Unity Editor, Unity Keyboard, and Unity Player.

Unity Mixer (see **Fig. 1**) is where you arrange multiple MIDI channels of Unity Session sounds, including mixing and matching the various classes of sound module plug-ins. Each channel provides separate selection of Library, Bank, and Program, and the new architecture allows you to mix and match types of sound sources—like samples, synthesis, and physical modeling—within the one Unity Mixer.

Each channel sports two in-line MIDI effects, two in-line audio effects, two audio-effects sends, transposition, tuning, pan, volume, and a few other goodies. The master section also has two in-line MIDI effects, two master audio-effect sends, and two master in-line audio effects. Annoyingly, the Unity Mixer interface under OS 9 has an extremely sluggish redraw that is atypical of modern software. BitHeadz states that this is an artifact of the way the code was optimized for OS X.

Unity Editor has been redesigned to accommodate all types of synthesis, sampling, and modeling. The tabbed window architecture is common to all; the contents change in context with the device. BitHeadz has also made a lot of small refinements to the editing functions. Crossfades can smooth transitions between adjacent samples, and you can Velocity-crossfade between as many as four layers of samples on a single oscillator (see **Fig. 2**). You can also mix two samples together to create a new one.

Unity Editor can divide a long sample into a series of smaller ones according to a specified tempo, sections of silence, or the current split points that you've set (see **Fig. 3**). Users can also define tuning, controller maps, and custom audio routing. Other additions include resampling, pitch shifting, time stretching, syncing of loops to external clock, and the ability to edit MP3 files.

The Unity Player application (see **Fig. 4**) is essentially a simplified version of Unity Mixer designed for performance. It provides basic assignments and controls for two MIDI channels in Split or Layer mode. Unity Player makes it easy to keep a subset of your sound-library favorites. Although Unity Player didn't exhibit the redraw problems mentioned earlier, the process of saving configurations (under OS 9) was still excessively sluggish.

The fourth application, Unity Keyboard, is primarily for testing proper installation and configuration of Unity Server by either pressing a key on your QWERTY keyboard or clicking on the onscreen keyboard.

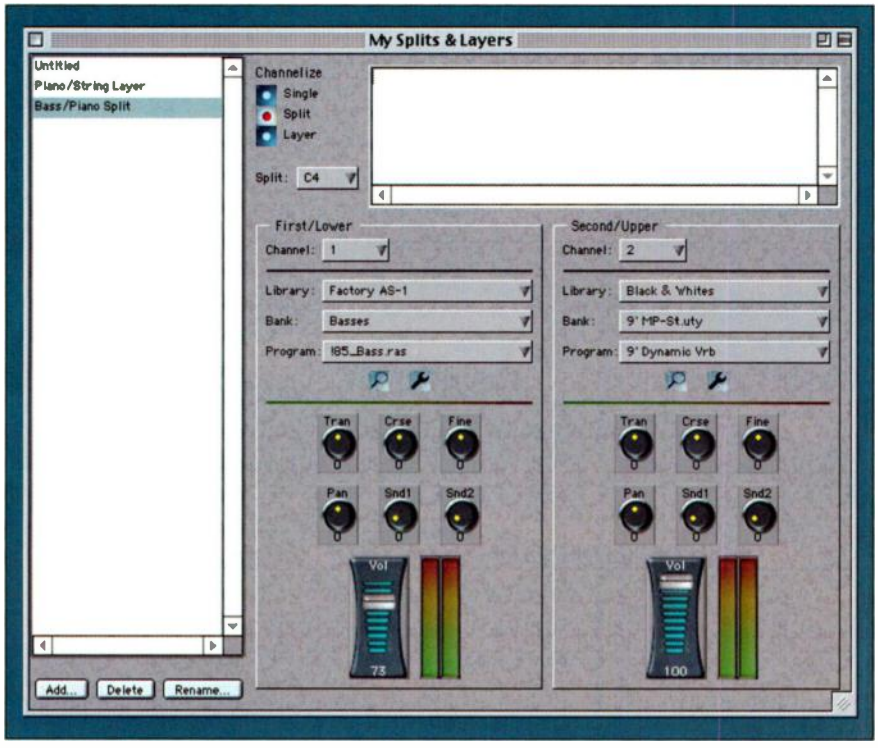

FIG. 4: Unity Player is a separate application that allows easy configuration and retrieval of Unity presets, including split and layer assignments. It also allows the integration of any two types of sound sources, such as physical modeling and sampling.

PLAYS NICELY WITH OTHERS

BitHeadz has done a lot of work to ensure that Unity Session integrates well with other popular software. In fact, the manual devotes nearly 70 pages to getting Unity Session working with various programs. Plug-ins specific to each application automatically bring Unity Server online.

Steinberg Cubase VST and Emagic Logic can communicate with Unity Session through ReWire, or Unity Session can function as a VSTi plug-in, complete with support for VST clock. Digidesign Pro Tools users can access Unity Session as an RTAS plug-in or with DirectConnect.

MOTU Digital Performer owners can take advantage of Unity Session's support for MAS 2.1. When using Unity Mixer with Digital Performer, you can

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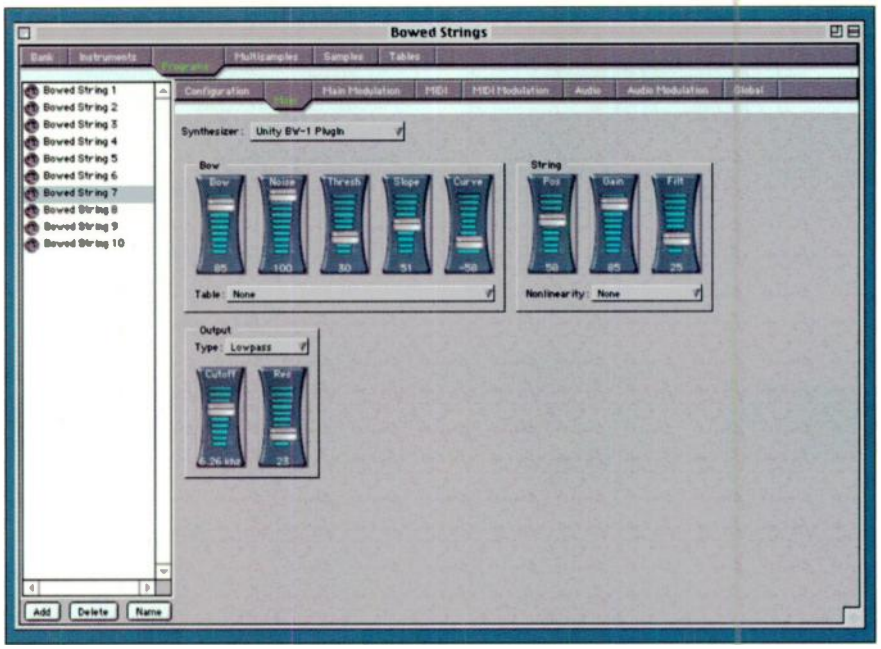

FIG. 5: The controls for Unity Editor's main page change according to the current sound source. This example shows the primary controls for the Bowed String physical-modeling synth.

assign MIDI tracks to any one of four independent buses that can, in turn, serve as independent inputs for a Digital Performer Audio or Aux track. Unity Session also supports Sound Manager, ASIO, and OS X's Core Audio.

On the MIDI side of things, Unity Session supports OS X's CoreMIDI as well as OMS, FreeMIDI, Roland PC300, and serial input. The product ships with dedicated applets for standalone connectivity and MIDI monitoring for the MIDI protocol you use. You need to launch one of those before booting a Unity Session application in order to communicate with Unity Session outside of a sequencer application. In the case of OMS and FreeMIDI, Unity Session automatically publishes patch names to other programs.

ROAD TEST

Because BitHeadz had discovered some bugs in Unity Session 3.0, I waited to review a subsequent version of the program. When I installed version 3.0.2 (which quickly followed 3.0.1), I encountered problems with the authorization engine. BitHeadz provided me with a manual work-around and then fixed the problem in version 3.0.3. Then one of the library CDs in 3.0.3 appeared as a blank disk on my Mac. After I installed version 3.0.4 and BitHeadz walked me around an online registration glitch that the company attributed to its ISP, I was able to proceed with the review.

Unity Session's interface is sensibly laid out and operation is fairly intuitive. The 431-page printed manual (available for an additional $15) is a rarity in this day and age and deserves praise. (Normally, the package includes only a PDF version of the manual.) No online documentation is provided except for rollover-tool tips that are curiously spotty in implementation. All of the Unity Session modules allow you to limit Banks and Patches according to selected Libraries, thereby enabling you to find the sounds you're looking for without getting overwhelmed.

The idea of dividing up the program's functions into individual modules makes sense from the standpoint of efficiency; I wish, though, that I could just tweak a sound right from Unity Mixer without separately launching Unity Editor. (You can, however, use the Program Action button to launch Unity Editor and automatically load the assigned program.)

I did encounter some operational problems. For example, I experienced some stuck notes when playing certain

patches from a MIDI keyboard. According to BitHeadz, the stuck-note problem was eventually tracked down to an elusive bug that will be fixed as part of the upcoming 3.0.5 release.

The Unity DS-1 plug-in also occasionally gave off a high-pitched whine while I continued to hold keys after some unlooped samples ended. BitHeadz explained that the problem occurs in some isolated samples that slipped through the cracks when converting the Unity library from 2.0 to 3.0. The program also just plain stopped responding or crashed on numerous occasions. That happened both under normal playing conditions and when I administered acid tests such as playing my MIDI controller with my forearm.

PHYSICAL FITNESS

I was eager to test the new physical-modeling synths: Hammered Strings, Clarinet, Flute, and Bowed Strings (see **Fig. 5**). Although I found the results to be interesting and occasionally unique compared with standard sampling and synthesis, the instruments were unconvincing when emulating the real thing. There were, however, some intriguing possibilities, such as bringing in the overblown harmonics of a flute by engaging the Mod wheel. In general, the physical-modeling aspects of Unity Session are a lot more interesting as building blocks and starting points for synthesis or resynthesis than they are for reproducing acoustic instruments.

According to BitHeadz, the main purpose for including physical modeling was to provide another approach to sound creation through the manipulation of individual instrument characteristics. The flute physical model, for example, might best be described simply as a "metal tube-shaped wind-instrument model" that you can manipulate to create new sounds.

Unity Session ships with zillions of great sounds, including the "Best of Retro" and "Best of Unity" banks that showcase the significant flexibility and sonic power of the program. The banks are augmented by several BitHeadz library titles: Black & Whites, Pop Drums, and Orchestral Strings.

Black & Whites features a variety of piano samples that are about on par with the average sampled piano collection. Pop Drums is a presliced library of decidedly pop and rock drum loops ready for Unity's tempo-adjustment feature. The Orchestral Strings library, produced by Big Fish, offers a well-rounded collection of strings played in most popular styles. Although none of these libraries will cause your jaw to hit the ground, they're all respectable and add tremendously to Unity Session's value and usability right out of the box.

What's more, BitHeadz has thrown in the latest version of its Osmosis application. It can convert any Roland S-760/770 or Akai S1000/3000 sample CD into Unity 3.0, SampleCell, or AIFF format;

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it also includes the ability to merge zones. When converting to Unity format, all applicable multisamples, keymaps, and filter settings are translated as well.

POWER SESSION

Creating a program with the scope and power of Unity Session was no small undertaking. Moreover, the program's ability to build not just libraries but complex Instruments from sound sources as diverse as samples, software synthesis, and physical modeling is formidable indeed. In addition, the redesigned modular plug-in architecture opens the door to future expansion by BitHeadz as well as by other developers.

Keep in mind, however, that harnessing this power comes at some cost in processing. Unity Session is CPU hungry even in this day of fast processors, especially when it comes to synthesis. The $649 program combined with a high-horsepower CPU is still a reasonable value when compared to closed-architecture hardware devices. If you're looking for an integrated software synthesizer and sampler with an open architecture and wide library support, Unity Session is one of the most powerful and flexible choices on the market.

On the other hand, it appears that BitHeadz has begun shipping this product before it has ironed out all of the wrinkles. Bugs and glitches can be especially frustrating when you're dealing with an application that does so much and pushes the edge of technology in accomplishing its tasks. I'm willing to chalk up some of the anomalies I experienced to the same difficulties you might encounter in configuring any computer to run a complex music application. In most cases, however, I'd rather have a more bulletproof program than the impressive number of features that Unity Session provides.

PRODUCT SUMMARY

BitHeadz
Unity Session 3.0.4
software synthesizer and sampler
$649

FEATURES	4.5
EASE OF USE	3.5
QUALITY OF SOUNDS	4.0
VALUE	3.0

RATING PRODUCTS FROM 1 TO 5

PROS: Powerful software synthesis and sampling under one roof. Can change loop tempos without affecting pitch. Wide sample-format support. Includes large, well-rounded library. Good sound quality.

CONS: Questionable stability. Synthesizer offers much lower polyphony than sampler. Complex Instruments can easily tax CPU. Mediocre audio effects.

Manufacturer
BitHeadz
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Web www.bitheadz.com

Jeffrey Paul Burger *is a songwriter and multimedia producer based in Sedona, Arizona.*

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ANALOGUE SOLUTIONS

VOSTOK

Have synthesizer, will travel.

By Mike Peake with Geary Yelton

From U.K. manufacturer Analogue Solutions comes the Vostok, a portable modular synthesizer that provides plenty of basic functions for producing and manipulating audio, as well as a few esoteric capabilities. Most notable are its matrix panel for patch programming and its suitcaselike box (see **Fig. 1**). Both are reminiscent of the classic EMS Synthi A that was highly regarded in the 1970s. Analogue Solutions stresses that the Vostok is not a Synthi A clone but is, rather, a configuration of modern electronics that borrows some of EMS's most practical design ideas.

The Vostok's modules include two analog oscillators, a digital wavetable oscillator, a noise generator, two filters, a voltage-controlled amplifier, two ADSR generators, two LFOs, a mixer, a ring modulator, and an 8-step analog sequencer. A built-in MIDI-to-control-voltage converter interfaces the Vostok with modern sequencers and other MIDI gear. With the exception of the MIDI circuitry and the wavetable oscillator, all the Vostok's circuits are completely analog.

FIG. 1: Bearing some physical resemblance to the vintage EMS Synthi A, the Analogue Solutions Vostok is a complete modular synthesizer in a suitcase.

OPEN-AND-SHUT CASE

The Vostok's size and weight make it an ideal carry-on item should you want to travel with it. The case is sturdy enough for everyday use, but you'll need a flight case if you intend to check it with your luggage or toss it into the back of your band's equipment truck for touring.

The Vostok's corners are reinforced with thick plastic, and the case has sturdy metal latches and a removable plastic front cover. Rubber feet on the bottom and back allow you to stand the Vostok upright or lay it on its back. If you already have a small collection of Analogue Solutions modules and you require portability and a power supply, you can also order the case separately.

CONNECT AND CONTROL

The Vostok's 22-by-22-point pin-matrix patch bay is one of the ways you can interconnect the modules (see **Fig. 2**). The matrix's horizontal axis hosts the audio and control-voltage (CV) sources, and the vertical axis has the destinations; you can connect any source to any destination by placing a pin at their point of intersection. Only 15 patch pins are supplied with the Vostok, and depending on the complexity of your patches, you might use up that supply quickly. The included pins are resistor pins, which allow you to route a source to more than one destination (as opposed to shorting pins, which offer a more direct link but can cause a drop in signal level when you patch a source to multiple destinations). Additional pins are available from Analogue Solutions.

One noticeable difference between the matrix patch bays on the Vostok and previous synthesizers is that the Vostok's is buffered. That allows you to patch multiple sources to a single destination without causing an offset in levels or voltages. When a patch pin is removed, the buffer holds the voltage until a new pin is inserted. You can even "play" parameters by partially inserting a pin in a rhythmic manner.

If a particular connection is unavailable on the patch matrix, the Vostok provides 69 ⅛-inch jacks for routing audio and control signals with patch cords. These patch points allow you to connect any source to any destination as well as interface with external gear, such as Analogue Solutions' Oberkorn sequencer. Also on the front panel are 52 parameter knobs, 13 indicator LEDs, and a joystick. The joystick, which feels smooth and solid, isn't spring-loaded and therefore remains in position when you release it. Control outputs for its *x*- and *y*-axes each have an attenuator knob with a range of ±12V.

In addition to signals for pitch, gate, and modulation, the Vostok's MIDI-to-CV module emits voltages for Legato and Accent in response to MIDI data. Absent are provisions for Pitch Bend and Aftertouch, which, oddly, the manual suggests is because the Vostok is optimized for sequencing rather than keyboard performance. The Legato function generates a 5V signal whenever the device detects simultaneous notes, and Accent generates a 5V signal whenever MIDI Velocity exceeds a value of 79. A Gate button triggers a 10V signal for as long as it's pressed.

PRODUCE AND PROCESS

The two identical, traditional analog voltage-controlled oscillators (VCOs) each feature a wide-range, continuous pitch control as well as knobs for Portamento, Pulse Width, Sawtooth Level, and Pulse-Wave Level. In addition to control inputs for Pitch Modulation, Pulse-Width Modulation (PWM), and Sync, each oscillator provides audio outputs for the pulse and sawtooth waveforms.

Modulating the frequency of one oscillator with the other appears to use AC coupling, producing more mellow

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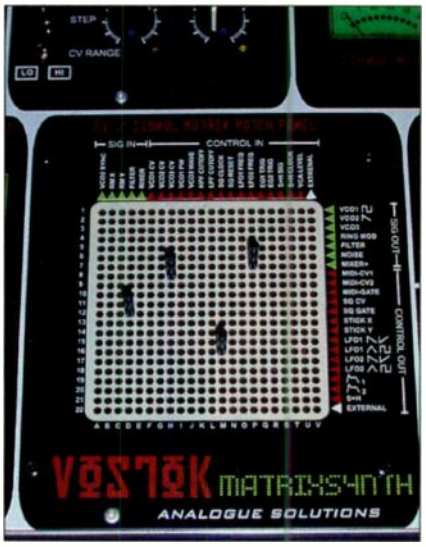
results than you might expect. (If you prefer a harder edge, you can route an oscillator to modulate the cutoff frequency of self-oscillating filters.) Either oscillator's frequency can be modulated down to the subaudio range for use as an extra LFO, if one is needed. Thanks to separate Glide controls on each oscillator, you can achieve the once-popular effect of using a touch of portamento on just one oscillator as you play them in pairs; I was pleased to discover that the Vostok made that classic sound possible.

In the patch matrix, the pulse wave from VCO 1 and the sawtooth from VCO 2 are available as audio and modulation sources. You'll need patch cords if you want to use two similar waveforms simultaneously. Likewise, VCO 2's PWM signal must be routed with a patch cord; it doesn't appear in the matrix.

A ring modulator circuit is located on the VCO 1 module. It has just two audio inputs and an audio output, and it's suitable for processing external sources as well as the Vostok's oscillators. Its squelch of the input signals isn't great, but it's fine if your aim is simply nastiness and grunge.

The third oscillator is a horse of a different color or, more specifically, a wider range of colors. VCO 3 is an 8-bit digital wavetable generator that produces 256 waveforms. You can select waveforms manually with the Initial Wave knob or dynamically by means of the Wave CV input and its associated Level control. Using an LFO or envelope generator, you can modulate the wavetable in the manner of the classic PPG Wave synthesizer. An intentionally retro-looking four-digit LED display indicates the pitch by note name and the waveform in hexadecimal notation.

VCO 3's pitch is quantized into semitones and covers a four-octave range centered at a fairly low frequency, making it most suitable for bass tones and sound effects. You can't increase or offset its range with external CV sources. (According to Analogue Solutions, a wavetable oscillator would need to be more complex, and therefore more expensive, to produce higher frequencies.) As an LFO, VCO 3 can produce some wonderfully strange modulation effects. As an audio oscillator, its 8-bit character is edgy enough to produce upper harmonics that high filter-resonance settings can accentuate to create interesting timbral results.



ROGER CORDELL

FIG. 2: Inserting pins in the matrix patch bay connects audio and modulation sources to their destinations, minimizing the need to use patch cords.

Like another Analogue Solutions product, the Phobos Filtered Coffee, the Vostok's filter section is based on that of the Korg MS-20 analog synthesizer. It consists of a highpass filter in series with a lowpass filter, which can produce a classic variable-width bandpass response. Both 12 dB-per-octave filters have independent cutoff, resonance, and modulation-level controls.

Two resonant filters working together can give rise to some interesting sound-design and processing possibilities. With high resonance settings and no signal input, the self-oscillating filters generate clean sine waves; introducing an audio signal and increasing its level creates a nice intermodulation of the two resonant peaks. At maximum levels, the result is an overdrive that can produce sounds similar to a swept, hard-synced oscillator.

The lowpass filter can self-oscillate across its full range, which goes from about 160 Hz to beyond audibility, but the highpass doesn't sweep below about 160 Hz or self-oscillate beyond 484 Hz. Consequently, the Vostok is incapable of producing very deep bass tones.

Vostok Specifications

Sound Engine	analog subtractive synthesis
Polyphony	1 note (monophonic)
Sound Sources	(2) analog VCOs; (1) digital wavetable VCO; (1) noise generator
Filters	(1) resonant lowpass and (1) resonant highpass in series; 12 dB-per-octave
Amplifier	(1) VCA
Effects Processor	(1) ring modulator
Control Modules	(2) ADSR generators; (2) LFOs; (1) sample and hold; (1) joystick
MIDI-to-CV Converter	MIDI In, Out, Thru; pitch, modulation, gate, accent, and legato CV out
Sequencer	8-step CV and gate
Utility Modules	(1) 6-input, 2-output audio/CV mixer with inverter; (2) 4-way signal-splitter/multiples; (1) VU-type signal meter
Matrix Patch Panel	22×22 patch connections; (15) resistance pins included
Patch Cord Connections	(69) ⅛" minijacks
Power	100–220V; IEC connector
Dimensions	17.32" (W) × 10.78" (H) × 7.40" (D)
Weight	14 lb.

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Above those ranges, however, the Vostok is quite capable of snappy filter zaps and harsh filter FM.

MODULATION VARIATIONS

Both envelope generators (EGs) are of the ADSR variety. In addition to a CV-level knob that turns clockwise for positive modulation and counterclockwise for negative modulation, the Vostok has knobs for each of the four stages, a jack for CV input, and a jack for CV output. LEDs indicate that a gate signal has been received, but they don't indicate whether the EG is actually firing. The envelopes can be triggered by LFO square waves as well as by external signals and gates from the MIDI-to-CV converter.

The EGs offer a Repeat function that you enable by setting the sustain level to zero; its rate is determined by the attack and decay times. Repeat can produce harsh amplitude modulation of

PRODUCT SUMMARY

Analogue Solutions
Vostok
modular analog synthesizer
$2,895

FEATURES	4.0
EASE OF USE	3.0
AUDIO QUALITY	3.5
VALUE	3.0

RATING PRODUCTS FROM 1 TO 5

PROS: Powerful array of synthesis and processing functions. Portability. Good range of analog and digital tones. Built-in MIDI-to-CV converter. Choice of patching with the patch matrix, patch cords, or both. Fun to play.

CONS: Wavetable oscillator unusable in mid to high octaves. Ring modulator passes too much input signal. Highpass filter doesn't reach lower frequencies. Envelope times and LFO rates could be greater.

Manufacturer

Analogue Solutions/Big City Music (distributor)
tel. (818) 985-0855
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the VCA at high rates, as well as pseudo-echo and other interesting mod effects. The only problem is that when Repeat is enabled, the EG's output never reaches zero, which can cause the VCA to pass a bit of signal as long as a gate is present; that's not an issue if you simply play staccato. Nonetheless, the Vostok is definitely more interesting for the Repeat feature's inclusion.

Another pair of control-voltage sources are identical LFOs. Two waveforms are simultaneously available from each LFO. The Levels/Select knob acts as a switch when you pull it, toggling the waveforms from falling sawtooth or triangle to inverted sawtooth or square. In addition to the two LFO outputs, a control input lets you modulate LFO rate with external sources such as sample and hold.

The Noise module contains a classic sample-and-hold circuit with an audio input, an audio output, and a clock input. By sampling the noise generator, it can produce traditional stepped random signals. A Slew control can smooth the transitions between steps.

The Vostok's 8-step analog sequencer is icing on the proverbial cake. Use it to create repeating melodic patterns or repetitive modulation of filter cutoff and other control parameters. A knob for each step lets you specify a series of control voltages, and the module has outputs for both voltage and gate as well as clock input and throughput jacks. By turning a step's knob all the way counterclockwise, you turn off that stage and prevent its gate from appearing at the sequencer's gate output.

Each clock signal will advance the sequencer by one step. The sequencer's clock source can be a gate from the MIDI-to-CV converter, a square wave from an LFO, or any source that exceeds a 10V threshold. If the sequencer is clocked by an audio oscillator, it can act as a waveform generator that you can play with a keyboard. If it's clocked by a low-frequency triangle wave, the sequencer will randomly select steps.

MODULAR MOBILITY

The Vostok provides most of the functions you'd hope to find in a modular synth. In fact, it packs so many goodies into a single package that it put me in a tough spot; it was hard to stop playing with it long enough to write this review.

I was pleased with the Vostok's convenient matrix patch panel, its combination of analog and digital oscillators, and its classic MS-20 filter replication. Factor in MIDI and external-signal processing capabilities, and you have an instrument that holds its own against comparably priced modern modular synthesizers.

Mike Peake *was a member of the Alesis Andromeda design and realization team and has been a modular-synthesizer enthusiast since 1978.* **Geary Yelton** *is associate editor of* **EM** *and rewired his custom modular Oberheim in 1978.*

METRIC HALO

MOBILE I/O 2882

A FireWire audio interface and then some.

By Eli Crews

When I got my new Apple Titanium PowerBook G4, my goal was to put together a portable multitrack recording rig that would run on battery power, weigh less than 30 pounds (including a MIDI keyboard), and fit into a small shoulder bag. Consequently, I was more than a little excited to get my hands on the Metric Halo Mobile I/O 2882, a multichannel audio interface that's optimized for mobile use. I was already a fan of Metric Halo's two software products, SpectraFoo and ChannelStrip, and I had high expectations for the company's first foray into the competitive arena of computer-audio interfaces.

The Mobile I/O comes in two flavors: the non-DSP model and, for $700 more, the +DSP model. The +DSP box has an extra digital signal-processing chip that will eventually host native effects and dynamics plug-ins. Because the software is still in development, however, the two units are functionally identical.

DOWN TO DETAILS

From the outside, the two models are also physically identical, housed in a sturdy 1U enclosure with rounded edges. Because the 2882 is a bit narrower and deeper than most rackmount audio interfaces, it fits perfectly beneath a laptop computer such as the PowerBook. If you choose to mount the 2882 in a rack, it comes with extension rack ears that bring it out to the standard 19-inch rack width and provide holes for mounting it.

The included MIO Console software controls nearly every function of the Mobile I/O by means of the FireWire bus. Thus, the 2882's front panel is almost completely free of controls, leaving plenty of room for indicator LEDs (see **Fig. 1**). In fact, the only front-panel controls are two tiny buttons that affect the stereo headphone output, a ¼-inch jack directly to their right. The Mute button quickly and conveniently kills the headphone signal, and the Dim button attenuates it by –18 dB. I prefer having total control from the computer, so the lack of front-panel controls isn't a problem.

What remains on the front panel are eight 10-segment LED meters for input, eight more for output, and four groups of green LEDs. One group shows the selected sample rate (44.1, 48, 88.2 or 96 kHz), and another indicates the active clock source. Status is shown by LEDs labeled Power, Phantom, FireWire, and Locked (which lights when the 2882 is locked to the clock source). Another group of LEDs specify which digital I/O is selected (AES/EBU or S/PDIF), and another Locked LED tells you whether the unit is successfully slaved to whichever of the two stereo digital inputs is selected. I appreciate having so much information displayed, but I wish the LEDs weren't so close together—it can be difficult to tell which one is illuminated, especially when the unit is viewed from an angle.

CONNECTION COLLECTION

The Mobile I/O's rear panel is crowded with I/O options (see **Fig. 2**). The eight analog inputs are four locking female XLR jacks and four balanced ¼-inch jacks, all of which can handle balanced or unbalanced signals. Signals at either set of inputs are routed through the 2882's preamps and 24-bit, 96 kHz A/D converters. Alongside the inputs are eight analog outputs on ¼-inch TRS jacks, whose signals come straight from 24-bit, 96 kHz D/A converters.

The digital I/O section includes ins and outs for word clock on BNC connectors, eight channels of ADAT Lightpipe, coaxial S/PDIF on RCA jacks, and AES/EBU on XLRs. Also on the rear panel are two FireWire ports and a DC jack for the external lump-in-the-line power supply. According to the User Manual, the Mobile I/O can run off any DC source, from 9V to 30V, that supplies at least 12W of power to either the FireWire or DC jacks. That means a FireWire connection from a laptop computer is sufficient to power the 2882 from its internal battery. Goodbye, power cords!

ASIO is the only way the Mobile I/O can communicate with pre–OS X applications, so if you're still working in OS 9 (like me), make sure your audio programs support ASIO. Driver updates are available on Metric Halo's web site. Downloads from the site also update the controlling software and the 2882's firmware, adding new features to their functionality. That's a very good thing, considering that many expected features either still aren't available or still have bugs.

CON SOLE MIO!

MIO Console, which at this writing is available only for the Macintosh, is the software for controlling all the Mobile I/O's parameters (except the headphone's Mute and Dim controls, which aren't yet operational). MIO Console is a comprehensive control panel with extensive functionality.

The main benefit of controlling the Mobile I/O's functions with software (as opposed to real knobs and switches) is that you can save and recall all the input, output, mixing, and routing parameters, either as individual parameter presets or as global console snapshots. That lets you

FIG. 1: The Mobile I/O's front panel displays analog I/O metering, system status, sample rate, and clock source. Its only hardware controls are buttons to lower or mute the headphone level.

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create templates for the various ways you might use the interface. Factory defaults for each savable parameter let you quickly return the 2882 (or one input channel, for example) to a "zeroed" state.

MIO Console consists of three main panels—Analog I/O Control, Mixer, and Mix/Output Routing—which you access with the panel selector bar at the top of the window (see **Fig. 3**). The Analog I/O Control panel provides remote control for all eight analog inputs and outputs. In addition to the pop-up menu for saving and recalling channel-strip presets, the Analog Input section offers controls for each channel's phantom power, trim (with a 42.5 dB range), and level (+4 dBu line, –10 dBV line, instrument, mic, or –20 dB mic pad). In addition, each channel has a PPM-style meter that exactly mirrors the respective meter on the hardware unit. You can also link channels in odd-even stereo pairs.

To the right of the Analog Input section are the input meters for the eight ADAT inputs and two stereo digital pairs, and then a knob (labeled Cans) for setting and monitoring headphone level. Farther to the right are pop-up menus for various system functions. The Digital Input Sample Rate Conversion (DI SRC) button determines whether the incoming AES/EBU or S/PDIF signal is converted to the selected sample rate on the fly. That can come in handy if, for example, you're transferring audio from a 48 kHz DAT into an existing 96 kHz DAW project.

Analog Output contains most of the same controls as the Analog Input section. The most notable difference is that the only two options for level are +4 dBu line and –10 dBV line. Next to that section are meters for ADAT and stereo digital outputs.

Clicking the Mixer button in the selector bar changes only the bottom half of MIO Console's window, which becomes a fully configurable mixing interface with a master fader and as many as 18 input channels visible at the same time. If you need them, you can access 18 more input channels by means of a scroll bar. Each mixer channel has prefader metering, a fader for Level control, a Solo button, a Mute button, and a pan knob if it's a mono channel in a stereo mix. I was disappointed that I couldn't use MIDI to control the mixer functions.

Tabs across the top of the window let you select which mix you want to control. Control-clicking on a tab reveals a pop-up menu for copying, pasting, saving, or recalling mix configurations. Sixteen discrete mono or eight stereo mixes are available, so you can route audio from any of the 18 hardware inputs and 18 DAW buses into any mix in any way you'd like. That lets you set up multiple mixes for different headphone feeds, "stem-based" mixing, or any other multichannel routing scenario. Such a scheme is ideal for monitoring, because the Mobile I/O is capable of near-zero latency, virtually eliminating the need for an outboard mixer.

MIO Console's third panel is the Mix/Output Routing panel; it contains a pop-up menu for Matrix presets and another for Patchbay presets. The Output Patchbay section lets you select what appears at each of the 22 physical outputs (including the headphones). You have three sets of options for internally routing signals to the outputs: from any of the 16 MIO mix outputs, from any of the hardware's 18 physical inputs (for direct hardware patchthrough with minimum latency), or from any of the 18 buses streaming from your DAW software through ASIO. The versatility of the patch bay is most impressive and powerful, allowing you to use the Mobile I/O as a DAW interface, a DAW-independent A/D/A converter, or a standalone mixer.

The Routing Matrix is a grid with inputs on the *x*-axis and mix buses on the *y*-axis. Clicking at the intersection of an input column and a mix row activates that input in that particular mix; your

Mobile I/O 2882 Specifications

Analog Audio Inputs	(4) balanced XLR; (4) balanced ¼" TRS
Analog Audio Outputs	(8) balanced ¼" TRS
Digital Audio I/O	8-channel ADAT Lightpipe; stereo AES/EBU; stereo S/PDIF
Word Clock	1× and 256× I/O on BNC
Preamplification	(8) remote-controllable preamps with 40 dB gain; switchable –20 dB pad; switchable 48V phantom power
Word Length	24-bit
Sample Rates	44.1, 48, 88.2, 96 kHz
Dynamic Range	110 dB (A/D); 120 dB (D/A)
Computer/Drive Connectivity	(2) IEEE 1394 FireWire ports (400 Mbps)
Power	(1) 9V–30V, 15W DC power jack; (1) 24V, 48W external power supply
Dimensions	14" (L) × 2" (H) × 11" (D)
Weight	7.5 lb.

FIG. 2: Packed with ports, the rear panel has jacks for balanced, unbalanced, ADAT, S/PDIF, and AES/EBU audio, as well as FireWire, word clock, and DC power.

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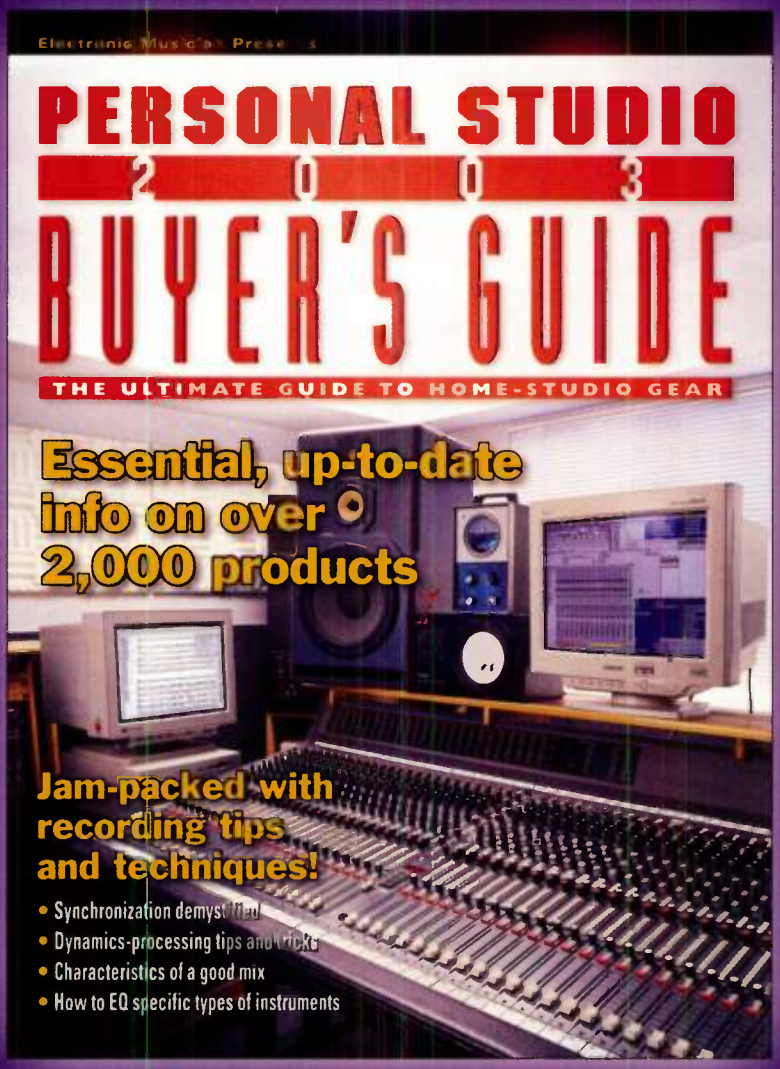

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choice is reflected in the Mixer panel by a fader appearing with the appropriate label on it. That provides a convenient visual interface for streamlining your mixes so that they contain only the inputs you're currently using. You can save various configurations for different routing scenarios.

TRIALS AND TRIBULATIONS

When I compared the 2882's preamps to my Focusrite Green 1 Dual Mic Pre, they stacked up pretty nicely, especially considering that the Mobile I/O costs about a third as much per channel as the Focusrite. Recording percussion through an Oktava MC012, the Focusrite had a touch more clarity on high frequencies and a little more roundness on low frequencies, but the difference was very slight. For both male and female vocals through a Shure Beta 58 and an Electro-Voice RE20, I could hardly tell the difference between the two devices, though the 2882 had a little less sibilance. I ran an RCA 77-DX ribbon mic through the preamp to test the noise floor, which also sounded comparable to that of the Focusrite.

The 2882's biggest stumbling block was its inability to deliver a clean signal through the Lightpipe inputs. I tried to transfer eight tracks from an ADAT XT20 using an optical cable, and I heard nothing but grunge and grime in both MOTU Digital Performer and BIAS Peak. The status LEDs told me that the unit was synced to the ADAT, but it sounded as if there were a clocking issue. Switching to my MOTU 2408, everything sounded fine. Online discussions (see the sidebar "Mobile Forum") informed me that I'm not the only one who's had trouble with the ADAT inputs, though the outputs work perfectly.

An even more serious glitch is that every so often, the audio outputs (including the headphones) went silent. The meters bounced happily along as if nothing had happened, but the only way to get audio back into my speakers or phones was by cycling power on the Mobile I/O. Metric Halo promises that a fix for both problems is forthcoming, but such problems are bad news for current customers.

MOBILE FORUM

To learn more about why some of the software functions are either spotty or missing in action (such as the Preferences dialog box), I started lurking on the Mobile I/O discussion group (http://mail.music.vt.edu/mailman/listinfo/mobileio). The user forum is the best technical support group I've ever encountered, hands down. Not only is it filled with incredibly helpful, intelligent, and insightful information regarding the Mobile I/O and related issues and products, but much of that information is from the head engineer of Metric Halo, B.J. Buchalter.

It's quite encouraging when the guy in charge of making sure the product works right takes the time to address his customers' concerns in a setting as intimate and informal as an e-mail discussion group. He is the first to admit that some of the features of the 2882 and MIO Console aren't quite up to speed yet, but he assures us that his team is working hard on those issues. Since I received the unit for review two months ago, I have already downloaded two software updates, the latest of which includes drivers for OS X 10.2. Early reports say that the Mobile I/O integrates with OS X quite well. In addition, Metric Halo will soon release a no-frills, OS X–only recording application.

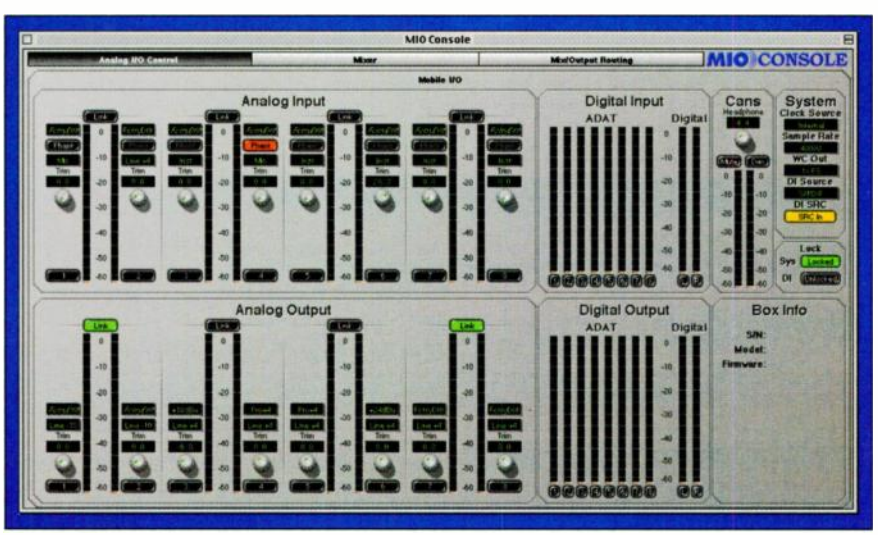

FIG. 3: The MIO Console software provides plenty of metering, as well as complete control over the inputs, outputs, and system functions.

TRAVELING LIGHT

The prospect of running the Mobile I/O from my PowerBook G4's internal battery using the FireWire bus was extremely attractive to me because I could record anywhere without being tied to AC power. Using Digital Performer, Propellerhead Reason, and a Midiman Oxygen 8 keyboard (which can be powered by the laptop's USB bus), I could theoretically have a full MIDI and audio studio that still weighed less than my goal of 30 pounds.

Unfortunately, the backlight on the PowerBook G4/667's display automatically turns itself off if there's too much strain from powering external devices. It is a known Mac issue that Apple is addressing for newer PowerBooks, but for me and a lot of other people, the laptop's battery can power either the keyboard or the Mobile I/O, but not both. I also experienced relatively fast

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battery drainage running the Mobile I/O from the FireWire bus—it gave me less than two hours of use.

PowerBook battery problems aside, the 2882's overall performance in remote situations was quite good. I took it to the Ex'pression Center for New Media, where ten channels of external Studer preamplification fed the analog and AES/EBU inputs for recording drum, bass, guitar, vocal, piano, trumpet, and clarinet tracks. Every now and then I heard a little digital noise on the incoming AES/EBU tracks, but reselecting the sample rate in Digital Performer or in MIO Console got rid of it. MIO Console's routing functions were especially handy for tracking and overdubbing.

WORK IN PROGRESS

The Mobile I/O 2882 has great potential to be a powerful and versatile audio interface. In combination with the MIO Console software, its flexibility and routing capabilities are extraordinary. It offers plenty of I/O, and the ability to plug a microphone or guitar directly into the 2882 eliminates the need for external preamps or DIs. Unfortunately, it has a few significant problems.

Although the Mobile I/O's analog output sounds great, its digital input can be undependable. The 2882 is easy to use, but only when it works as it should. It offers much more functionality than its price might suggest, but functionality doesn't mean much when your playback session comes to a grinding halt. As of this writing, the 2882 has some serious bugs, and until those bugs are squashed, it remains a work in progress.

Eli Crews *used the Mobile I/O to sample his eight-month-old son's toys for a drum beat for his band The Loins, a duo with wife Beth Lisick.*

PRODUCT SUMMARY

Metric Halo
Mobile I/O 2882
audio interface
$1,495
+DSP model $2,195

FEATURES	3.5
EASE OF USE	3.0
AUDIO QUALITY	3.0
VALUE	2.0

RATING PRODUCTS FROM 1 TO 5

PROS: Transparent sound. FireWire-bus power. Flexible mixing and routing functions. Remotely upgradable. Excellent customer support.

CONS: Announced features still unavailable. No Windows drivers. Unstable ADAT inputs. Intermittent AES/EBU input noise. Audio randomly drops out until power is cycled. Mixer functions not MIDI controllable.

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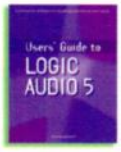
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KURZWEIL

KSP8

Honey, they shrunk the studio!

By Mark Nelson

Imagine being able to take every effects processor in your rack—reverbs, delays, dynamics, and EQs—and shoehorn them into one box. As long as we're dreaming, let's add a flexible software patch bay, dedicated 5.1 surround processing, quick hands-on editing, and great sound. That, in a nutshell, is the concept behind the Kurzweil KSP8.

With its brushed-aluminum surface, the KSP8 looks cool, calm, and ready for business (see **Fig. 1**). The faceplate is nicely laid out. On the left are the meters and a slot for a Smart Media card. In the center is a large display surrounded by function buttons. Next to the data wheel are buttons for cursor functions, data storage, a contextual bypass (depending on where you are in the interface, it works globally or selectively), and a keypad. All of these are duplicated on the optional RSP8 Remote (see the sidebar "The RSP8 Remote").

Metering functions (located on the left, above the Smart Media slot) include eight tricolor LEDs, for viewing signal levels at four different gain stages (input, pre-FX, post-FX, and output), the Meter Stage selector, and LEDs that indicate the current selection and clipping. To meter from the display, hold down the Meter Stage button.

The six soft buttons below the display take their cues from the current display page, and the dedicated buttons are grouped according to function. The dark blue Edit and Exit buttons on either side of the display look and feel different from the other buttons, so you won't mistakenly press these two in the heat of a session.

The KSP8's basic I/O complement is four analog inputs and outputs and stereo digital I/O (see **Fig. 2**). The review unit came with the KANA8 option card, which adds another four analog ins and outs to the unit. Other options include 8-channel cards with AES/EBU, Lightpipe and TDIF, and mLAN connections.

PROJECT OBJECT

My first task was to find a place for the KSP8. At over 15 inches deep, it wouldn't fit into the lower rack spaces in my studio desk. Then, like many musicians, I tried to see how far I could get with the new gear before having to reach for the manual. When I powered up the KSP8, I was stumped by the welcome screen. The manual says "the KSP8 offers a familiar interface for anyone who has used Kurzweil products before." Just getting to where I could audition the effects required quite bit of head scratching and page turning. If you are new to Kurzweil gear, prepare to spend some time with the KSP8's manual. Once you get used to the interface, though, it's very easy and convenient to use.

The basic organizational unit in the KSP8 is the *object*, Kurzweil's name for a class of hierarchically arranged software parameters. All objects except the algorithms can be edited and stored in any of the 999 internal locations or on Smart Media cards. Understanding how objects relate to each other is crucial to using the KSP8.

Algorithms. Stored in ROM, algorithms are the signal-processing heart of the KSP8 system. The 249 algorithms includes single effects (reverbs, time-based and modulation effects, cabinet simulators, dynamics processors, EQ) and multiple-effects Combis (such as a stereo chorus followed by a delay and a reverb).

Algorithms are not just little snippets that you can string together to build an effect. Rather, each algorithm is a full-fledged effects block, complete with a set of eight Quicks (preselected, easily accessible parameters). The eight soft knobs on the RSP8 remote offer instantaneous hands-on control of the Quicks—that feature alone makes the remote essential. The complete list of algorithms and their specifications requires a 330-page PDF document, which is available on CD-ROM or from Kurzweil's Web site.

Algorithms consume differing amounts of processing power, measured in Processing Allocation Units, or *Us*. One of the strengths of the KSP8 is that it allocates DSP power dynamically. As long as you don't exceed a maximum of 16 Us, you can place an effect anywhere you want. Ample mono, stereo, and surround algorithms are available to handle most processing needs. The only way to audition an algorithm is to place it in a Preset.

Presets. Presets are made up of an effects algorithm and its associated parameter settings. For example, you can create variations of a single plate-reverb algorithm and store them as different Presets.

Chains. A Chain is a group of effects, each with its own editable parameters, modulation sources (MODs), and Quicks. Like presets, Chains are placed on an effects bus. A Chain can be of any length, as long as you respect the total DSP overhead of 16 Us.

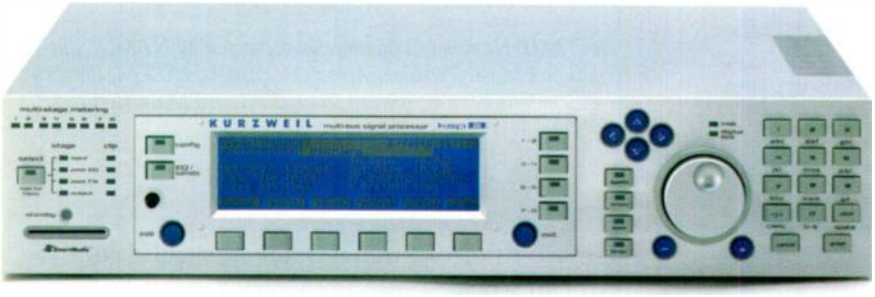

FIG. 1: The front panel of the KSP8 offers metering and navigation tools, as well as a large data wheel and alphanumeric keypad.

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SOURCE CODE: EMCB

Studios. Studios represent the complete signal path, from input to effects bus to output assignment. If an option card is installed, the KSP8 automatically knows which inputs and outputs you have.

The KSP8 excels at flexible routing. A Studio can have any combination of mono and stereo inputs—analog or digital—feeding as many as eight internal effects buses. The routing options allow you to submix internally or use one effect to modulate another.

Think of a Studio as a snapshot of all of your settings. For example, for a rough mix of an R&B song, I set up a Studio with one stereo and three mono inputs feeding four stereo effects buses. I configured a stereo Chain for the sax on effects buses 1 and 2 and placed a warm plate reverb on buses 3 and 4 for the vocal. Next I submixed all the bass and drum tracks to stereo and inserted a mastering effects Chain across buses 7 and 8 to pump up the low end and tame the dynamics. Last, I set up a basic club ambience for the entire mix.

The fact that I was able to process an entire mix of this complexity through a single device is amazing. Better still, it sounded great! If I could only have one piece of gear in my rack, this would be it. The KSP8 ships with a collection of default Studio templates in ROM that cover basic mono, stereo, and surround situations.

By the way, all of the inputs are routed through two EQ blocks on the way to the effects sends. The EQs come in a wide variety of flavors, from the simple (highpass, lowpass, bandpass, and notch filters) to the complex (with modulation effects and noise generators). Most of the common parametric-EQ effects do their job and stay out of the way sonically without using any effects resources.

KSP8 Specifications

Analog Inputs	(4) ¼" TRS
Analog Outputs	(4) ¼" TRS
Digital I/O	XLR (AES or S/PDIF)
Word Length	16, 20, or 24 bits
MIDI I/O	In, Out, Thru
Frequency Response	20 Hz–20 kHz, ±0.15 dB
Maximum Input Level	+22 dBu
A/D/A Converters	24-bit, 128× oversampling
Dynamic Range	> 110 dB unweighted @ 1 kHz
Crosstalk	< –100 dB @ 1 kHz
Total Harmonic Distortion + Noise	< 0.002% @ 1 kHz, +19 dBu
Display	240×64 backlit LCD
Dimensions	3U × 15.125" (D)
Weight	13.25 lb.

The Master Page and Table. The Master Page in the Master Table is where you establish settings (for clock source, word length, digital format, and so on) that affect the entire device. Only one Master object at a time may be stored internally, but Master edits may be written and restored from Smart Media. This is useful if you move your KSP8 to a different studio.

CONTROL FREAK

Every editable parameter on the KSP8 can be controlled using MIDI. However, be prepared to spend time programming, because there are only a handful of default assignments. As with everything else, the KSP8 offers a wide variety of options at the Studio, Preset, and Chain levels.

The four studio modulation pages (SMODs) offer extensive options for controlling inputs, outputs, sends, EQs, and mix levels. The chain modulation pages (CMODs) let you configure real-time controls for effects parameters. MIDI Program Change messages can be used to select Studios, Chains, and Presets. For time-based effects, you can set tempo maps in bpm, with tap tempo, or by sending the KSP8 MIDI Clock data.

What really sets the KSP8 apart from the crowd of multi-effects processors are the software control sources: LFOs, envelope generators, and quirky mathematical equations called FUNs (short for Functions). FUNs combine two different control source inputs, such as an LFO, a MIDI controller, a numerical value, or another FUN.

For example, the equation *sin (a+b)*, where *a* is an LFO and *b* a numeric value, either transforms a sawtooth wave into a smooth sine wave or an extremely complex waveform, depending on the input. You have 50 FUNs and a plethora of input sources to choose from, which gives the KSP8 some of the modulation power of a synthesizer.

NOW HEAR THIS

I tested the KSP8 in a variety of configurations. For instance, I used it on a complete mix, on a drum submix, for vocal processing, and as a substitute for my usual selection of guitar stomp boxes. No matter what I threw at it—even complex arrangements of mono and stereo Chains—there was power to spare. Unlike some effects units that

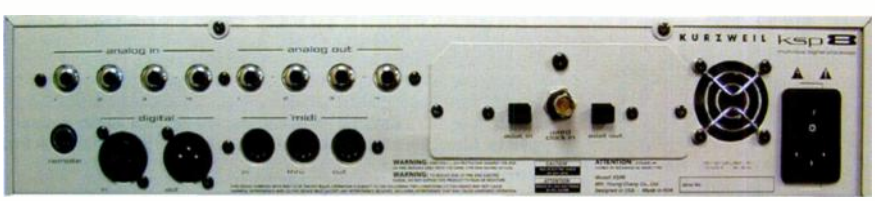

FIG. 2: The KSP8 comes with four ¼-inch analog inputs and outputs, and XLR connectors for AES/EBU or S/PDIF digital I/O.

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offer a handful of processor-intensive reverbs and then try to dazzle you with hundreds of wimpy patches, the KSP8 delivers nothing but terrific, usable effects. Once or twice I exceeded the 16-U limit when assigning presets, but each time I was able to find a substitute with little or no loss in audio quality.

Although some of the factory Presets were too over the top for my taste, many are usable just as they are. The KSP8's reverbs, in particular, fared very well in an A/B comparison with high-end dedicated stereo processors costing as much as or more than the KSP8. You can edit and overwrite any effect with confidence because the original is safely tucked away in ROM.

When you get past the standard effects, things really get interesting. The specialty effects that use FUNs, LFOs, and other modulation sources are amazing, especially when you add real-time MIDI control or use the RSP8's joystick. For example, from a single spoken word, I created an immense, swirling pad that seemed to last forever. Thanks to some creative use of LFOs and FUNs, the original vocal drifted in and out of the mix as it panned slowly from left to right over long intervals.

SOUND ALL AROUND

I took the KSP8 to Oregon Sound Recording to evaluate its surround effects. The unit supports a variety of input routing options before you get to the 5.1 bus: eight mono inputs can be submixed internally; a stereo input can be bused to the 5.1 and stereo buses simultaneously; or you can go 5.1 in and 5.1 out. Obviously only some of these options are available on the stock unit: you'll need to expand the I/O to get the most out of the surround routings

For our first test, studio owner Sean McCoy and I processed a stereo source to simulate a live environment, which is a common mixing technique. By subtly adjusting the pan, diffusion, predelay, and other Quick parameters, we not only created a stunningly realistic concert hall, but we could select our seats. Next, we sent individual tracks from the mixer to each input. By adjusting settings in the individual FX Sends page, we could move each instrument around the room with the joystick.

The KSP8 lets you determine whether or not a sound skips the center channel as you pan in surround. That allows you to leave a hole for any dialogue that will be added to the mix. McCoy and I were amazed that a unit at this price point could produce such amazing effects with such high sound quality.

PRODUCT SUMMARY

Kurzweil
KSP8
digital effects processor
$2,999
RSP8 Remote Control $595
KANA4 Option Card $450

FEATURES	5.0
EASE OF USE	3.5
AUDIO QUALITY	4.5
VALUE	5.0

RATING PRODUCTS FROM 1 TO 5

PROS: Flexible routing. Real-time control. Innovative tools for shaping effects. Supports for 5.1 surround effects.

CONS: Tough learning curve. Metering requires you to leave the editing screen.

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THE FANTASTIC 8

The KSP8 gives users unprecedented power and control of stereo and surround-sound processing. What's more, Kurzweil's unique tone-shaping FUN equations bring samplerlike modulation to any sound source, creating effects that are simply out of this world. Although it's an option, I consider the RSP8 remote a necessary component. I couldn't imagine using the KSP8 without it. Likewise, I'd suggest adding one of the optional I/O cards, particularly if you plan on doing surround-sound projects.

Whether or not you mix in surround, the KSP8 is an outstanding value. Once you get the hang of it, the flexible interface lets you instantly recall the perfect combination of routing, EQ, dynamics, and effects for just about every studio task imaginable. And the bottom line is that it sounds great.

Mark Nelson *lives and works in Southern Oregon's Applegate Valley.* *Thanks to Sean McCoy for help in this review.*

THE RSP8 REMOTE

The RSP8 remote features a set of buttons, LEDs, a display, and a data wheel that duplicate those found on the face of the KSP8 (see **Fig. A**). The remote adds eight soft knobs, for hands-on effects-tweaking, and a joystick, for panning or real-time control over any parameter you choose.

The RSP8 is about the size of a cigar box and has the same brushed-aluminum finish as the KSP8. Wooden side rails add a touch of class, and a soft rubber mat on the bottom keeps the remote from slipping around your desk. There's even an adapter that lets you mount the unit on a mic stand—handy for studios where flat space is at a premium—and it comes with a 52-foot cable. The RSP8 is powered by the KSP8, and with the HUB7, a single RSP8 can control up to seven KSP8s.

FIG. A: All of the KSP8's controls are duplicated on the RSP8 remote. The joystick can be used for real-time effects control, such as panning in a surround configuration. If you add the HUB7 card, a single RSP8 can control as many as seven KSP8s.

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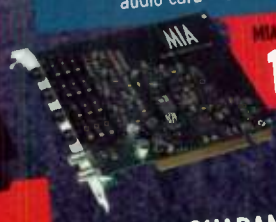

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SOFTWARE TECHNOLOGY

VAZ 2010 (WIN)

This virtual analog software synth should keep you busy for a very long time.

By Brian Smithers

If you're a fan of big, fat analog sounds, check out VAZ 2010. Software Technology has taken a subset of its well-respected VAZ Modular's features and served them up in a powerful but user-friendly configuration at a very reasonable price. Although it's available only for Wintel machines, VAZ 2010 offers compatibility with DXi and VSTi plug-in standards, and it also functions in standalone mode.

Despite its fixed architecture, VAZ 2010 offers a great deal of flexibility in designing patches, and with all its complexity, it's still relatively easy on your computer's processor. I tested it on a Celeron 1 GHz notebook with 512 MB of RAM, and seven VAZ 2010 synthesizers tipped Cakewalk Sonar's CPU meter at about 30 percent. The CPU load under Steinberg Cubase VST was similar. When used in standalone mode without a sequencer running concurrently, the overall CPU load would be even less.

SOUNDING OFF

VAZ 2010 features 16 synthesizers (see **Fig. 1**); each one has its own step sequencer. All of the synths run through a 16-channel mixer that supports VST and DirectX plug-ins (on all 16 channels) and also provides a handful of useful built-in effects. With that much going on, you could do a significant amount of work without ever leaving standalone mode.

Two oscillators are available, and a third source can be mixed with them. Options for the third source include ring modulator, noise, the output of the mod amplifier, or an external audio source. You can also set LFO 1 to track the keyboard as a third oscillator. The three sound sources ordinarily feed the filter, but you can use a Post button for each source to bypass the filter.

Available waveforms for Oscillators 1 and 2 include sawtooth, pulse, and multisaw, a combination of four sawtooth waves. The wavetable/sample option is a nice bonus; it allows anything from using an audio file as a waveform to basic key-mapped sample playback. Additionally, Oscillator 1 features an external input, and Oscillator 2 provides oscillator sync, a powerful way to create complex waveforms.

Every waveform offers a variable parameter, and any of a number of sources can modulate that parameter. (In fact, almost anything can be modulated in VAZ 2010, as you will see.) The sawtooth can be morphed into a triangle, the pulse wave's width can be varied, the multisaw can be detuned, and so forth. Each oscillator also has two points at which you can patch in frequency-modulation sources.

Various filter configurations are available, including 2-pole variable- and fixed-resonance bandwidth lowpass, bandpass, and highpass types, as well as another 2- or 4-pole type that offers separation modulation. Separate controls for cutoff, resonance, and bandwidth are provided, along with three points to patch in cutoff modulation sources and one for resonance modulation. If you think that sounds like a lot of power to create dynamic timbres, you're right; VAZ 2010 leaves no excuses for making boring, static sounds.

THE MOD SQUAD

The list of modulation sources is quite extensive and applies to all modulation destinations (see **Fig. 2**). You can assign a modulation source to any number of simultaneous destinations. Each destination has a slider to control modulation amount and a +/– switch for inverting the parameter's response.

Three variable-rate LFOs are available, each with its own characteristics.

Minimum System Requirements

VAZ 2010

Pentium II/350; 64 MB RAM; Windows 95/98/2000/ME/NT/XP

FIG. 1: The fundamental architecture of a VAZ 2010 synth is fixed, but myriad possibilities are available within that structure, including the ability to modulate just about anything from a large set of sources.

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LFO 1 offers sawtooth and pulse waveforms; the symmetry of either can be varied. A Trigger switch causes the LFO to restart its cycle at the beginning of each note; otherwise, the LFO cycles continuously without regard to what's being played, lending variety to the note attacks.

LFO 2 also features the Trigger option, but its waveforms are triangle or sample and hold. A variation slider causes a delay in the onset of modulation for the triangle wave and causes the sample and hold to slide from one value to the next. LFO 3 simply offers triangle and sine waves.

The two ADSR envelope generators can be set to one of four modes. The default mode allows for legato behavior for a monophonic synth. In that mode, successive notes with no space between them do not retrigger the envelope's attack, emulating a slurred articulation on a wind or string instrument. The Multi switch overrides that behavior, causing the envelope to retrigger at each new note. Reset forces the envelope to close completely prior to each attack, effectively ensuring that the envelope completes its cycle for each note. Cycle causes the envelope to return to the attack as soon as it reaches its sustain, giving a repetitive effect. Using Cycle mode, it took me about three seconds to duplicate the pinging sound my car makes when I open the door without turning off my lights. Shortening the decay time caused the envelope to recycle quickly enough that it became an audible frequency component.

The three oscillators can be used as modulation sources (for example, filter cutoff could be made to track pitch), as can a built-in noise source or the external input. Accent and two other modulation sources are available directly from the step sequencer, allowing sonic variations to track the sequence's melodic variations. Of course, MIDI Velocity and Channel Pressure are fair game. Moreover, two MIDI Control Change messages can be defined in VAZ's preferences as mod sources. A simple MIDI Learn function allows you to attach MIDI messages to virtually any slider.

Finally, two modulation sources are provided for (are you ready for this?) modulating other modulation sources. The Mod Amplifier allows you to change the amplitude of an LFO or other modulation source, and that amplitude can even be modulated. The Lag Processor effectively smears the shape of any modulation source, with the result that, for example, a square wave LFO would end up more like a trapezoid. The degree of smearing is determined by the Time slider.

When you've fried your brain from working out all the possible modulation routings, don't forget to use the Amplifier section to assign a volume envelope or to create interesting amplitude-modulation effects. Adding a bit of Overdrive lends a satisfying degree of grit to the sound, as you might expect. Synths can be polyphonic with as many as 16 voices, monophonic, or unison, meaning that only one note at a time can sound, but it uses all available voices. Mono and unison modes can use high-, low-, or last-note priority. A rare Duo mode assigns the lowest note to Oscillator 1 and the highest note to Oscillator 2.

Portamento variations include the default always-on mode, an auto mode that slides only between overlapping notes in mono or unison mode, and an exponential glide whose rate increases with the size of the interval. The arpeggiator offers up, down, up-and-down, and two random modes over a four-octave range.

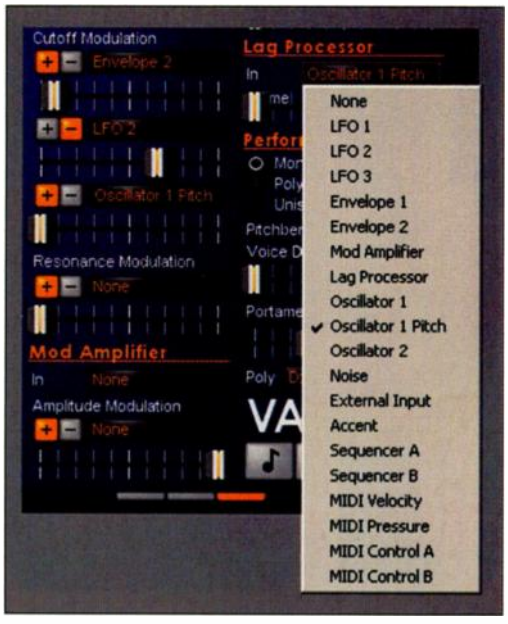

FIG. 2: VAZ 2010's list of modulation sources is extensive. MIDI messages, oscillators, LFOs, envelopes, and more are available to help shape your sounds.

PRODUCT SUMMARY

Software Technology
VAZ 2010 (Win)
software synthesizer
$171.83 (download only)

FEATURES	4.5
EASE OF USE	4.0
QUALITY OF SOUNDS	4.0
VALUE	4.5

RATING PRODUCTS FROM 1 TO 5

PROS: Great analog-modeling sounds. Great bang for the buck. Operates in standalone, VSTi, or DXi mode. Supports VST and DirectX plug-ins along with several built-in effects. Flexible mixer routing. Extensive modulation possibilities. Useful step sequencers.

CONS: Documentation is skimpy. Does not report patch names to the host application.

Manufacturer
Software Technology
tel. 44-161-355-1980
e-mail info@software-technology.com
Web www.software-technology.com

PLAYTIME

Each synth has a corresponding step sequencer (see **Fig. 3**). A sequencer allows you to program up to 16 different patterns of 16 steps each, and the Song Editor allows you to chain patterns together and transpose them independently up to a length of 255 patterns. A pattern can have up to 16 independent voices. Various options for controlling and varying pattern playback are available.

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You can set the tempo in one-beat increments from 1 to 500 bpm, or you can lock the sequencer to an external source such as a sequencing program. Each step can trigger modulation of synth parameters with an Accent switch and two Control sliders.

Step sequencers are not usually my weapon of choice, but VAZ 2010's sequencers kept me interested for a good long time. They offer enough complexity to build interesting lines, yet they are easy to use.

VAZ 2010 is a snap to integrate with a sequencing program such as Cubase VST or Sonar because it supports the VSTi and DXi virtual-instrument standards. At first, though, I had some difficulty getting VAZ to respond on more than one synth at a time. No matter what channel I transmitted on, the topmost synth in the editor was the only one that played. I eventually determined that it was because the MIDI Auto Thru setting automatically routed any MIDI input to the topmost synth—as you would want it to for auditioning or designing patches. For multitimbral recording and playback, however, MIDI Auto Thru needs to be turned off. (The option is set to off by default.)

Although VAZ 2010 doesn't report patch names to the host application, it does allow you to build a map of 128 patches that can then be addressed by program change messages from your sequencing software. That's simple but time-consuming to set up—fortunately, most users will only have to endure the process once. One cool feature worth mentioning lets you audition patches directly from the Open Patch dialog box. That helps a lot when you're digging through piles of patches, looking for the perfect sound or sequence.

A SYNTH ODYSSEY

In your sequencing program, you can record VAZ 2010's tracks to audio tracks, as you can with any VSTi or DXi plug-in. Sequences within VAZ 2010 can be "captured," or rendered as audio files that you can then import into your sequencing program.

You can also use VAZ as an effects processor. In Sonar, for example, you would simply assign VAZ as an insert effect and then choose External Input as Oscillator 1's waveform. You could then apply VAZ's filter and any modulation effects to any audio passing through that Sonar track. Any effects applied in VAZ's mixer are also applied to the Sonar track, allowing you to combine DirectX and VST plug-ins on the same track. That provides a handy way to add multiple VSTi plug-ins to a program, even if the program only supports the DXi format.

The mixer within VAZ 2010 is pretty interesting, with an insert on each synth and two aux sends. One of the built-in effects is a plug-in chainer, which allows you to string together four effects on a synth channel. The other built-in effects are simple but useful—not the sort of thing that will make you toss your favorite VST or DirectX bundle, but appropriate for the sort of sound-shaping for which VAZ is intended.

Just about the only negative I can throw at VAZ 2010 is that its documentation is on the skimpy side. The material that's there is good, but, for example, there is no mention about using VAZ as a VSTi or DXi. I liked the seven one-page tutorials on designing sounds; more of those would be helpful.

Software Technology maintains an online forum for registered users. On the forum, you stand a good chance of interacting with Martin Fay, the brains behind the VAZ family. Scores of downloadable patches designed by fellow VAZ users are available to expand your sonic palette or to use as models for your own designs. That level of support mitigates my complaints about documentation somewhat, but not entirely.

I would have been impressed with VAZ 2010's sound and architecture at almost any price, but at the price Software Technology is charging, VAZ is a no-brainer for anyone with the least interest in analog modeling. Whether you're looking to rock the dance floor with some mondo bass tones or you're itching to build your analog-sound-design chops, you'll get more than you bargained for with VAZ 2010. ●

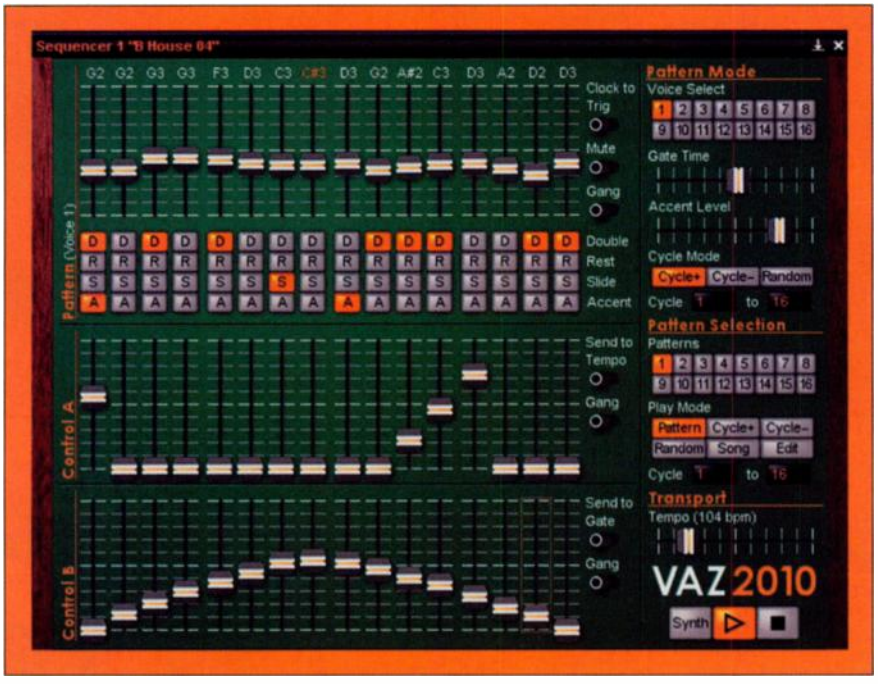

FIG. 3: A separate step sequencer is available for each synth. You can chain together 16 patterns, each with 16 steps and 16 voices, into Songs containing as many as 255 independently transposable patterns.

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AUDIO-TECHNICA

AT4040

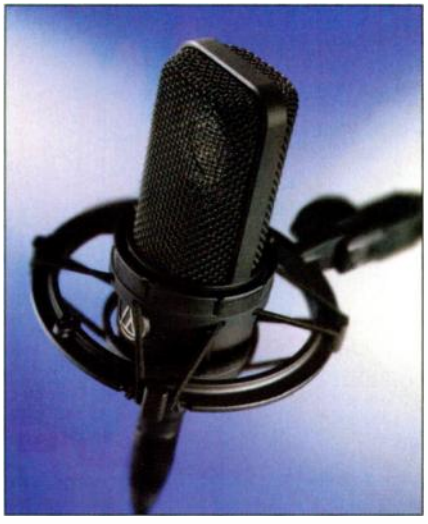
A new standard in low-cost large-diaphragm condenser mics.

By Richard Alan Salz

The new Audio-Technica AT4040 is not just another knock-off mic made to look and sound like one of the treasured classics. Nor is it another mic distributed by yet another company that doesn't actually manufacture microphones. Furthermore, it is not one of those products that relies on hype or gimmicks to spark the consumer's interest.

What the AT4040 is is the culmination of ten years of serious R&D at Audio-Technica. The company's goal? To produce a superior product at a very affordable price. Though the 4040 does incorporate new technology, it is not a revolutionary product for Audio-Technica. It is simply the next step in the evolution of the company's 40 series of mics.

The 4040 is a large-diaphragm, side-address, "true" condenser microphone that operates in a cardioid-only polar pattern. Two micro switches on the lower edge of the mic body engage a highpass filter at 80 Hz and a 10 dB pad. The 4040 has a matte-black finish and weighs in at less than a pound. Its overall fit and finish would be entirely acceptable on a microphone costing three times as much.



A bright performer with exceptional transient response, the AT4040 is a great pick for anyone seeking an affordable, versatile large-diaphragm condenser.

The 4040 looks familiar, and rightly so—the body and grille are the same as those used on the venerable AT4033. Obviously, using preexisting castings helped in delivering the mic at a low price. But there was a sonic rationale, as well: company testing revealed that the 4033 body was both sonically transparent and resistant to noise (physical and RF) and shock. This is also the first 40-series mic to employ surface-mount circuitry rather than conventional through-hole construction—another move that helped keep costs low.

The 4040 features an aged, gold-vapor-deposited diaphragm that is a mere two microns thick. It employs a transformerless circuit design that is said to eliminate low-frequency distortion while providing improved transient response. The mic's self-noise is a respectable 12 dB, and maximum SPL handling is rated at 145 dB (155 dB with the pad engaged).

Like all 40-series microphones, the 4040 is manufactured in Japan, and each one is individually tested at Audio-Technica's Stow, Ohio, headquarters before hitting the shelves. The 4040 package includes an AT8449 shockmount, a nice embroidered velveteen dust cover (which will now be shipped with all 40-series mics), and a vinyl-and-hardboard storage case with foam-rubber lining.

LISTEN UP

The pair of 4040s I received for this review were not matched, nor did they have consecutive serial numbers (not that that is a guarantee of anything). Just the same, I found them to be extremely close sonically—when positioned in a XY-coincident configuration, I achieved a very high null by reversing the polarity on one of the mics.

I tested the 4040s extensively in mono and stereo setups and on a variety of sources. All tests were conducted using the following equipment for recording and monitoring: a Neotek IIIc console, Urei 809 and Fostex NF-1 monitors, a D.A.V. Electronics Broadhurst Gardens No. 1 (solid state) microphone preamp, an MCI/Sony JH-24 multitrack, and a Studer A 80 RC master recorder.

In tests, the 4040 gave me bright but smooth highs, flat or slightly scooped low mids (or high lows), and solid lows beneath the scoop. These results are borne out by the mic's frequency plot, which shows appreciable boosts (3 to 5 dB) at 6.5 and 12 kHz, a mild dip between 60 and 100 Hz, and a relatively flat low end extending down to at least 30 Hz (at which point the plot is cut off). Also notable were the mic's exceptionally good transient response and relatively open cardioid pickup pattern.

MOUTH TO MOUTH

Given its bright high end, the 4040 sounded surprisingly good on a loud, strident-sounding male rock vocalist, handling his bright, rather harsh voice without being unduly painful. However, I did have to try a variety of positions to discover the sweet spot, which proved to be slightly above the mouth of the singer and approximately four inches back. Fortunately, the singer wasn't a "spitter," so I was able to get away with not using a pop screen.

Overall, the 4040 sounded similar to Audio-Technica's popular AT4033, but it was both cleaner and warmer sounding at the same time. The 4040 is also quite a bit less prone to popping than the 4033.

To test the 4040 on female vocals, I recorded my wife (a classically trained soprano) singing some traditional Celtic folk songs. We were both pleased with the sound, which combined a nice sense of air with a good mix of head and chest voice. Although no one would have mistaken the 4040 for a dialed-in Neumann U 47, the sound was more than respectable. Fortunately, my wife's voice is very smooth and balanced, so the accentuated highs delivered by the 4040, though evident, did not sound grating. However, I suspect a female singer inclined to brightness or

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harshness would likely be better served by a darker-sounding microphone.

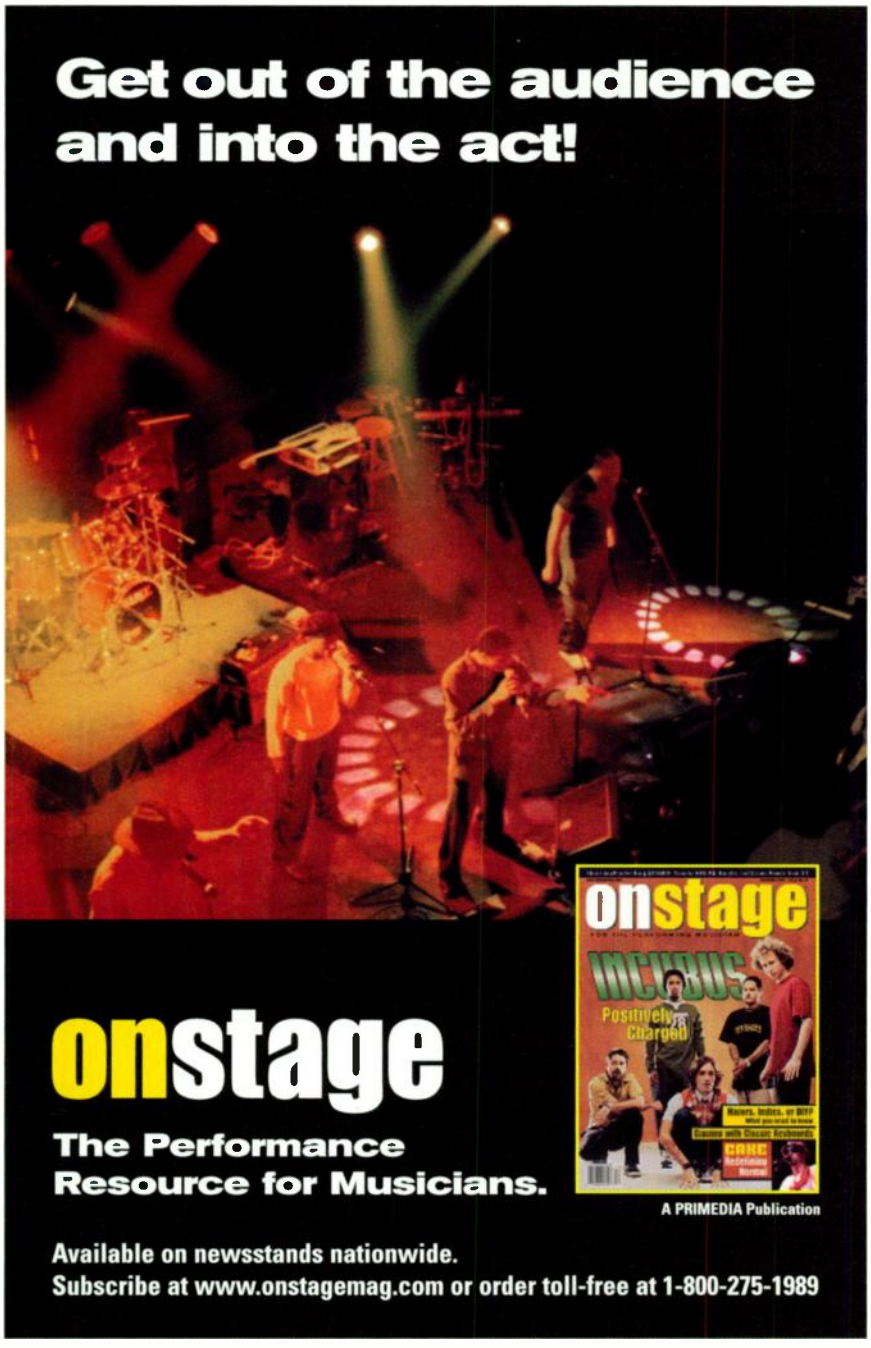
DRUM DUTIES

I love shoving random mics into and around kick drums to see how they hold up. Perhaps I've been lucky, but the only mic I have ever toasted in this manner was a beyerdynamic M 88—a mic that is, ironically, employed fairly commonly for kick-drum duties, especially by live-sound engineers.

Currently, my studio's 22-inch GMS maple kick drum is tuned to complement a '70s-sounding project that is in progress. I switched out the AKG d12e I'd been using with one of the 4040s, but kept the same preamp (the D.A.V.). With the 4040 placed about one inch into the drum, I got a good, solid fundamental note with excellent attack. Audio-Technica may be onto something with its claim that the 4040 exhibits "superior correlation of high-speed transients"—the 4040 does seem quite a bit faster than other mics I have heard in its price range. Incidentally, I didn't need to engage the 10 dB pad to prevent clipping of the 4040's electronics. I did note a fair amount of leakage—the cardioid pattern on this mic is fairly broad—but to the 4040's credit, the leakage sounded good when combined with the other mics on the kit.

I also gave the 4040s a go as drum overheads (again using the D.A.V. preamp), positioned four or five feet in front of the bass drum in an ORTF configuration. I was really pleased when I listened to the playback from the two 4040s. With the exception of the lowest note of the kick drum (the subharmonics, really), the sound of the drums was balanced almost perfectly. In addition, the transient response was excellent, and there was a complete lack of the high-frequency nastiness and harshness that low-cost condensers are generally prone to. With a bit of mild compression, I had a sound that was ready to go, without any corrective EQ. After adding a kick-drum mic, I had the kit sounding great with just three microphones.

Next, I pulled the mics back into the



PRODUCT SUMMARY

Audio-Technica
AT4040
large-diaphragm condenser microphone
$499.95

AUDIO QUALITY	4.0
VALUE	4.5

RATING PRODUCTS FROM 1 TO 5

PROS: Sounds great. Excellent transient response. Very versatile—works well on a broad range of instruments. Very affordable. Includes nice shockmount, storage box, and dust cover.

CONS: Warranty extends for only one year.

Manufacturer
Audio-Technica U.S., Inc.
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room, about 18 feet from the drum kit, to test them as ambient mics. Though I was again pleased with the results, it was in that application that I could tell the difference between a great five-hundred-dollar microphone and a great several-thousand-dollar microphone. The 4040s sounded really good, but certain other mics I have used—which cost three to ten times as much, admittedly—provide a more realistic sonic picture of the kit in the room, particularly in terms of three-dimensionality of the sound. However, the 4040s still sounded more than acceptable as room mics; they even sounded better than some costlier mics I have used.

Normally I prefer using a small-diaphragm condenser on tambourines, triangles, shakers, and the like, as they tend to sound tighter and more focused than large-diaphragm condensers. Though the 4040 captured more room sound than I like on these percussion instruments and made the tambourine sound a bit "splattery," it still sounded good overall, and certainly had no problem keeping up with the fast transients.

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SIX-STRING WONDER

I spent a good amount of time testing the 4040s on my Jean Larrivee Jumbo cutaway acoustic guitar, positioning the stereo pair in three configurations: ORTF, XY coincident, and as a spaced pair (one near the 12th fret, the other near the opposite side of the sound hole). The Larrivee is a loud guitar that pretty much embodies the "smile" EQ curve people often set on graphic equalizers: it's very bright and has lots of bass, but it is a bit recessed in the midrange.

Even on such a bright guitar, the 4040s were quite flattering no matter which stereo configuration I used. I got my best results using the XY setup with the mics positioned about four feet back and aimed toward the top of the guitar. In that position, the 4040s captured a very solid center image that was nicely blended with a good picture of the room's acoustics.

AMP FRIENDLY

Some people refuse to put anything other than a Shure SM57 against the grille of a guitar amp. In my experience, though, a good condenser mic can get much closer to the actual sound of an amp. Not that a 57 is bad—it's not, but neither is it the be-all, end-all of guitar-amp microphones.

The 4040 did a great job on a Paul Reed Smith CE 24 played through a vintage Silvertone 1482 amp (a small tube combo amp with a single 12-inch speaker in a semiopen cabinet). With the mic positioned nearly against the grille and aimed toward the midway point of the speaker (between the cone and surround), I got a nice-sounding, throaty growl. A quick switch to a 57 yielded a sound that was lifeless by comparison.

Just for fun, I set up the second 4040 two inches away from the rear, open part of the cabinet (with the polarity reversed, of course). After micromanaging the mic's position a bit, I had a great, ballsy-sounding combination going.

AT4040 Specifications

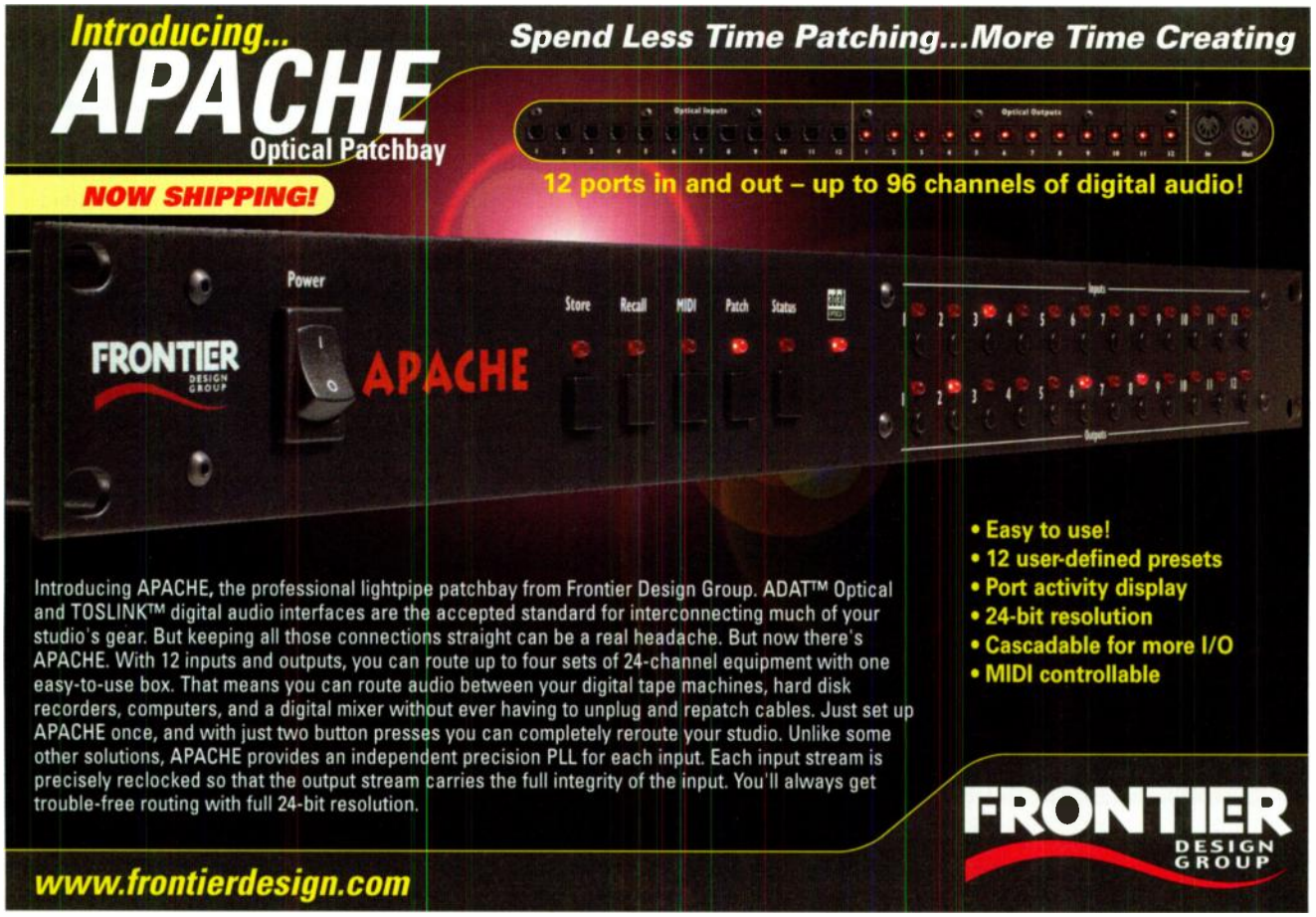
Element	externally polarized, DC bias capacitor ("true" condenser)
Diaphragm	1", 2μ, 24-karat-gold sputtered Mylar
Polar Pattern	cardioid (fixed)
Frequency Response	20 Hz–20 kHz
Dynamic Range	133 dB
Sensitivity	–32 dBV/Pa
Signal-to-Noise Ratio	82 dB
Self-Noise	12 dB
Power	48V phantom
Maximum SPL	145 dB; 155 dB with pad
Highpass Filter	80 Hz, 12 dB/octave
Attenuation Pad	10 dB
Dimensions	6.69" (H) × 2.10" (D)
Weight	0.79 lb.

JACK OF ALL TRADES

The Audio-Technica AT4040 is an excellent value in today's crowded microphone marketplace. Like its predecessor the AT4033, it redefines what to expect from an affordable large-diaphragm condenser microphone, in terms of both sound and build quality. The 4040 is sufficiently quiet, can handle high SPLs, and sounds quite good on a wide range of sources. In addition, it comes with a very nice and effective shockmount as well as a storage case and dust cover. All of that makes it not only an excellent choice for first-time condenser-microphone buyers—those most in need of a versatile, jack-of-all-trades kind of transducer—but also a useful addition to just about any mic locker. The 4040 would likely also be a good choice for stereo location recording, as the mics are very well matched right off the shelf.

Though there are certainly other desirable sonic flavors available from comparable, competing products, I believe you'd be hard-pressed to find an overall better-balanced performer than the AT4040. Indeed, in the large-diaphragm-condenser-mics-under-$500 category, the AT4040 could well prove unbeatable.

Richard Alan Salz *is a producer, engineer, and composer living in Southern Vermont.*



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Quick Picks

PLUGSOUND

Volume 3, Drums & Percs Elements (Mac/Win)

By Dan Phillips

Ultimate Sound Bank's Plugsound series is one of a new breed of software-based instruments, combining a self-contained sample library with a dedicated playback plug-in. I reviewed Volume 3, Drums & Percs Elements ($99.95) using the MAS version with MOTU's Digital Performer 3.1.1. The package also includes VST 2.0 versions for Mac and Windows, and an RTAS version for Pro Tools (Mac).

The program includes hundreds of kits built from about two thousand samples. The sounds are organized into a broad range of categories, including rock and jazz kits, vintage drum machines, drums for Techno and Electro styles, and acoustic percussion.

Percs of the Job

Among the many acoustic kits, my favorites are the thick, organic Hot Rods kits and the loose and juicy Brushes kits, with their well-designed velocity switches. I also like the solid, basic timbres of Raw Kits 05 and 07. They aren't quite as rich and expressive as my current favorite sampled drum library, but that other library costs twice as much as Plugsound and requires a separate sampler. The volume balance of the kits sometimes seems a little off, with hi-hats that are too loud or snares that are too soft.

The Stylistic Kits category is usefully divided into genres such as Electro, House, Techno, Jungle, Disco, and so on. Techno Kit 07 is a standout, with its deep kick and airy snare. I also really appreciate the hard-hitting, punchy New York Kits 01 and 11. The Drumulator program in the Electronic & Machines category is a nostalgic treat; it was my first drum machine, and Plugsound captures it here in all its 8-bit, 27 kHz glory. The FX Kit Program served well as the quirky anchor to a hip-hop track. The strangely plural Percussions category has a wealth of options, from Agogos to Kutuwappa to Waterbells. I particularly like the Atmosphere Percs with shaker and bongo rolls that are perfect for a cinematic-suspense vibe.

Drums & Percs is not simply the host for a sample library. The plug-in also offers a selection of sound-sculpting tools, including two separate multimode filters, filter and amplitude envelopes, and an LFO that you can route to pitch, pan, amplitude, or filter cutoff. There are also four handy Velocity curves, as well as a Mono mode with glide. I presume these features play a bigger part in the other Plugsound volumes—most of the sounds in Drums & Percs leave them at their default settings. Volume, Pan, and the cutoff and resonance for one of the filters can be modulated with MIDI controllers; only the standard Bypass control appears as an automation destination.

Beat Generation

The documentation notes that Plugsound can achieve more than 30 notes of polyphony on fast computers—a somewhat lower count than some other software instruments. With audio hardware buffers set to 64 samples for minimum latency, simple kick-snare-hat patterns caused an average CPU load of about 50 percent on my G4/400 MHz, despite the manual's helpful hints for optimizing performance. When I increased the buffer size to the maximum 512 samples, the CPU load went down to only 10 to 20 percent, but the latency was too high for comfortable playing and caused sync problems with other MIDI and audio tracks.

Plugsound's Volume 3, Drums & Percs Elements packs hundreds of drum kits and percussion samples into a software synth plug-in.

Selecting programs should be fast and simple in any sample player. Sadly, Plugsound falls short in this area. Sound selection relies heavily upon multilayer hierarchical menus as many as five stages deep. Some applications remember the current selection when you click on the menu again, but Plugsound doesn't; instead, you must traverse the submenus every time.

Fortunately, you can also select programs numerically (although MIDI Program Change is not supported). The numbers follow the same organization as the menus so that similar sounds are grouped together. That makes it fairly easy to select a category from the menus and then use the up and down arrows to step through the category's sounds. However, the up arrow moves to lower program numbers and the down arrow moves to higher ones. It's a small thing, but I often found myself stepping in the wrong direction.

Bang for the Buck

Drums & Percs Elements offers a broad variety of eminently usable acoustic and electronic drum sounds, along with a soft synth to play them, for a very reasonable price. I hope that future versions will see improvements in both the user interface and the plug-in's processing efficiency. If you lack a sampler and want to cover your basic needs for drum sounds on the cheap, Drums & Percs is definitely worth a listen.

Overall EM Rating (1 through 5): 3

Big Fish Audio (distributor); tel. (800) 717-FISH or (818) 768-6115; e-mail info@bigfishaudio.com; Web www.plugsound.com

SPECTRASONICS

Stylus 1.0 (Mac/Win)

By Jeff Burger

Spectrasonics' Stylus ($299) is a software sample player for VST, RTAS, and MAS sequencers, and it elevates the genre of sliced loops to the status of instrument. The plug-in is a breakbeat-oriented sound module built on Spectrasonics' Groove

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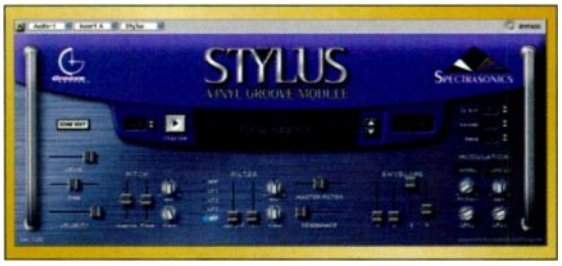

Spectrasonics' Stylus offers a multitude of sampled grooves and the means to seed countless variations in feel, tempo, pitch, and timbre.

Control format, a variation on the slice-and-dice approach popularized by tools such as Propellerhead Software's ReCycle loop editor. Groove Control provides libraries of sliced loops along with the MIDI sequences that trigger the slices into a groove. Spectrasonics added a few proprietary tricks, but the basic result is that you get independent control of tempo, pitch, and most significantly, feel.

Get Your Groove On

Stylus takes Groove Control to a whole new level. For starters, the product comes with 3 GB of presliced grooves produced specifically for Stylus. The system is self-contained, so you can't import other elements or loops. However, the collection is both robust and top-quality within the genres of hip-hop and breakbeat. The two main categories, Breakbeat Loops and Percussion Loops, come in several different layouts and provide a flexible-working environment. Each loop appears in a basic menu organized by bpm. Clicking the Preview button auditions the loop at its default pitch and tempo. You can also trigger the loop from a MIDI controller, in which case the pitch and tempo change as you deviate from the loop's root key.

Once you locate a loop that you like, you switch to its Groove Control equivalent, in which each slice is mapped to a MIDI Note for independent triggering. You then load the associated MIDI file into your sequencer (most sequencers support drag-and-drop). By triggering the Groove Control version of the loop from its corresponding MIDI sequence, you can change tempo, quantization, swing, and dynamics, thereby changing the feel without affecting pitch. This opens the door for many creative opportunities such as editing song section variants, triggering the loop elements manually, or using a different sequence.

These same loops are organized under Groove Menus and Swing Menus as well—a different loop mapped to each of 61 MIDI Notes, each locked to the tempo in the menu's name. That makes comparisons and auditioning easy, but the real juice is in the ability to trigger multiple loops at once by holding down more than one note. The ability to audition complex loop combinations in real time is alone worth the price of admission.

Stylus also offers menus of one-shot sounds such as turntable scratches, claps, snaps, clicks and what appears to be the complete collection of kit and percussion elements that constitute the loops. For example, you get a collection of approximately 1,000 kicks and snares to choose from. Although you can't change a slice's MIDI Note map within a loop, you can use multiple instances of the plug-in and manipulate the events in the MIDI files.

By the Slice

Stylus' controls elevate the program beyond sliced-sample playback. The sexy interface includes controls for Pan, Velocity, pitch, filter (highpass plus three slope variations of lowpass), master ADSR envelope, and two LFOs (sine wave only). These controls normally affect the entire loop; however, pressing the Zone Edit button followed by a MIDI note from your controller applies the onscreen controls to the individual loop slice mapped to that note. The ability to shape the sound of the individual loop elements means you can mutilate grooves in incredible ways. Stylus sends and tracks the zone control changes you make during playback—including multiple passes to tweak multiple parameters.

Installation was easy, although it takes about 30 minutes to transfer the 3 GB library from the five CDs onto your hard drive. The installer places the necessary files in the plug-ins folders of your sequencer. Installation also adds aliases for the library elements in neatly organized hierarchical submenus in the Apple menu or the Windows Start menu for quick access to the files. Authorization is by way of online challenge-and-response with a 48-hour grace period.

Stylus is much more demanding of memory than CPU cycles The installer suggests boosting sequencer memory allocation by 100 MB (125 MB for DAE with Pro Tools) for up to eight instantiations of the plug-in. Each instance beyond that requires approximately 10 MB more. PC users can run Stylus with Windows 98. As of this writing, Stylus only works with OS 9 (9.04 minimum) on the Mac side. However, by the time you read this, an update with support for VST, MAS, RTAS, and OS X Audio Units should be available as a free download.

Needle-Drop

Tools that become inspirational musical partners are among the most exciting recent developments in music technology. Stylus fits that description with its magical blend of elegant architecture, ease of use, high fidelity, and powerful results that make it a masterpiece. Most importantly, all of that adds up to endless hours of musical inspiration and experimentation—and that's really what it's all about.

Overall EM Rating (1 through 5): 4.5

Ilio Entertainments (distributor); tel. (800) 747-4546 or (818) 707-7222; e-mail ilioinfo@ilio.com; Web www.spectrasonics.net

SONOMIC

Online Library Card (Mac/Win/Unix)

By Dennis Miller

Sonomic is one of several online services offering direct download of samples and sound effects. Like the others, it offers various options for accessing its sounds that are intended to suit the needs of different types of users. The Sonomic Online Library Card ($39.95), available only through retail stores, is a new offering from the company and allows the user to download a total of either 50 samples or 20 sound effects from the online collection of more than 200,000 sounds.

Finding the sounds you want can be the most challenging part of using any online

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library service, and Sonomic's approach, though not perfect, is fairly simple. At the main page, you'll find two different search engines. Click on the HTML engine, for example, and you'll be given the choice of locating either sound effects or samples. Click on sound effects, and you can then enter keywords to search only selected categories (Ambiences and Animals, for example) or the entire collection. You can also limit your search to a specific number of channels (mono, stereo, or All) or "frequencies" (44.1, 48, or All). Previews are available in Windows Media and RealAudio streaming formats.

Cough It Up

For the keyword "cough," I got 48 hits ranging in length from one second to nearly four minutes long. Therein lies one of the problems: because you get a fixed number of downloads, you might end up with as little as 20 seconds of data or as much as 70 minutes. I prefer the model of some other services where you pay a fee for some fixed amount of data ($50 for 500 MB, for example), or pay by the sound, with the amount prorated based on the length of the sound you're downloading. Sonomic does offer other types of subscriptions, including monthly subscriptions for $29.95. But here again, you are allowed 10 sound effects or 30 samples regardless of the sounds' actual size (your download "balance" rolls over to the next month if it is not completely used). Unlimited downloads start at $799.99 annually.

Sonomic's huge library contains selections from a number of major players in the sound effects and sample world. Among them are the renowned BBC SFX Library and the complete offerings of Sampleheads, Zero-G, and others. Sonomic's collection will suit a vast range of musical needs—there are an extensive number of loops for dance-music folks, not to mention processed piano sounds, distorted guitar riffs, and hundreds of non-Western instrument samples. There are also a number of multisampled instrument sounds, including acoustic, electric, and ethnic examples.

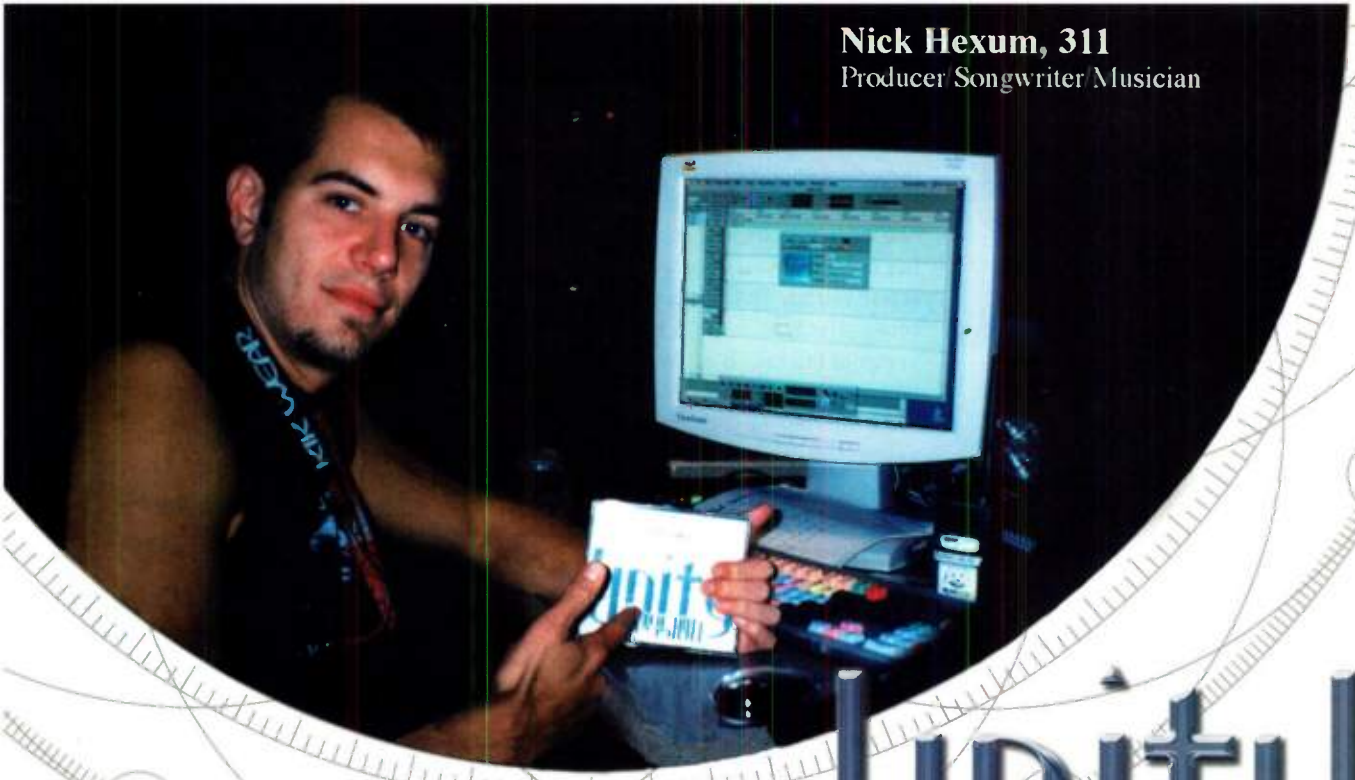
I didn't find many representatives of "fringe" sample styles, such as those offered by Rarefaction or Fizzarum, though some of the vocal effects—the offerings from Zero-G, for example—could fall into this category. However, it was good to see a large number (over 200) in the Foley group, a category that can never offer too many choices.

Order Out

Placing an order with a Library Card is easy—you register the first time you log on and from then on, you just sign in using your e-mail address and password. Once you've made your selections, you view your shopping cart, pick the format you want (Acidized WAV or AIFF), and initiate the download. Unfortunately, Sonomic has no option to zip or stuff all the sounds you're downloading and send them in a single archive, which would be very useful. I would also prefer not to have to opt out of having my user info passed along to other companies.

Sonomic's SoundBay feature builds a database of your purchases and allows you to search your collection. You can also store sounds in your SoundBay area, which is set up automatically after your first purchase; that lets you access them from any computer. That sure beats dragging a bunch of CD-ROMs with you when you go on the road!

The Sonomic Online Library Card buys you 50 samples or 20 sound effects from the company's online collection of over 200,000 sounds. Users can store the sounds they purchase at the company's Web site using the SoundBay feature.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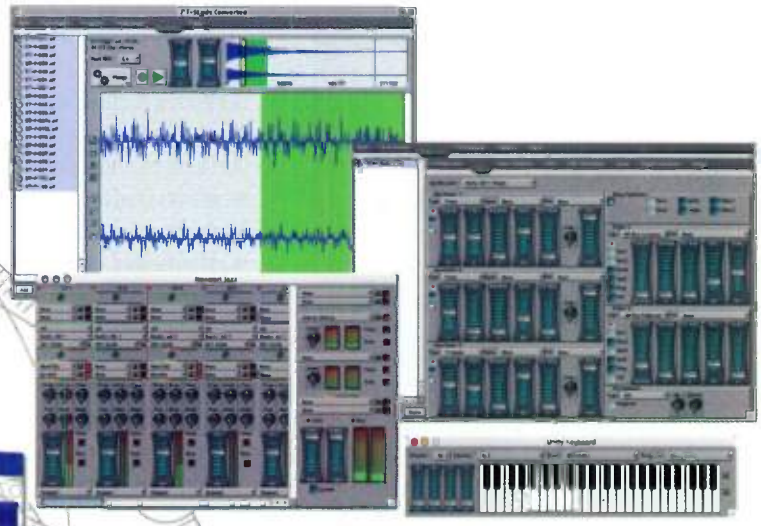

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Quick Picks

Get Down

Downloading samples offers huge benefits over buying sample libraries on CD-ROM. The most obvious of these is that you can buy only what you need and of course, try before you buy. But the ability to select *only* sound effects or samples, not some combination of the two, is an unnecessary limitation that could be avoided if you simply had a total number of megabytes available to you. Moreover, once you download the sounds, you'll have to find a way to keep them organized, as you won't have a booklet or index such as those found in CD-ROM collections. Of course Sonomic's SoundBay is intended to help with this, assuming you buy from only one company and have access to an Internet connection any time you wish to browse your sample collection.

Sonomic gives you access to a huge collection of samples and sound effects from a number of major sound providers. The Online Library Card is an economical way to sample the company's offerings, but a little more flexibility would make it an even better buy.

Overall EM Rating (1 through 5): 3

Sonomic; tel. (212) 473-5776; e-mail info@sonomic.com; Web www.sonomic.com

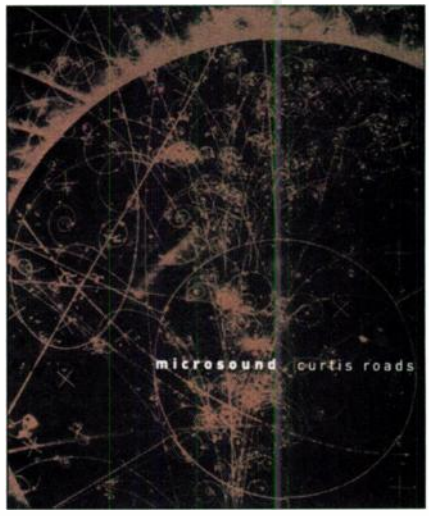
MIT PRESS

Microsound

By Douglas Geers

Mixing historical, theoretical, and practical information, *Microsound* ($47.95) is an interesting and informative scholarly text that is ideal for those who wish to explore granular sound. In the book, author Curtis Roads, a composer and associate professor of media arts and technology at the University of California, Santa Barbara, investigates ways to create, shape, and control granulated musical sounds.

The book's content varies widely from the philosophical topics of time, composition, and aesthetics (chapters 1 and 7 through 9) to practical discussions of how to create particular kinds of musical sound (chapters 3 through 6). All are well written, though sometimes the prose is a bit terse. I especially appreciated Roads's attempts to take on nontechnical subjects such as composition and aesthetics.



***Microsound*, by Curtis Roads, introduces the history, theories, and techniques of granular synthesis.**

The text addresses a professional audience and assumes that readers have a working knowledge of acoustics, digital audio, and mathematics. Readers lacking these skills might want to keep a reference book such as Roads's *Computer Music Tutorial* on hand.

An accompanying CD of audio examples provides the much needed sonic realization of the techniques discussed in the book. Unfortunately, Roads does not cite specific CD tracks as he presents each subject. Instead, a single appendix at the end of the book presents and explains the CD's contents. That's much less convenient for readers.

Zooming In

Roads begins the book with an explanation of the range of possible time scales of music, from the infinite to the infinitesimal. I found his *supra* time scale intriguing, as I usually don't think of music in terms of centuries. On the other end of the time scale lies *microtime*, the measure of sound grains. Here Roads provides some useful information about the limits of human perception and how granular sound relates to these.

Chapter 2 presents a history of microsound from antiquity to the present and begins with a four-page listing of all known electronic instruments created from 1899 through 1950. While interesting to read, it wasn't clear to me why the list belongs in

this book, as none of these instruments used granular techniques. Roads then traces atomistic ideas of nature and sound, from the ancient Greeks up to a very modern Greek, composer Iannis Xenakis. This history helps put contemporary ideas and their roots into perspective.

Getting Grainy

With his fundamentals in place, Roads describes how to compose granular sounds. Chapter 3 explains the basic parameters and types of granular synthesis. It also discusses how the manipulation of grain parameters such as duration, waveform, frequency, density, and spatialization can dramatically transform sounds. These procedures create much of the "magic" of granular synthesis; chapter 3 alone could therefore justify purchase of *Microsound* for many musicians.

Chapter 4 leads the reader through "a catalog of particle-synthesis techniques." I found the 11 synthesis types described here a bit uneven in effectiveness, but enjoyed that they stretched my conceptions of how to deploy sound grains.

In chapters 5 and 6, Roads delves into the rich possibilities of transforming existing sounds through granulation, first with simple grains (chapter 5) and then with grains derived from a windowed spectrum analysis using phase vocoder and wavelet techniques (chapter 6). Both approaches yield exciting sonic results, but readers must persevere through a barrage of theoretical explanations in chapter 6 on their way to the practical applications.

Chapters 7 and 8 demonstrate and discuss how composers have implemented granular sounds in their works. Roads focuses mostly on his own compositions and ideas, which is understandable but eventually a bit disappointing. I would have enjoyed discussion of a wider range of musical approaches and sounds.

Roads ends chapter 9 with a brief summary of his ideas and describes how he feels granular-sound ideas might be used in the future. A generous bibliography, indexes of the names and subjects mentioned in the book, and the appendix mentioned above listing the CD's contents conclude the text.

Grainiac

This book is a condensed presentation of ideas that have arisen over three decades of the author's experimentation and composition. It treats the subject of granular sound fully and deeply, and stands as the best single text on this subject ever written. However, it is written for a scholarly audience and thus may be of limited interest to those who are looking for a straightforward "cookbook" for creating granular sounds. Though at times it dallies on tangential subject matter, *Microsound* is packed with insight and stimulating ideas.

Overall EM Rating (1 through 5): 4

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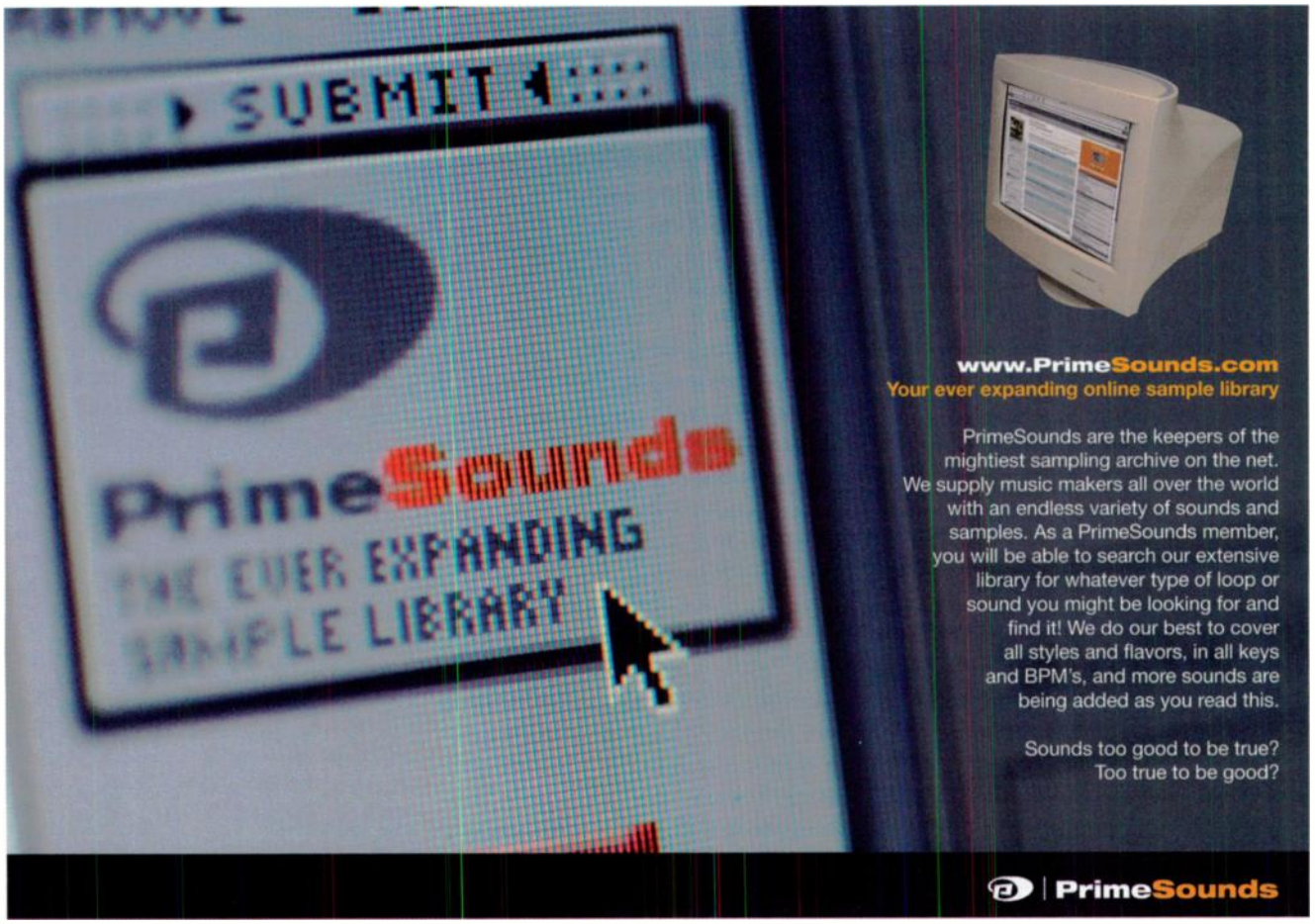

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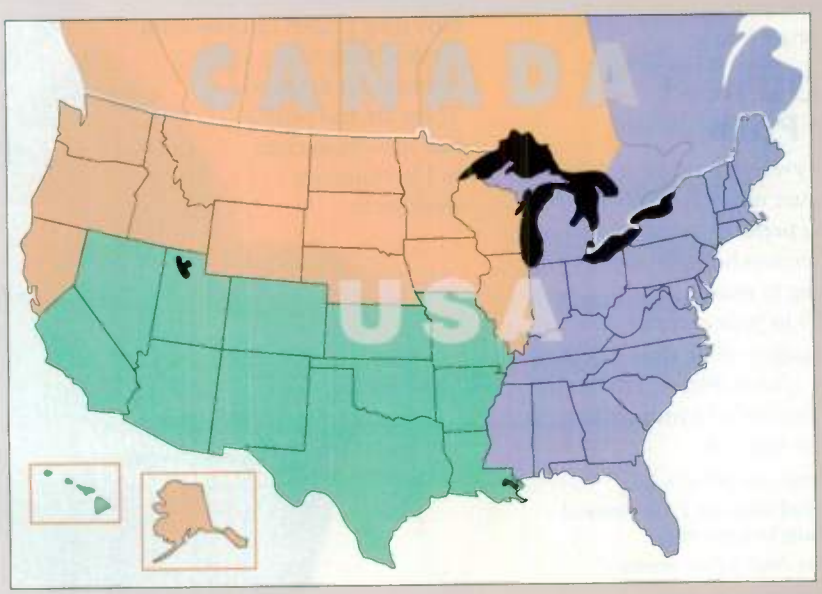

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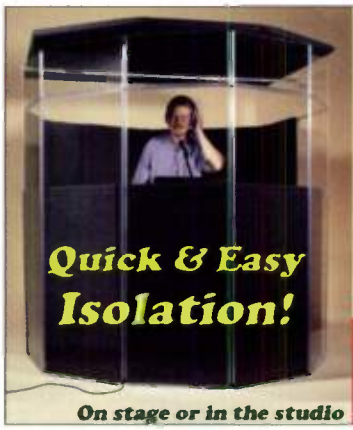

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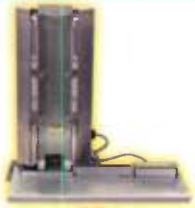
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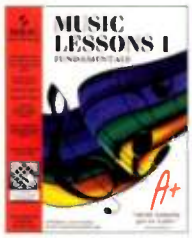

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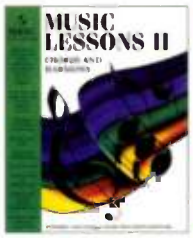

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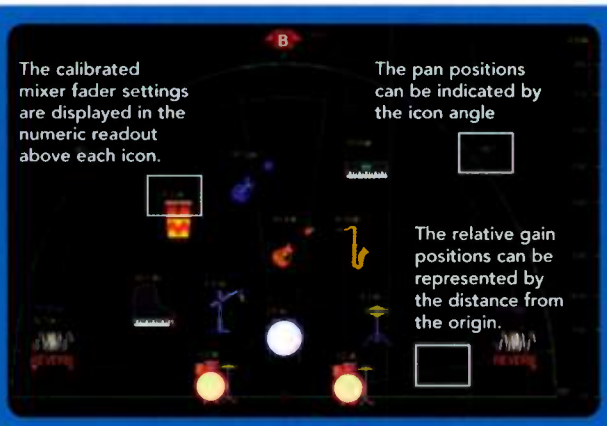

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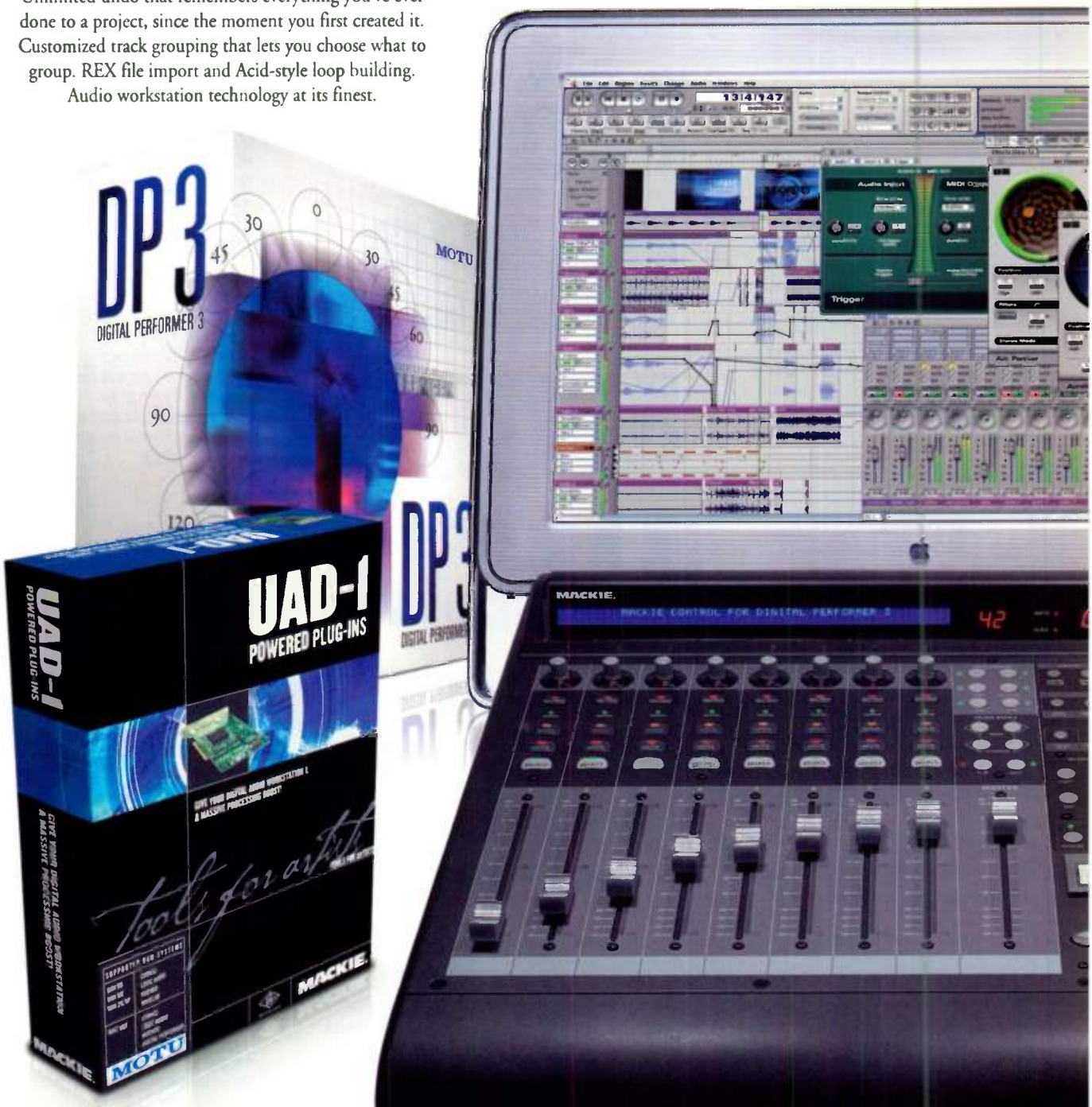


Mackie UAD-1

UAD-1 is a PCI card that allows you to run dozens of sophisticated effects plug-ins inside Digital Performer without bringing your Mac to its knees. What's the secret? A custom-built, monster DSP. It's like adding an extra $20,000 worth of effects gear to the dozens of native plug-ins included with DP.

Mackie Control for DP3

Designed in direct collaboration between Mackie and MOTU, the new Mackie Control automated control surface puts 9 touch-sensitive Penny & Giles automated faders under your fingers (8 plus a master), 8 motion-sensitive rotary encoders, and dozens of custom-programmed switches. Want more faders? Add 8-channel Control XT expanders. You'll feel like you are putting your hands on Digital Performer itself.

THE MOTU STUDIO CALL SWEETWATER

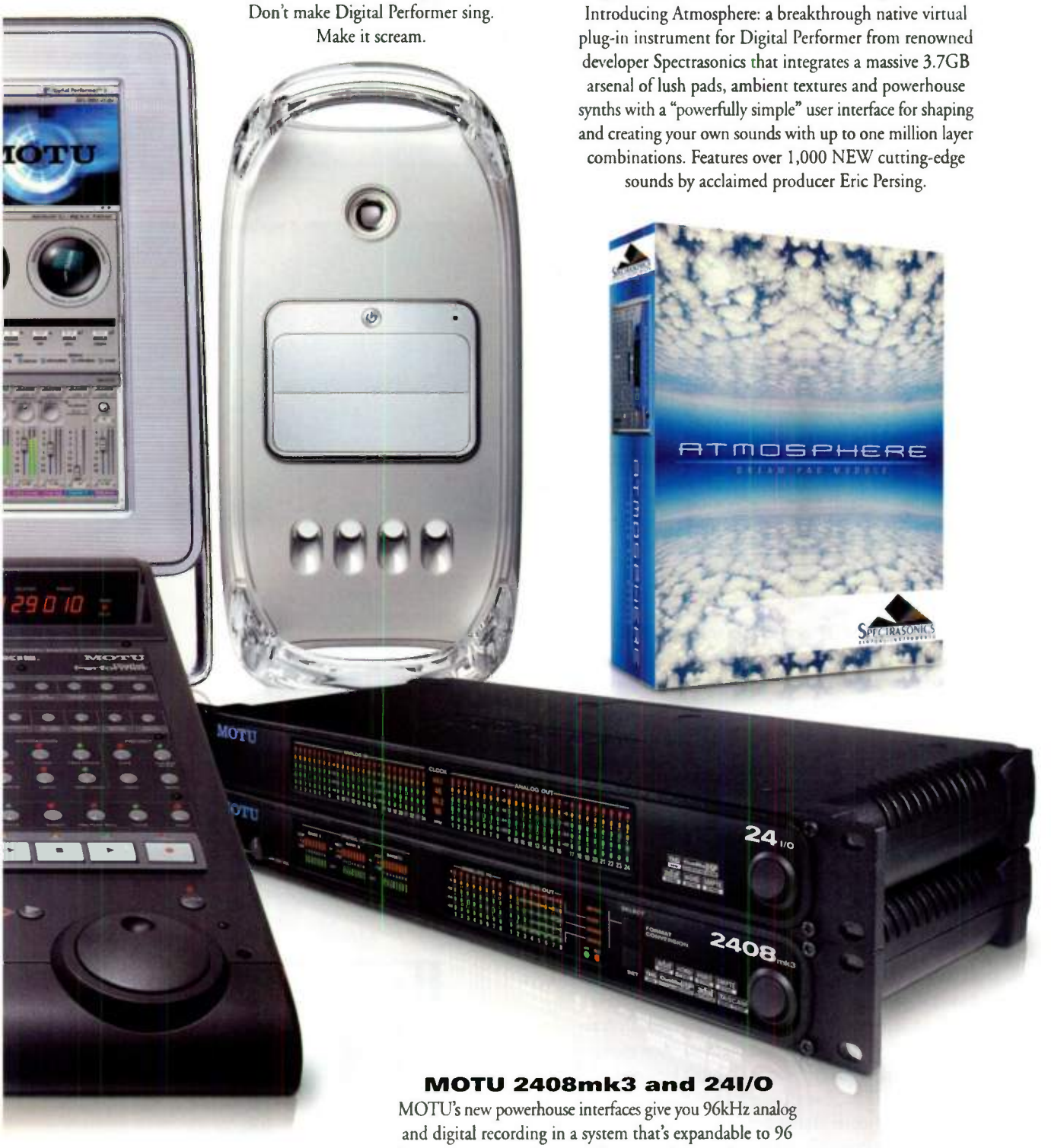
THE MOTU STUDIO

The New Power Mac G4

Dual-processor heaven for Digital Performer.
Don't make Digital Performer sing.
Make it scream.

Spectrasonics Atmosphere™

Introducing Atmosphere: a breakthrough native virtual plug-in instrument for Digital Performer from renowned developer Spectrasonics that integrates a massive 3.7GB arsenal of lush pads, ambient textures and powerhouse synths with a "powerfully simple" user interface for shaping and creating your own sounds with up to one million layer combinations. Features over 1,000 NEW cutting-edge sounds by acclaimed producer Eric Persing.



MOTU 2408mk3 and 24I/O

MOTU's new powerhouse interfaces give you 96kHz analog and digital recording in a system that's expandable to 96 inputs and outputs. Connect all your synths, sound modules, drum machines and effects processors and mix it all from your computer desktop with absolutely zero host buffer latency. Looking for the latest breakthrough in native audio recording? Look no further.

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MORE GEAR FOR THE MOTU STUDIO

Applied Acoustics Lounge Lizard

Lounge Lizard is the very first physical modeling virtual instrument for Digital Performer. What does that mean? Incredible realism and warmth. Physical modeling reproduces the sound and feel of a real instrument in ways that synthesizers and samplers can't. Choose from many classic electric piano presets, or shape your own with powerful, yet intuitive controls. Lounge Lizard delivers the complete, authentic electric piano experience to your Digital Performer studio.

TC Works D-Coder

Produced by Waldorf, the legendary German synth company that brought you PPG Wave and Attack, D-Coder is a Vocoding synthesizer plug-in for TC PowerCore and Digital Performer. D-Coder goes way beyond classic vocoder concepts by providing 100 bands (instead of the usual 30 or so) and an integrated tone-generating synthesizer, allowing you to create vocoding effects with no external carrier signal. It's like having a Waldorf Q synth inside DP, but with no processor drain on your Mac, thanks to Powercore.

VoiceMaster Pro/Baby Bottle

The next generation Focusrite VoiceMaster Pro is the complete vocal channel featuring Class A mic pre, Vintage Harmonics processor, Voice-optimized EQ, Opto-compressor, Tube Sound circuit, 24 bit/96 kHz A-D option, revolutionary Latency Free Monitoring and much more. The award-winning Blue Baby Bottle is a handmade, Class A studio mic ideal for recording vocals, percussion, or any acoustic instruments. Add the Blue Pop/Shock kit and you have an oustanding bundle. $1548 retail value, now $999 for a limited time.

BIAS Peak 3

Burn Redbook CD's. Read and write MP3, Dolby AAC™, 24 bit WAVE and more. Batch process hundreds or even thousands of files. Ultra-fast waveform editing. Run standalone or launch directly from DP3. Unlimited undo/redo with graphic edit histories. View multiple audio documents simultaneously. Unique DSP and looping tools like Convolve, Repair Clicks, Loop Tuner™, Loop Surfer™, Guess Tempo™, Duplicate, and more. Hot swap real-time effects in series, parallel, or hybrid using Peak's Vbox™ SE VST matrix. Native for Mac OS 8.6 thru Mac OS X - including version 10.2 Jaguar. Optimized for Apple's G4 Velocity Engine. The ultimate editing, processing and mastering companion for Digital Performer.

Summit Audio 2BA-221

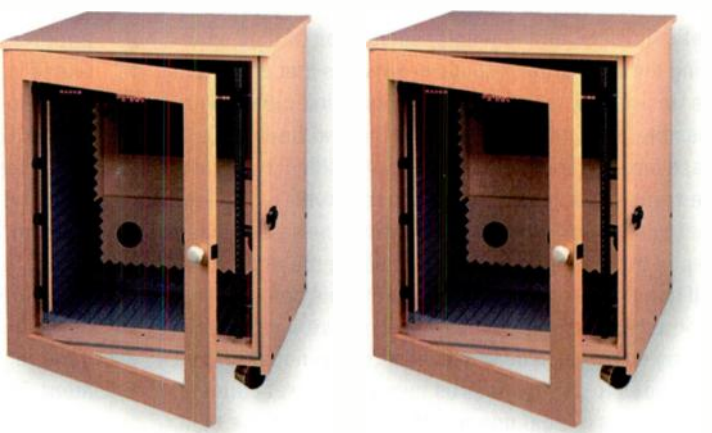
The better your audio sounds going into your MOTU workstation, the better it sounds period. Introducing the extraordinary new 2BA-221 continuously variable impedance microphone preamp. Mix mic, line, and Hi-Z instrument inputs through the 2BA-221's hybrid vacuum tube output and/or its solid state output. Modular, expandable input design, swept high pass filter, insert jack, and internal power supply make the 2BA-221 a powerful tracking and mixing tool.

Glyph Trip2

Glyph Technologies, the industry leader in high-performance audio storage, brings you the ultimate in FireWire disk storage: Trip2. Early-warning SMART technology alerts you to potential drive problems before they happen. Slide a Glyph-engineered, vibration-resistant (and therefore ultra-quiet) drive cartridge into one of six expansion bays and feel the bullet-proof reliability through your fingertips. Glyph FireWire is the perfect compliment to MOTU PCI on today's latest Power Macs because FireWire disk access and PCI audio streaming are handled on different busses, so you maximize the performance of your system.

Raxxess IsoRaxx

The only sound you should be hearing in your MOTU studio is the sound of your speakers. Simply install your computer, external hard drive or any other acoustically challenged equipment in your studio into the IsoRaxx. IsoRaxx has all of the features you need to keep your equipment safe and quiet, reducing fan and hard drive noise by an average of 21 dB. IsoRaxx's electrostatic filter intake helps keep dust bunnies out of your hard drives, and the lock-and-key front door keeps your gear from growing legs. With IsoRaxx, you won't miss what you've been hearing.



The MOTU Experts

From purchasing a plug-in to building an entire MOTU-based studio from the ground up, Sweetwater's expert sales engineers can help you make the best decisions for your studio — and your music. Call today for the best in price, selection and service.

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By Larry the O

Weavers of the Tangled Web

If all the work you do is for your own pleasure and involves no commerce of any sort (including use of others' work, such as sampling), you may have at least a chance of not having to concern yourself much with contracts, nondisclosure agreements, partnership papers, and other sundry and, in some cases, insidious legal documents. However, since you can't even release an album without at least having to deal with publishing and copyright issues, most of us will never get that chance.

There are obviously good reasons for many legal documents to exist. It is a depressing fact that contracts, on the whole, spend a bit of time specifying the exchange of goods or services that constitute the desired transaction and pages of ink citing every possible thing that could go wrong and how each of these dire contingencies would be resolved. Hopefully, the transaction can therefore occur with much less energy being expended on watching one's back every step of the way—assuming you believe the other party will honor the terms of the contract. This can be a real boon when the transaction is a creative act like producing an album, where a level of trust is necessary on both sides to get the desired outcome (a great album). Nevertheless, legal documents are a pain in the bum, even if they never need to be invoked.

Before attaching your signature to any legal document, it is smart to consult a competent attorney, especially if the document involves negotiation. Whoops! There goes a quick thousand dollars, and the longer the negotiation process continues, the faster the meter runs the tab up to astronomical proportions. Sometimes you can't afford to have legal advice and you can't afford not to.

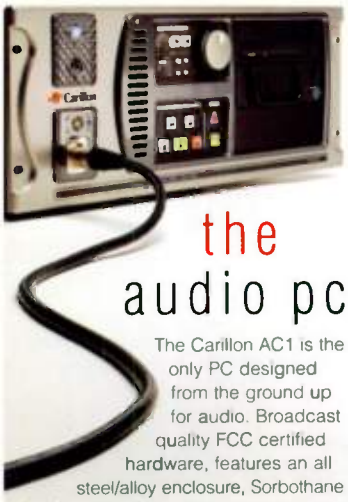
The reason you really do want to have an attorney is that legal wording is typically indecipherable unless you are fluent in the arcane dialect of the law, while the consequences of that wording can drastically affect your livelihood and your life. Each and every word of a well-written legal document has meaning that could extend well beyond the ostensible and fundamental purpose of the document, and the end result for the unwary layperson of a creative (but not legal) bent can be a legal Trojan horse of heinous proportions. These are high stakes indeed, and it is best to let your shark do lunch with their shark rather than submerge yourself into their midst unprotected.

I've even been confronted with a nondisclosure agreement I had to sign before I could see the contents of another document I was supposed to sign that contained nondisclosure clauses. I wouldn't even be allowed to tell someone that I wasn't allowed to tell them things. Given the incredibly litigious nature of our society, perhaps this is understandable, but it is still absurd and unbearably odiferous.

Being the son of an attorney myself, I think Shakespeare expressed feelings rather stronger than mine when Dick the butcher says, in *Henry VI,* "First thing we do, let's kill all the lawyers." But I do think the only good legal document is a fully dissected legal document. There are times when your objective can only be reached by dealing with a legal agreement, and there is no choice but to engage in a Duel of the Dorsal Fins. When that happens, you'll be glad to have your own attorney, but don't simply trust him or her with your future, either: make sure you understand things yourself. As Mark Twain wrote in *Pudd'nHead Wilson,* "Behold the fool saith, 'Put not all thine eggs in the one basket'—which is but a manner of saying, 'Scatter your money and your attention;' but the wise man saith, 'Put all your eggs in the one basket and—*watch that basket!*'" ❀

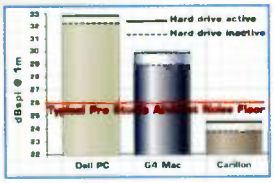
We welcome your feedback. E-mail us at emeditorial@primediabusiness.com.

STEVE CURL



the audio pc

The Carillon AC1 is the only PC designed from the ground up for audio. Broadcast quality FCC certified hardware, features an all steel/alloy enclosure, Sorbothane vibration damping & the very best components including our own Ultramute PSU. Ultra low noise performance & a host of audio specific features, like front panel patching and inexpensive 'real controllers', have earned praise from journalists & name professionals alike.



NOISE LEVEL HEAD TO HEAD

Anechoic chamber test (Southampton University's Institute of Sound & Vibrational Research)

Mike Hedges *Producer: U2, Phil Collins, Manics, Travis etc.*

"The Carillon AC-1 is silent, robust and portable. I can keep it switched on in the control room without even thinking about fan noise."

Chris Nutall *Sound Designer: AIR Studios (with Tim Vine-Lott)*

"The AC-1 is really fast and it doesn't crash. It's also extremely quiet. I'm now using it for all my DSP work"

Chuck Ainley *Producer: Mark Knopfler, Lyle Lovett etc.*

"The Carillon computer rocks! The hardware is beautifully designed and barely audible. It's also really well optimized - Nuendo runs like a dream".

Carillon

866-4CARILLON

(866-422-7455) email: info@carillonusa.com

To order online and for full details on all of our systems, features and Pro Users visit us at:

www.carillonusa.com

Specification and prices subject to change without notice.
Patent Application Nos US 09 909,130 CE 01306246.8 GB 0018000.0

SX PRO RECORDIST
Carillon solution

System shown with optional monitor

steinberg Aardvark

- 24bit AARDVARK Q10 audio interface
- 8 microphone preamps, 4 with phantom power
- 2 Hi-Z guitar inputs
- 3 MIDI ports with LTB MIDI timing protocol
- CUBASE SX Professional recording software
- Integrated multitrack recording, editing and mixing
- Built in VSTi software instruments

Sound Quality and Ease of Use are key factors for live recording. The SX Pro Recordist fulfils both requirements with distinction. That's 8 microphones direct into the computer with no fuss, no hardware mixer, no complicated routings and very little cabling. The 8 mics can be simultaneously recorded onto separate tracks in Cubase SX for state of the art mixing and editing. You can then add further groups of 8 tracks, depending on the power of your "Core System". Record an entire band, a properly mic'd drum kit, even a choir or a string or brass section, quickly and easily.

SYSTEMS FROM **$2899**

Lease packages from $99 per month

Standard with this system:

how System specific set-up, manuals, tutorials & help

fix Our own one-stop online remote control tech support

Loopstation sound source & search engine with over 5000 pro samples

Custom set of Software specific short-cut command key caps

Steinberg Wavelab Lite edits, masters + Clean CD burning etc

Our true "turnkey" solutions include manuals, tutorials & help written for each system as an entity. Expertly optimized and configured, they're

TOTAL SYSTEM INTEGRATION

ready to run so you can focus on making music. Reviewing the VST Songwriter, *SOS magazine* said "I had absolutely no operational problems during the course of my review"

Cubase SL Foundation System	$1799	ProTools 002/001 Systems	FROM $2199
Cubase SL Kontakt	$1999	ProTools HD Workstations	FROM $11499
Cubase SX Pro Recordist	$2899	Nuendo Workstation	$3799
Reason Breakstation	$1799	UltraSampler (Gigastudio)	$2399

Cubase SX · 002 · PRO TOOLS HD · SONAR · NUENDO · Sibelius · HALion · NI · TASCAM GIGASTUDIO

Sonar Foundation System	$1749	Core Systems from	$1199
Sonar Songwriter	$1799	Configure custom systems online with:	Carillon system builder
Sonar Project Studio	$1999		

Please visit **www.carillonusa.com** for full specifications

SOUNDCHASER STOP PRESS

As of October 25th, Sound Chaser has ceased normal business. Carillon and Soundchaser have reached an agreement whereby Carillon will be the exclusive source of Soundchaser's most successful configurations, most notably the GigaDAW TK1. All systems will be revised and optimized for Carillon's AC-1 hardware and include Carillon's own 'Fix' remote support and system specific 'How' & 'Help'.

Soundchaser CEO Paul Erlandson said "We are confident that Carillon will provide excellent service and high quality products for all of your DAW and audio needs".

High Definition Audio Redefined

Does high definition audio need to break your bank account? **Not anymore.**

Is the new MOTU HD192 system affordable? **Absolutely.**

Does the HD192 cost more than the MOTU 1296? **No.** The new HD192 offers more and costs less.

Are the HD192's A/D converters the same as another popular 192kHz audio interface? **Indeed.**

Does the HD192's dynamic range exceed 120dB? **Yes.**

Is this a theoretical number? **No.** It's a real-world measurement.

Does the HD192 core system include MOTU's powerful new PCI–424 card with CueMix DSP™ monitoring? **Yes.**

Will I hear host buffer latency (delay) when monitoring live inputs? **No!** CueMix DSP eliminates monitoring latency.

Is CueMix DSP flexible? **Yes.** It's a DSP-driven digital mix matrix that you control with our redesigned, intuitive CueMix Console software (included).

Is it time to reconsider high definition audio? **Definitely.** Think HD192.

- **12 XLR analog ins/outs** — transfer 12 channels into or out of your computer at 192 kHz.
- **Expansion** — connect up to four HD192's for 48 analog inputs and outputs.
- **Extension** — mix and match with any MOTU PCI audio interface (2408mk3, 24I/O, 2408mkII, 2408, 1296, etc.)
- **PCI-424 card** — connect four interfaces and monitor live inputs with zero host buffer latency via CueMix DSP.
- **On-board SMPTE sync** — resolve the HD192 directly to time code with fast lock-up and sub-frame accuracy.
- **Digital I/O** — AES/EBU with sample rate conversion.
- **Compatibility** — works with all audio software for Mac and Windows 98SE/Me/2000/XP.
- **Available** as a core system (with PCI card & Macintosh AudioDesk software) or as a PCI-424 expansion I/O.

MOTU

motu.com

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