Electronic Musician

September 1993

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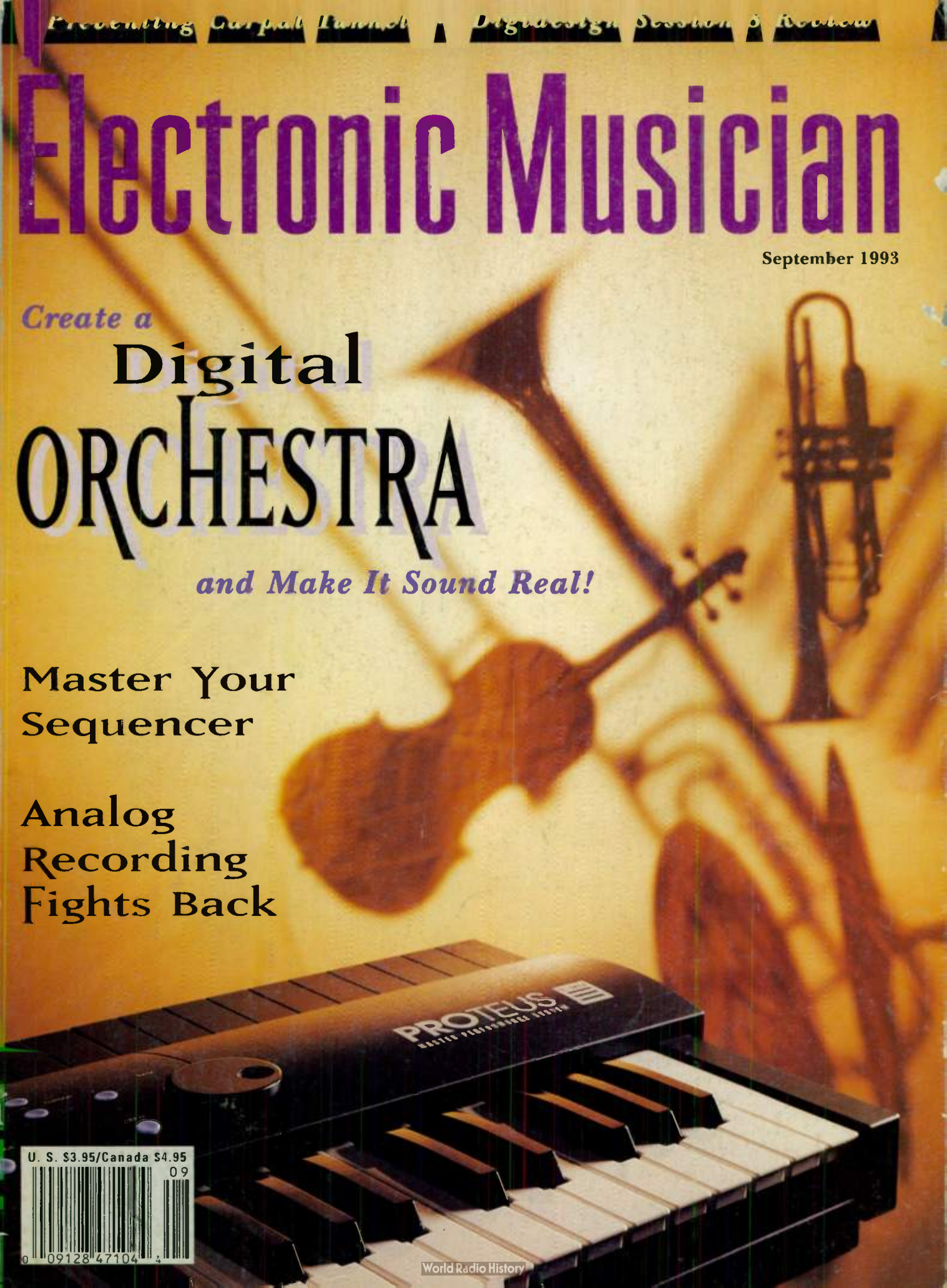

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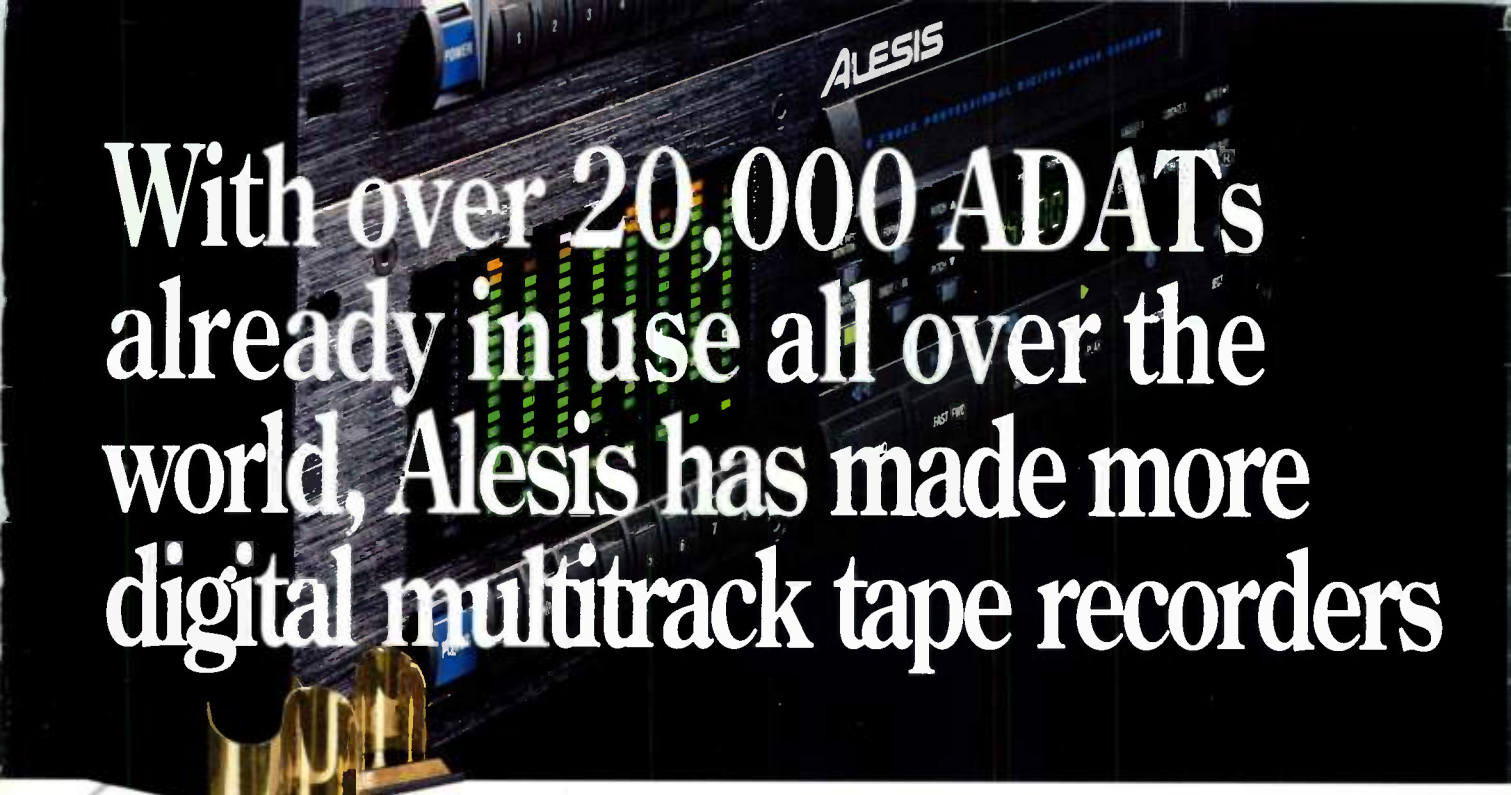
With over 20,000 ADATs already in use all over the world, Alesis has made more digital multitrack tape recorders



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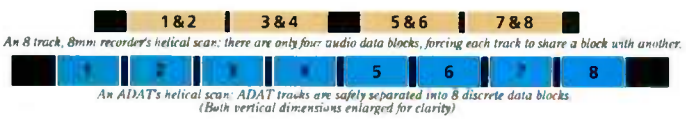
Its revolutionary impact on the recording industry has made ADAT the de facto standard in digital multitrack. The enormous number of ADAT users worldwide, the fact that Fostex has licensed the ADAT format for their own digital recorder, and the growing list of leading companies focusing on industry compatibility by becoming members of The ADAT Group™, all mean that when you choose ADAT, you're compatible with a vast array of music and audio equipment, now and in the future. And, you're supported by a network of professionally trained Authorized ADAT Service Centers worldwide.

The adat Group™

The ADAT Format – made for multitrack

ADAT records eight tracks of 16-bit linear, 48 kHz sample rate audio, with no data compression "tricks" or channel sharing. We chose Super VHS® (S-VHS®) tape as a foundation, then designed ADAT's data structure and heads specifically for the rough-and-tumble, back-and-forth, punch-in-and-out environment of multitrack recording. To make sure that recording one track wouldn't disturb any other track, we divided each helical scan into eight separate data blocks. Some digital recorders combine data from two different channels into the same data block on tape, which means that each time you record a track, another track must be read into a buffer and actually re-recorded even though it is in "safe" mode.



An 8 track, 8mm recorder's helical scan: there are only four audio data blocks, forcing each track to share a block with another.

An ADAT's helical scan: ADAT tracks are safely separated into 8 discrete data blocks. (Both vertical dimensions enlarged for clarity)

The 8 track, 8mm helical scan format risks introducing errors into "safe" tracks each and every time you press record.

The ADAT format records each track discretely, as all professional multitrack recorders should.

Bigger is Safer

Microscopic contaminants in the studio aren't just probable, they're statistically inevitable. If the format can't overcome them, they'll cause mistracking, noise, distortion, even total muting of the audio. Formats smaller than S-VHS are more vulnerable to contaminants, dropout, and misalignment, especially when exchanging tapes between machines. One 8mm digital format attempts to squeeze the same amount of sound into one-tenth the tape area that ADAT does. ADAT's S-VHS tape offers more total surface area to meet the demands of digital recording, and its wider 100 micron tracks are five times less vulnerable to being derailed by dust. Because even though technology makes it possible to make formats smaller and smaller, dust stays the same size.

Comparison of tape areas for 1 second of audio: ADAT (1,211 mm²) and the 8 track, 8mm helical scan format (133 mm²).

Actual microscopic comparison of the ADAT tape format and the 8 track, 8mm helical scan format (enlarged approximately 100 times).

ADAT's wide 100-micron tracks offer an extra margin of safety for digital audio.

The 8mm's 20-micron tracks squeeze more data into the same area, with little room for error.

than any other company. More than Sony. More than Mitsubishi. More than Yamaha, Akai, and Tascam combined.

More than just a tape recorder– The ADAT System

ADAT, when combined with the BRC™ Master Remote Control, is a complete digital recording and digital editing system with features that no other recorder, analog or digital, can match. The BRC is a full-function autolocator and MIDI/SMPTE time code chase-lock synchronizer. Plus, it controls digital copying between ADATs, like a disk-based recorder, but much simpler to use.

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A fiber optic cable for digital connection is included with every ADAT.

The BRC Master Remote Control, shown with optional RMB™ Remote Meter Bridge, supercharges your ADAT System by adding SMPTE and MIDI synchronization, storable autolocation points, copy and paste digital editing and more.

ADAT/BRC digitally stores important session notes

Unlike analog autolocators, the BRC can recall 400 points, storable on each ADAT tape for later recall, so you can keep your mind on the project instead of having to remember minutes, seconds and frames.

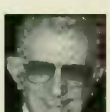
Instead of scribbling notes on cumbersome studio track sheets, the BRC lets you store 400 autolocation points, 20 Song start points, punch in and out points, MIDI tempo maps, SMPTE offsets, and more in the two-minute data header of the ADAT tape. The BRC's alphanumeric display lets you name each cue point and song. It even has a handy built-in list of 16 standard cue point names you can edit.

The ADAT Worldwide Network

Thousands of ADAT Worldwide Network™ multitrack recording group members are reaping the benefits of choosing The ADAT System. As WWN members, they are able to collaborate and exchange ADAT tapes with other talented musicians, producers, composers and engineers throughout the world. Alesis is proud that so many creative people worldwide are using this American-made product, making ADAT the most popular digital multitrack tape recorder in history. The recording professionals below don't endorse ADAT, they *use* it every day. Their credentials speak for themselves. Visit your Authorized ADAT dealer and see what the new standard in digital multitrack recording can do for you.

Dave Rouze
Technical engineer for Larry Carlton, currently using ADAT to record all Larry's live concerts. 2 ADAT's and a BRC.

Jay Graydon
Two time Grammy® Award winning (twelve nominations) producer, engineer, writer, and guitarist. 4 ADATs and a BRC.



Owen Bradley
Country Music Hall of Famer. Producer of many legendary country music artists. 9 ADATs and a BRC.

Francis Buckley
One of the top dance and pop engineers in Hollywood. 4 ADATs and a BRC.

Web Staunton
Grammy-nominated chief engineer and studio owner. 3 ADATs and a BRC.

Mick Guzauski
L.A.'s leading platinum mixdown engineer. 4 ADATs and a BRC.

Andy Hilton
Owner and Chairman of the largest pro-audio equipment-for-hire company in the U.K. and Europe. Plenty of ADATs.

Ray Benson
One of country music's hottest producers/arranger/writers. 3 ADATs and a BRC.

Tom Size
Has engineered and mixed a wide range of music from rock to legendary jazz. 3 ADATs and a BRC.

Russell Brower
Two Emmys (eight nominations). Sound designer and producer for film, television and major theme parks. 2 ADATs and a BRC.

Tim Wilson
Consultant and system designer for leading recording artists and engineers. Has installed more ADATs than he remembers.

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"Brilliant" is what Electronic Musician magazine called Studio Vision, and recently added it's *"the leading program in the category."* Keyboard magazine said it's *"Marvelously liberating"* and MIX magazine has labeled Studio Vision *"A revolutionary step."*

To help you start making music faster we're including our 90 minute *"Looking Into Vision"* video with Vision and Studio Vision. The video shows you how to quickly make a song, set up a MIDI interface, edit your music, integrate Galaxy, record digital audio guitar tracks, and more. Plus you get Galaxy the universal librarian — the industry standard Mac software for storing and arranging patches for over 150 instruments.

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REVIEWS

DEPARTMENTS

Cover: Photo by Stan Musilek

Orchestral Maneuvers

Re-creating acoustic music with electronic instruments is a challenging art form.

ANNE HAMERSKY

The world of electronic music and most of the music industry is built on dreams. Some musicians dream of writing and recording a Top 10 hit, while others simply want to produce a CD of original music they can play for friends and family.

Among the least discussed of these industry-driving dreams is the fantasy of composing your own symphony or other orchestral work. Despite the apparent antithesis between the old school of classical music and the modern world of electronic musical tools, many musicians can now use these tools to create traditional orchestral music in the privacy of their homes. According to our last survey, 50% of EM readers said they were very interested in classical music.

It's hard to overlook the irony of using electronic instruments to emulate acoustic music. However, one of the many benefits of music technology is that it allows you to compose whatever type of music you desire (and, in this case, removes the need to hire an orchestra to perform your work). Technology is so often blamed for having a negative effect on traditional music and musicians that it's easy to forget the positive impact it can have.

Over the last few years, great improvements have been made in musical gear that help these dreams become reality. Most synths now include realistic-sounding samples of orchestral instruments, and several are specifically devoted to the task. For example, E-mu's Proteus/2 is a dedicated orchestral sound module. In addition, you can add orchestral-sound ROM upgrades to the E-mu Proteus/MPS, Kurzweil K2000, and Roland JV-80/880 synths.

Many sophisticated notation programs have added features that improve their suitability as partners for orchestral composition (see "Modern Manuscripts" in the August 1993 EM). Instead of just focusing on generating printed notation, many packages offer more complete sequencing and playback functions that allow you to record, edit, hear, and see your work within a single environment. Similarly, sequencers are adding more notation-friendly features designed to appeal to classically trained musicians.

Having the right equipment, though, is not enough. As anyone who has tried to create an orchestral sound with synths can tell you, symphonic music is fundamentally different than a pop tune. If you simply sequence, quantize, and overdub part by part, you'll end up with something that sounds, well, not quite right.

One of the more interesting challenges facing many electronic musicians is the effort required to produce music that sounds acoustic. This month's two-part cover story ("The Electronic Orchestra," on p. 40) offers many tips and techniques for creating a realistic emulation of an acoustic orchestra using electronic instruments. It explains in detail how to select the right sounds, how to combine them, how to record the parts, how to quantize them, and more. If you want to explore the genre of electronically generated acoustic music, this is a great place to start.

If you're not interested in generating orchestral music, this issue offers other practical application features. For example, "Speed Sequencing," on p. 63, presents many ways to improve your sequencing process. "Maximizing Sample RAM," on p. 54, reveals how to make the most efficient use of the limited RAM in your sampler or RAM-equipped synth. Regardless of your musical interests, you'll find solid, useful information in both of these articles.

Bob O'Donnell

Electronic Musician

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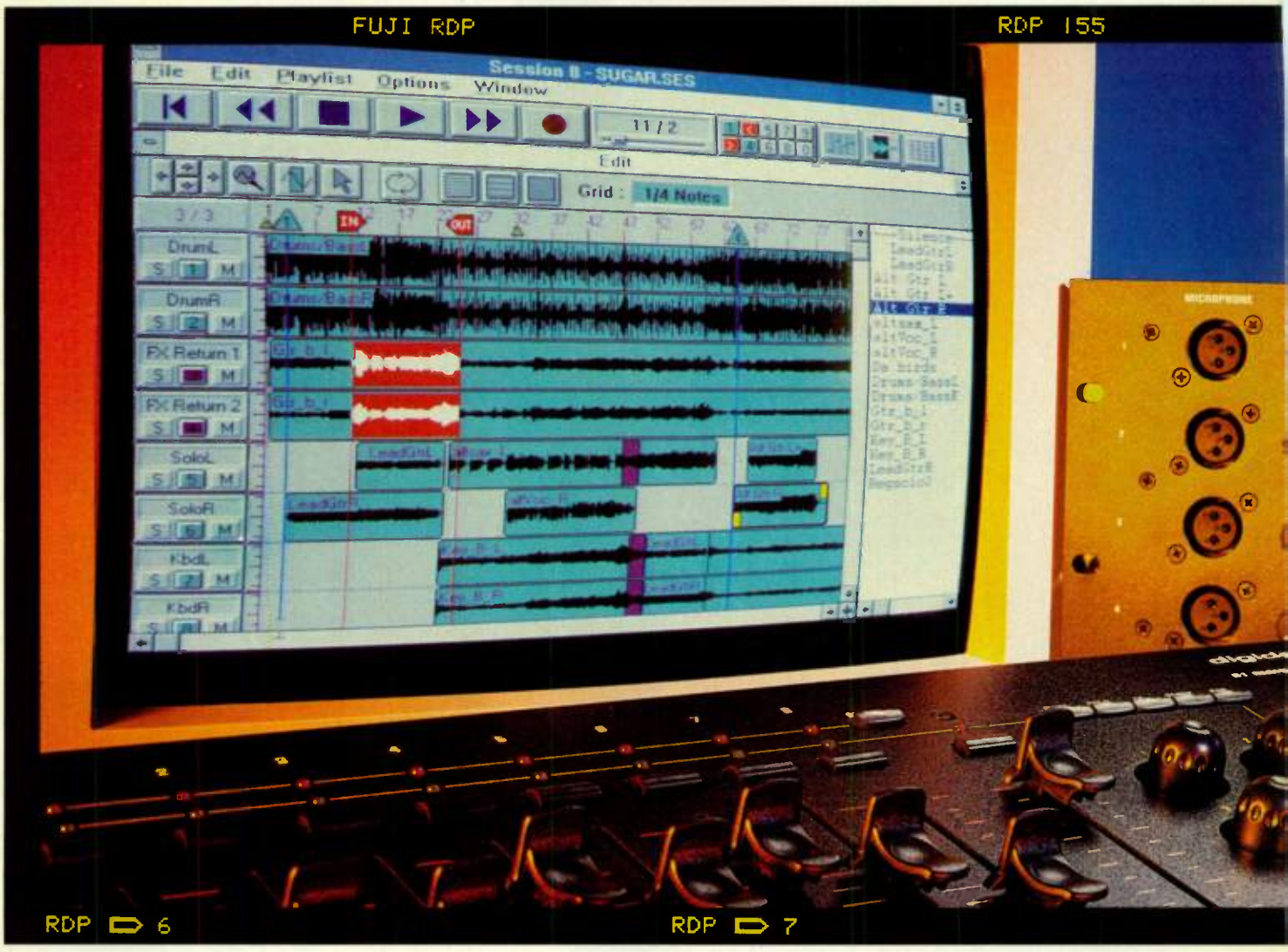

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Craig Anderton, EQ magazine

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LETTERS

MICS MADE SIMPLE

I read Jim Miller's article entitled, "Sampling Master Class" (June 1993) and feel compelled to add to the subject of mic technique. I've learned through twenty years of recording acoustic music that there is more to creating a true stereo image than just using two microphones. First, look at the mic placement God gave you: two directional capsules (your ears) pointed 90 degrees off the frontal axis and 180 degrees apart, separated by six inches (your head). The brain learns to "locate" sounds in the stereo field by interpreting the subtle differences in arrival time and waveform phase relationship between the two ears, based on the fact the brain knows the distance between the ears is a fixed constant.

When the distance between the two capsules is much wider than the width of your head, two problems occur. First, the stereo image smears. For example, if you listen to the sax with the mic placement shown in **Fig. 4** in the article using stereo headphones, your brain will interpret a poor center image (unless you were born with one of your ears on your kneecap). Also, a significant amount of sound comes out of the valves on each side of the horn; the image will subtly shift from left to right, depending on the note the sax plays, and the acoustic resonance of the room the player is in.

Second, if you sum both channels to make a mono sound, you will have phase-cancellation problems. When a single sound source arrives at two mics placed at different distances from the sound source, one waveform will arrive ahead of the other, causing the two waveforms to be "out of sync," or out of phase, with each other when added together.

A never-fail stereo miking technique is the X-Y placement: two cardioid mics placed 45 degrees off frontal axis and 90 degrees apart, separated by six inches. When you put the headphones on, it is as if you are hearing the sound at the source. Have the instrumentalist play scales from the top to the bottom of the instrument's range and walk around him or her and listen. You will find at least one spot where the level of each note is even across the instrument's range, and the sound is pleasing. Better yet, wear a set of headphones and listen to the mics as you move them.

Paul Wickliffe
President/Chief Engineer
Skyline Studios, Inc.
New York, NY

MORE MT-32 INFO

Thank you for the informative article on the Sound Canvas ("Colors for Your Canvas," July 1993). I wish to comment with regard to the sidebar "I Want My MT-32." Mr. Schlesinger describes the "front panel protocol" for accessing the MT-32 sounds, and also states that "when the appropriate SysEx is loaded from a sequencer, the SC automatically calls up the proper ROM sound from the proper category." This may be true but proves to be problematic if, like me, you are using a sequencer (i.e., *MasterTracks Pro* 3.6—Atari platform) that does not permit the inclusion of SysEx data as part of the sequence. I have successfully accessed the MT-32 sounds, and the Variation bank using the controllers and Program Change messages as specified on p. 45 of the SC-55 manual.

To call up the MT-32 sounds:

1. Set Controller 0=127
2. Set Controller 32=0
3. Program Change=PC# of desired instrument (see p. 69 of SC-55 manual).

To call up Variation sounds:

1. Set Controller 0=CC0 value for the desired instrument (see p. 68 of SC-55 manual).
2. Set Controller 32=0
3. Program Change=PC# of desired instrument.

To reset to Capital sounds:

1. Follow the Variation sounds procedure with this change: Controller 0=0.

As stated in the manual and proven through personal experience, these controller and program change values *must* occur in the order as specified above to ensure the appropriate result. Also note that this information is channel-specific, so be sure to "channelize" all controller and program change values.

R.G. Rhoades
President,
Educator MIDI Aids
Mechanicsburg, PA

WHICH CAME FIRST?

In your July 1993 issue, Paul de Benedictis of Opcode wrote to complain about a statement you made in your article on universal editor/librarians ("Computer Musician," April 1993). In that article you stated that Dr. T's *X-oR* "pretty much defined the form." Mr. de Benedictis missed the point. The "form" author Bob Lindstrom was talking about was for universal editor/librarians, not editor/librarians in general, and certainly not only Macintosh editor/librarians.

There were (and are) significant programmers and programs on computers other than the Macintosh! A few people were writing and marketing graphic MIDI editor/librarians on the Apple II and Commodore 64 before the Mac even had a commercially available MIDI interface. Kevin Laubach's *DX-Pro*, my *DX-Heaven* (both Apple II), and Emile Tobenfeld's *DX Editor* for the Commodore 64, all released in 1984, were probably the first graphic editors for MIDI instruments.

As I remember, the first commercial

DMITRY PANICH

universal librarian was *GenPatch*, followed by other universal librarians, such as *OMNIBanker* and *Super Librarian*. The first universal editor/librarian was *X-oR* for the Atari, released in July of 1989. Although others were announced at approximately the same time, it stood alone for quite a while before competition arrived in the form of *GenEdit* and *MIDI Quest*. To give some perspective here, *Galaxy Plus Editors* was released almost two years later!

In addition to being the first universal editor, *X-oR* was far more integrated than previous universal librarians—it was the first to address the user's MIDI setup as a whole, rather than one device at a time. *X-oR* was also the first universal program to contain a full database-like feature for classifying and retrieving patches. Maybe this begins to explain why Lindstrom said that it "defined the form."

Robert J. Melvin
Somerville, MA

A DIFFERENT OPINION

I thought "State of the Art Sequencing" by Christopher Yavelow (May 1993) was a fairly good overview of the products on the market. In an overview like this, there is no way to cover every feature of every product, and that is not the purpose anyway. I did, however, have a problem with the conclusions. Many people will use this article as a starting place in searching out their Macintosh sequencing software. From Yavelow's conclusions you could believe Passport's *Pro 5* had no reason for consideration. I would like to offer a different perspective.

As the article mentions, *MasterTracks Pro* has its share of innovative features, and its user interface "really suggests the term 'user-friendly,'" but this does not tell the whole story. I feel *Pro 5* offers the most transparent interface of any sequencing package available. I also think a lot of people don't need all the bells and whistles some of the programs provide. They just need a solid sequencer that does the job without inhibiting the creative process.

Also, Mr. Yavelow tells the readers to check out the programs, but where can they do this? Not everyone has friends with a broad enough selection to try, even fewer have access to a trade show. That leaves the retailer. I see fewer music stores devoting time and inventory to music software. They are losing too many sales to the mail-order catalogs, who don't have to spend time demonstrating the software. If we don't support our local music stores, then they can't support us.

Don Roberts
Nashville, TN

AN EM STORY

My name is Dave Snyder, and my "story" appeared in the April 1990 "Letters" section of EM. My mother wrote a letter explaining how MIDI and electronic music helped me continue my musical endeavors after they were interrupted by a waterskiing accident. I want to thank you (finally!) for publishing that letter. I also want to give you a brief idea of how I am using MIDI and electronic music technology.

As my mother's letter said, I was in a waterskiing accident. I dove from my water ski into shallow water, hit my head on the lake bottom, and *wham*—one serious case of posterior whiplash.

When I got back to school, after months of rehab, most people accepted that I was still the same guy they knew before. But one thing was missing: my musical ability. Actually, the ability was still there, but I had no means of physically accessing it. It was like a bad case of "musical constipation." MIDI and electronic music were definitely my Ex-Lax. After my first dose I was hooked, and I've been musically regular ever since. The world of high tech has repaved the roads of creativity, self-expression, and all those other goodies that go with creating our own music.

That was five years ago when I got my first synth (Roland D-10) and sequencer (*Master Tracks Pro*/Apple IIe). Since then, I've accumulated lots of knowledge and electronic music "stuff." My current set-up includes the D-10, and the following Yamaha products: RX7 drum machine, TG33 Tone Generator, AM802 mixer, EMP700 effects processor, and C1 Music Computer on which I run *Cakewalk Pro*. I also have a cool little home-made MIDI Controller 64 device. I can't use my feet to activate a sustain pedal, so I made a "mouth-activated psuedo-sustain pedal." (Gives a whole new meaning to putting my foot in my mouth.)

David Snyder
Ashland, PA

BETTER WITH AGE

I'm a theatrical sound designer and electronic musician who's read your magazine since the *Polyphony* days. It continues to get better with each issue and year.

Joe Pino
Houston, TX

It's really great to rely on a good magazine like EM to provide info for MIDI users. Almost every issue I've read contained very useful articles that helped me a great deal in making music. Other publications just don't cut it because they are too glam-oriented without getting too much into the nuts and bolts side of things that working musicians need. Keep up the great work.

Dave Cho
La Palma, CA

ERROR LOG

December 1992, "The Blue Ribbon SoundWorks *SuperJAM!*" p. 118: We accidently omitted the Product Summary, which includes the EM Meters, for *SuperJAM!* 1.0c (Amiga). It should have said: Features 4.5; Ease of Use 4; Documentation 4; Value 4. Interested readers can contact The Blue Ribbon SoundWorks; tel. (404) 377-1514; fax (404) 377-2277.

July 1993, "Letters," p. 11: The illustrator credited should have been Ad McCauley, not Gordon Studer.

July 1993, "Colors For Your Canvas," p. 54: Because of incorrect information provided to us by Roland, the prices for the upgrade on the Sound Canvas 2.0 were listed incorrectly. The labor costs are $65, the ROM $50, and the required CPU ugprade $40. The total cost is $155.

July 1993, "Working Musician: Rave New World," p. 99: The photo of Kelix and Mouse should have been credited to Chris Mitchell.

We welcome your feedback. *Address correspondence to "Letters," Electronic Musician, 6400 Hollis St. #12, Emeryville, CA 94608. Published letters may be edited for space and clarity.*

Brush.

Canvas.

1992 MULTIMEDIA WORLD READERS' CHOICE WINNER

Masterpiece.

Yes, you too can create beautiful works just like the masters. Start composing with the SC-55 Sound Canvas, utilizing its 317 CD-quality sounds and terrific digital effects. Next, bring the SB-55 Sound Brush into play, with its ability to replay any piece created in 3.5" standard MIDI file format. *Voila!* Artistry. For hundreds less than other sound modules—and with greater ease of use, greater portability, even a wireless remote. Experience what we like to call Interactive Listening.™ Experience the Roland Sound Brush and Sound Canvas. Now on exhibit at your Roland dealer.

Roland®

Call or write for a free standard MIDI file demo disk. Roland Corporation US, Dept. SC-55, 7200 Dominion Circle, Los Angeles, CA 90040-3696. (213)685-5141 ext. 315.

FACE IT. YOU NEED

It's enough to drive you crazy.

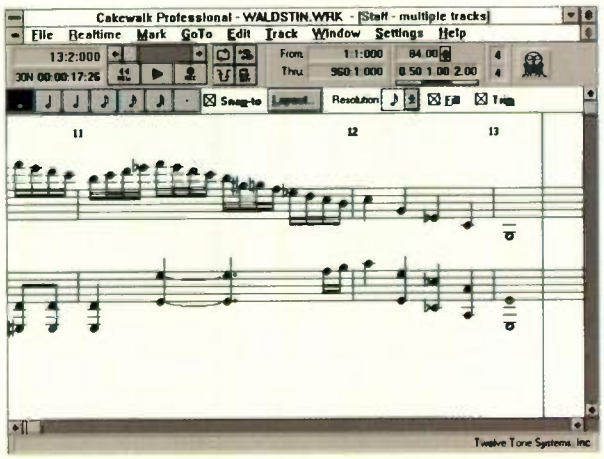
You've been searching for software that will help you turn your musical ideas into polished performances. But the first program you tried wasn't powerful enough. And the other was so complex, you didn't know where to start.

Maybe it's time to see a Professional.

Cakewalk Professional for Windows™ is the 256-track MIDI sequencer that's powerful *and* easy to use.

Express Yourself

The detailed **Event-list view** lets you view and edit all MIDI events on multiple tracks at once. You can even insert non-MIDI "special" events like digital audio waves (voice, special effects) that play back on .WAV-compatible sound cards.



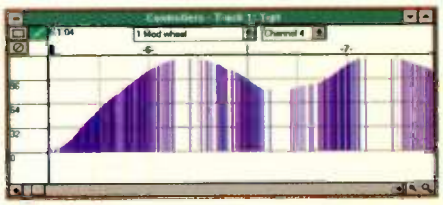
Staff view

Tempo

Take Control

Cakewalk Professional also has a graphic tempo map and **Controllers view** for drawing tempo and Controller changes with your mouse.

Use up to 16 assignable faders to send out MIDI Controller events while recording or during playback. Fader positions update in the **Faders view** during playback to show Controller values.



Controller view

Professional Staff

A multi-track **Staff view** lets you edit up to 10 staves of standard notation. You can insert, delete, and move notes with your mouse. Like all views, the Staff window scrolls during playback.

Use the **Piano-roll view** for inserting, resizing, and moving notes in a piano-roll grid. You hear the notes change pitch as you move them. And you can redraw note velocity levels as well.

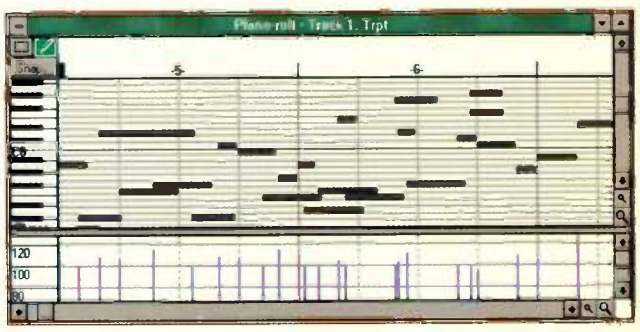
Markers

Get On Track

Use the **Track/Measure view** for assigning track parameters like MIDI channels and patches. And you can adjust parameters in real time, like volume, pan, key offsets, and velocity levels. All Track parameter columns can be moved and sized. Use the Measure pane for fast "drag-and-drop" editing of selected measures.

Professional Experience

Cakewalk Professional works hard to earn its "professional" status: a variable timebase of up to 480 pulses per quarter note; support for all SMPTE/MTC formats; a Meter/Key map; a **Markers view** for creating a text list of "hit points"; and a powerful



Piano-roll view

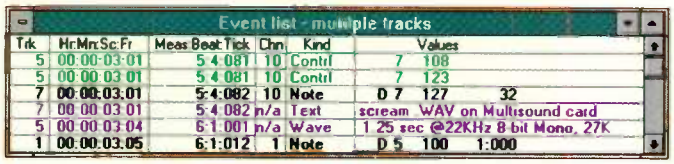
PROFESSIONAL HELP.

Event Filter for selective edits, like splitting out drum notes onto separate tracks.

Faders view

CAL-
SWING 16.CAL

Cakewalk Professional has a 256-bank System Exclusive generic librarian, for storing and sending your instrument sound banks and presets.



Event-list view

Sysx

Meter/Key

And the built-in Cakewalk Application Language (CAL) even lets you create your own editing commands, like chord generators, drum maps, and "swing quantize" routines. (A free library of CAL routines is available to all registered users.)

Get Help Fast

Unlike some sequencers, Cakewalk Professional has context-sensitive, on-line help available at any time. Just press the F1 key to get help with what you're working on. Examples, definitions, and even a list of answers to common questions are a mouse-click away, supplementing the comprehensive *User's Guide*.

Comments

See A Professional Today

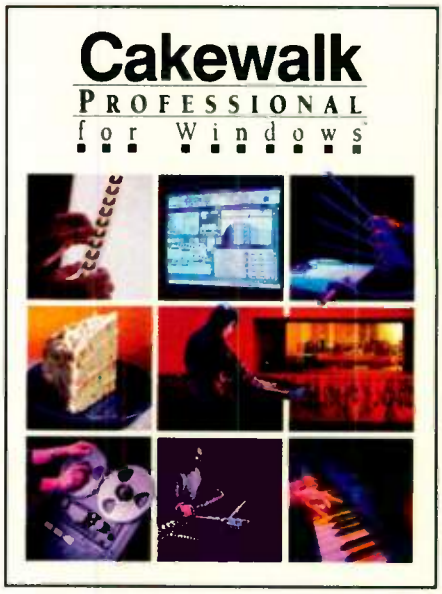
Cakewalk Professional for Windows ($349) is sold at finer music and computer stores worldwide. For more information, or for the name of a dealer near you, call

800-234-1171 or
617-926-2480.

A demo disk is available for $10.

System Requirements: IBM PC with 10 MHz 80286 or higher, 2 MB of RAM, hard drive, mouse; Microsoft Windows 3.1. Supports any combination of up to 16 MIDI ports on devices with Multimedia Extensions drivers (including Roland MPU-401 compatibles and Music Quest MQX interfaces).

Twelve Tone Systems, Inc.
P.O. Box 760 Watertown, MA 02272
Fax: 617-924-6657



Twelve Tone
SYSTEMS

CD3000

CD-ROM For The Real World

Akai proudly introduces the first sample player to really make sense for today's musicians and studios. Instead of buying yet another playback unit with a limited range of EPROM-based samples, you can have an instrument which grows with you - the CD3000, a 32-voice sampler with a built-in CD-ROM drive.

Rather than an unchanging palette of samples to work with, the CD3000 provides you with access to an ever-expanding selection of sounds via the premier method of library distribution, the CD-ROM disc. And since the CD-ROM drive is built-in, the convenience is unmatched.

The CD3000 makes it easy to take full advantage of its access to CD-ROM libraries. Set Up files can be created which will automatically load any specified programs and samples, even from different partitions. Any editing you perform can be saved to a floppy disk, or to external hard disk drives via the included SCSI connector. Yes, you can fully edit programs and samples!

And, get this: you can even record directly into RAM from standard audio CDs! So, your audio CD sample collections are *not* obsolete.

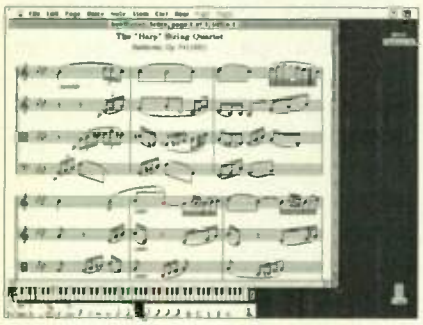
To get your library off to a good start, the CD3000 comes supplied with not just one, but an incredible *five* CD-ROMs, free! These discs have been created by Akai and some of the foremost sound library developers in the world: East-West Communications, The Hollywood Edge, and InVision Interactive. This fact alone makes the CD3000 an unbeatable value. From there, you can go on to use any CD-ROMs created for Akai samplers.

There's a lot more, so visit your nearby Akai Professional dealer soon for a complete demonstration.

AKAI
professional

P.O. Box 2344
Ft. Worth, TX 76113
(817)336-5114 Fax (817)870-1271

WHAT'S NEW



▲ ECS LIME

Electronic Courseware Systems is shipping *Lime* 2.0 ($295), a music-notation program for the Macintosh. The program accepts real-time and step-time MIDI input, as well as mouse and computer-keyboard entry, and supports Standard MIDI Files. It provides up to 60 staves, with no limit to the number of voices and up to sixteen MIDI channels per staff. Rhythmic durations from 64th notes to double whole notes are supported. Special features include true multiple meters, with non-coinciding barlines; multiple left and right staff indenting; and automatic engraver spacing. Lyrics can be attached to notes, and you can copy-and-paste blocks of lyrics and music into a word processor. The program runs on any Mac with 2 MB of RAM, System 6.x or later, and a hard drive. A *Windows* version is expected sometime this fall. Electronic Courseware Systems; tel. (800) 832-4965 or (217) 359-7099; fax (217) 359-6578.

Circle #401 on Reader Service Card

▶ AKAI DR4D

Akai's DR4d ($1,995) provides 4-track hard-disk recording in a 3U rack-mount box. The 4-in, 4-out digital recording and editing device is available with an optional 200 MB hard drive ($495) and does not require a personal computer. As many as four DR4d's can be chained for up to sixteen tracks, and seven SCSI hard drives (up to 30 GB capacity) can be used per DR4d, with overflow recording across multiple disks.

The recorder utilizes 18-bit, 64x oversampling A/D and 18-bit, 8x oversampling D/A converters and can record at 32, 44.1, and 48 kHz. The user interface is similar to that of a tape recorder, with standard transport controls, four LED level meters, and up to 108 location markers. The analog inputs (selectable +4 dBm or -10 dBu) and outputs use balanced, ¼-inch TRS jacks. The machine also offers AES/EBU (XLR jacks) and S/PDIF Type II (RCA jacks) digital I/O. Editing functions include Copy, Move, Erase, Delete, and Repeat, and there is an Undo feature and a Jog/Shuttle wheel. There are no DSP functions (e.g., EQ or time compression), but there is a variable pitch feature.

Options include a second SCSI interface ($199), which allows the DR4d to communicate soundfiles to and from a personal computer; a second pair of digital I/O ports ($299); a SMPTE interface board ($199); and a MIDI interface board ($159) that supports MIDI Machine Control. Editing software for the Macintosh computer is under development. Akai/IMC; tel. (817) 336-5114; fax (817) 870-1271.

Circle #402 on Reader Service Card

▲ E-MU SOUNDENGINE

E-mu Systems unveiled the SoundEngine Music Module ($595), the company's first General MIDI sound module. The desktop device offers 384 16-bit sounds (including the 128 GM Level 1 sounds), onboard reverb, and a built-in Macintosh serial MIDI interface with MIDI In/Out/Thru ports. The 32-voice, 16-part multitimbral SoundEngine is a sample-playback device that uses the same technology as the Proteus/1. The sounds are from the E-III library and include selections from the Proteus. E-mu is bundling modified versions of Opcode's *EZVision* sequencer and *Edit-One* editor/librarian software with each unit, with an upgrade path to full versions of the programs. E-mu Systems; tel. (408) 438-1921; fax (408) 438-8612.

Circle #403 on Reader Service Card

▼ GOLD LINE MS3 MULTI/SEND

Gold Line introduced the MS3 Multi/Send monitor mixer ($349). The device offers two line-level inputs (with XLR and ¼-inch jacks) and one switchable mic/line input (XLR only), each of which is hardwired to a Thru output and routed to a monitor-mix line out, 8Ω headphone out, and 600Ω headphone out. This lets a performer create a custom monitor mix of an instrument signal and the console's cue signal, while passing the original signals unchanged (via the Thru outs) to the main mixer or another Multi/Send. The inputs can be balanced or unbalanced, and the unit can operate at -10 dBu and +4 dBm levels. The mic input passes phantom power for condenser mics. Gold Line; tel. (203) 938-2588; fax (203) 938-8740.

Circle #404 on Reader Service Card

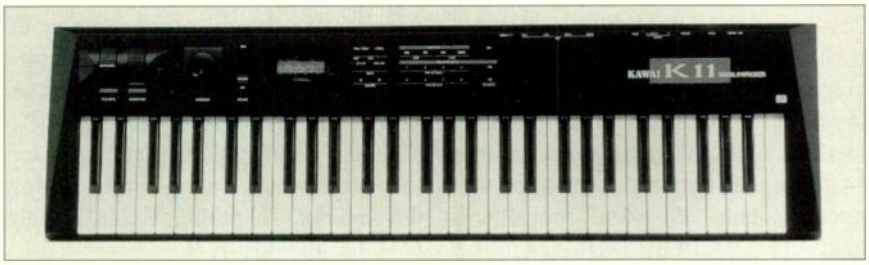
▼ KAWAI K11

Kawai's 32-voice, 32-part multitimbral K11 synthesizer ($1,249) features a 61-key, weighted, Velocity and Aftertouch-sensitive keyboard. The sample-based synth includes 18-bit DACs; resonant, sweepable filters that can operate in bandpass, highpass, or lowpass mode; 7-stage envelopes; amplitude modulation; and 55 tuning temperaments.

The K11 comes with 6 MB of sample ROM, allocated among 256 Single samples and 256 percussion samples. It has 384 patch locations, including a bank of General MIDI patches, a supplemental preset bank, and a bank of 128 user locations. There also are 64 Performance patches, up to four of which can be used in any split/layer combination. Each bank includes seven drum kits containing 128 more sounds.

The onboard effects processor provides six reverbs with individually adjustable decay time, predelay, high-end damping, and depth. The synth also has an onboard Macintosh serial-port MIDI interface with one MIDI Out/Thru, a dedicated MIDI Thru, and two independent MIDI In ports. Kawai America; tel. (310) 631-1771; fax (310) 604-6913.

Circle #405 on Reader Service Card



▲ PRO IMPACT DRUM TRIGGERS

Professional Impact Systems presents Professional Impact drum triggers ($24.95). Pro Impact triggers feature heavy-duty construction for durability and a high output level for accurate triggering. The triggers can be mounted on the drum head or shell, and all mounting hardware is provided. Professional Impact Systems; tel. and fax (513) 258-3291.

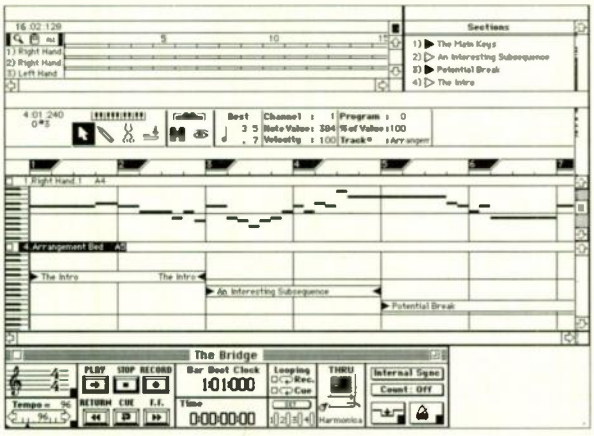
Circle #406 on Reader Service Card

▼ OSC METRO

OSC is shipping *Metro* ($225), a professional-level sequencer for the Macintosh. The program supports 32 instruments (256 MIDI channels) and up to eight layers, with 32 sections of up to 99 tracks each and sixteen subsections of up to 99 tracks each. It offers step-time and real-time entry; two Loop Recording modes; real-time, graphic editing of MIDI data, including continuous controllers; controller chasing; and AutoMoving sliders that can be assigned to any controller. Markers can be navigated via the Tab key.

Other features include transpose; reverse; harmonize, in scales or chromatically; Standard MIDI File import/export; and quantize and "Human Feel." *Metro* can handle multiple time and key signatures and provides remote control of step-recording and transports (i.e., the transport controls are mapped to MIDI keys). A MIDI monitor is included. The sequencer supports Opcode's *OMS*, the Apple *MIDI Manager*, and Mark of the Unicorn's MIDI Time Piece MIDI interface/patch bay and runs on a Mac Classic or better, with at least 2 MB of RAM and System 6.x or later.

Metro is designed to integrate and synchronize with OSC's *Deck II* ($299), a graphical, multitrack, digital-audio recording and editing program for the Macintosh. *Deck II*, a major rewrite of the *Deck* program formerly distributed by Digidesign, supports 4-in, 4-out, nondestructive, hard-disk recording and unlimited virtual tracks when used with a single Digidesign Audiomedia II, Audiomedia LC, Sound Tools II, or Pro Tools system, or Raster Ops' MediaTime board.



Sampling rates are 44.1, 44.056, 48, and 47.952 kHz. The program offers real-time moving-fader automation, with 24-bit resolution; time line-style multitrack waveform editing, with track slip; and unlimited track-bouncing.

Deck II allows continuous sync to all SMPTE formats (including 25 fps and 29.97 drop-frame) and synched playback with supported MIDI sequencers running simultaneously on the same Macintosh.

It also functions as a *QuickTime* post-production tool, with synchronous audio and video playback from disk. *Deck II* requires a Mac II or better, with at least 4 MB RAM, System 7, and a Digidesign or Raster Ops sound card. The program supports *OMS* and *MIDI Manager*. OSC; tel. (800) 343-3325 or (415) 252-0460; fax (415) 252-0560.

Circle #407 on Reader Service Card

▶ FENDER PX 2200 SERIES

Fender released its PX-2200 series powered mixers, including the 8-channel PX-2208 ($1,450) and PX-2208D ($1,650), 12-channel PX-2212D ($1,899), and 16-channel PX-2216D ($2,099). Each channel of the mixers has a 60 mm fader; balanced, XLR mic input and ¼-inch, TRS line input; trim pot; insert point; PFL solo switch; pan pot; switchable, 48V phantom power; and two monitor sends (pre-fader/pre-EQ, switchable to post-fader, using a jumper) and two aux sends (post-fader/post-EQ, switchable to pre-fader). The 3-band channel EQ includes a low-frequency shelving filter at 80 Hz, high-frequency shelving at 12 kHz, and mid-frequency peak/dip at 2.5 kHz.

The master section includes monitor 1 and 2 master faders and two stereo effects returns, with level and pan controls. In-place soloing is provided on the main outputs, sends, and returns. Two 9-band graphic EQs and the power amp can be switched to operate on the L/R stereo buses, the mono sum bus, or the monitor buses. All PX mixers except the PX-2208 contain a 128-preset digital reverb with input clip indicator; the PX-2208 has a spring reverb. The main left, right, and mono outputs are balanced TRS, while RCA jacks and level controls are provided for the stereo tape inputs and stereo mix outputs.

The 2208D and 2208 offer a 2-channel, 150W (into 4Ω) power amp, while the power amp in the 2212D and 2216D deliver 250W/side. The fan-cooled amps can drive 2, 4, or 8Ω loads and are built into a separate chassis from the mixer. The entire package comes in a road case/console stand that, when set up, also protects the cabling between the mixer and power amp. Fender Musical Instruments; tel. (602) 596-9690; fax (602) 596-1384.

Circle #408 on Reader Service Card

▼ CROWN CM-311

Crown's head-worn CM-311 microphone ($279) is designed for touring singers. According to the manufacturer, the lightweight, electret-condenser mic provides superior noise cancellation, improving gain before feedback, and offers excellent isolation from ambient stage sound. Its element includes a pop filter and is said to handle even loud vocalists without distortion.

The headband fits behind the head and can be concealed in hair, and the boom stays out of your face; both are adjustable. A belt pack supplies 9V battery power, or the mic can operate under phantom power. The CM-311 has an XLR output for direct wiring and a ⅛-inch, phone-jack output for connection with a wireless transmitter. Crown also offers the CM-311/E ($198), which includes the mic but omits the battery pack. It operates with wireless transmitters that can supply 9 VDC. Crown International; tel. (219) 294-8000; fax (219) 294-8329.

Circle #409 on Reader Service Card

▼ MUSIC QUEST MIDIENGINE 2PORT/SE

Music Quest is shipping the MIDIEngine 2Port/SE ($199.95), a dual-port MIDI interface and SMPTE synchronizer for laptop PCs. The 2Port/SE connects to the PC via the parallel printer port. The two MIDI In ports and two independent Out ports feature deep FIFO data buffering, which helps avert MIDI data-loss problems with slower computers and MIDI applications and lets you run in *Windows* 80386 Enhanced mode. The interface uses message filtering and data compression to efficiently drive 32 MIDI channels, and channel remapping is available on all ports.

The SMPTE generator/reader supports all SMPTE time-code formats, with automatic code-regeneration and adjustable freewheeling (jam sync). Line-level, balanced or unbalanced SMPTE signals pass through stereo, ¼-inch connectors. An MCI-compatible, multiclient *Windows* driver is included for multimedia applications, and drivers are supplied for DOS versions of *Cakewalk* and *Cakewalk Professional*.

Also new from Music Quest, the MIDIEngine FrameLock ($179.95) a SMPTE sync box that reads and writes SMPTE formats (with freewheeling and automatic code-regeneration) and converts SMPTE to MIDI Time Code. The device offers MIDI message filtering and channel remapping on both of its dual MIDI ports, and an activity LED monitors SMPTE In and MIDI data. All device parameters can be programmed via SysEx, and offline SMPTE striping can be triggered via a button. Music Quest; tel. (214) 881-7408; fax (214) 422-7094.

Circle #410 on Reader Service Card

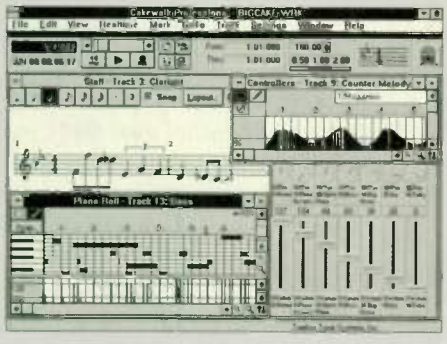
REV UP ▲ ▲ ▲ ▲ ▲

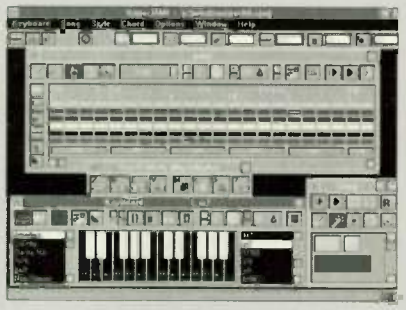
▼ TWELVE TONE SYSTEMS

Twelve Tone Systems announced *Cakewalk Professional for Windows* 2.0 ($349; upgrades from *Cakewalk Pro for Windows* 1.0 $49 plus shipping; from *Cakewalk Pro* for DOS $75; from original *Cakewalk* $129), with nearly 50 new features and enhancements. The upgraded program offers notation printing (up to sixteen staves), using a custom TrueType font, with full Print Preview and automatic triplet detection. A Play List that automatically loads and plays sets of up to 128 songs has been added for live-performance applications.

Real-time editing during playback has been implemented in the Piano Roll, Controllers, and Staff views. The Faders view has been enhanced to include sixteen assignable sliders and 32 assignable knobs. Loop recording has been added, and an interactive Punch feature allows you to record multiple segments without stopping playback. Any *Cakewalk* command or Cakewalk Application Language (CAL) program can be triggered from any computer key or MIDI instrument, and functions corresponding to *Cakewalk* commands have been added to CAL so you can record CAL programs like macros. Twelve Tone Systems; tel. (617) 926-2480; fax (617) 924-6657.

Circle #411 on Reader Service Card



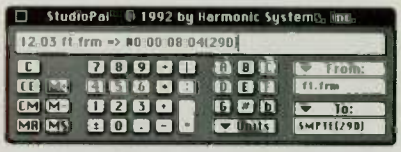


▲ BLUE RIBBON SOUNDWORKS

The Blue Ribbon SoundWorks is shipping a *Windows* 3.1 version of its *SuperJam!* algorithmic composition and accompaniment program ($129). The program supports *Windows* 3.1-compatible sound cards and allows real-time MIDI sequencing and graphical editing for interactive melody and chord creation. The Eas-O-Matic MusicMaker feature provides automatic algorithmic composition of melodies and chord progressions. *SuperJam!* includes 30 editable musical Styles for song-creation; 60 more Styles are available, and you can create and edit your own Styles and chords. The virtual "backup band" includes six user-selectable "players" that provide accompaniment and help you audition your work.

Composition tools include drum-mapping, note-editing, progression assignment, and Velocity control. You can change Styles, patterns, rhythms, tempos, keys, and chords "on the fly," and multiple time signatures, instrument types, tempos, and styles are available within a song. You can record lead lines and save your compositions as Standard MIDI Files. The Blue Ribbon SoundWorks; tel. (404) 315-0212; fax (404) 315-0213.

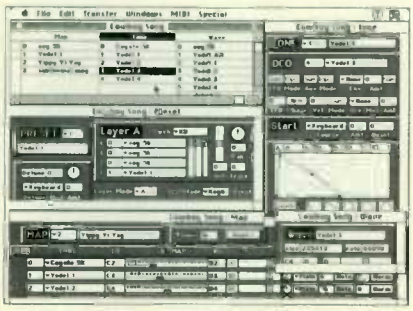
Circle #412 on Reader Service Card



▲ HARMONIC SYSTEMS

Harmonic Systems announced *StudioPal* 1.2 ($69.95; updates from 1.0 $8). The new version of the company's conversion calculator program for the Macintosh improves SMPTE data entry and adds variable frame rates, copy-and-paste functions, and a History window. Pitch-change and sample-rate conversions have been enhanced. Click Track units have been added, and there is better support for mixed-unit addition and subtraction. Harmonic Systems; tel. (415) 485-5242; fax (415) 485-6018.

Circle #413 on Reader Service Card



◀ INTERVAL SYSTEMS SP-REMOTE

Systems released *SP-ReMoTe* ($149), a front-panel editor for the Peavey SP sample player and Macintosh computer. The program offers complete, real-time, graphic editing of Multis, Presets, Maps, and Tones, with a hierarchical overview of related items and a zoom feature.

AutoMap options are included for quickly creating multisampled, mapped presets. The program also imports and converts S1000/S1100 Programs to mapped SP Presets. Interval Music Systems; tel. (310) 478-3956; fax (310) 478-5791. ●

Circle #414 on Reader Service Card

We've Always Talked Performance. Now Let's Talk Price.

266 Dual Compressor/Gate

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Uses the newly developed dbx AutoDynamic™ attack and release circuitry which delivers classic dbx compression for a wide range of applications—plus an advanced new gate circuit which overcomes the functional limitations of traditional "utility" gates. Both compression and gating provide superior versatility and sonic performance.

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Illustration By Jotto Seibold

COOL SCHOOLS

When songwriter Sam Cooke admitted he didn't know much about history, science books, or the French he took, he reflected the attitude of many students. For musicians, however, schooling is increasingly important. Technology permeates every facet of the music industry, and those who learn to use it are more likely to survive in the business.

With classes like these, you're never too cool for school.

Of course, you can learn a great deal about music technology by reading **EM**, but there is no substitute for a comprehensive curriculum, knowledgeable instructors, and hands-on experience. This fact is not lost on colleges and universities; more and more academic institutions are offering programs that range from a few courses to full-fledged degrees in synthesis, sampling, electronic performance, recording, multimedia authoring, and software and hardware engineering.

the home team

The opportunities for education in the ways of music technology are many. In some cases, traditional music departments at four-year liberal-arts schools are adding high-tech music labs and courses designed to familiarize music students with the brave new world of computers and MIDI.

For example, the music school at Duquesne University in Pittsburgh, Pennsylvania, has always tried to expose its students to the latest technology. According to Bill Purse, chair of the Music Synthesis and Guitar departments, "We've always tried to integrate the tools of modern composers and performers into a program that

by scott wilkinson

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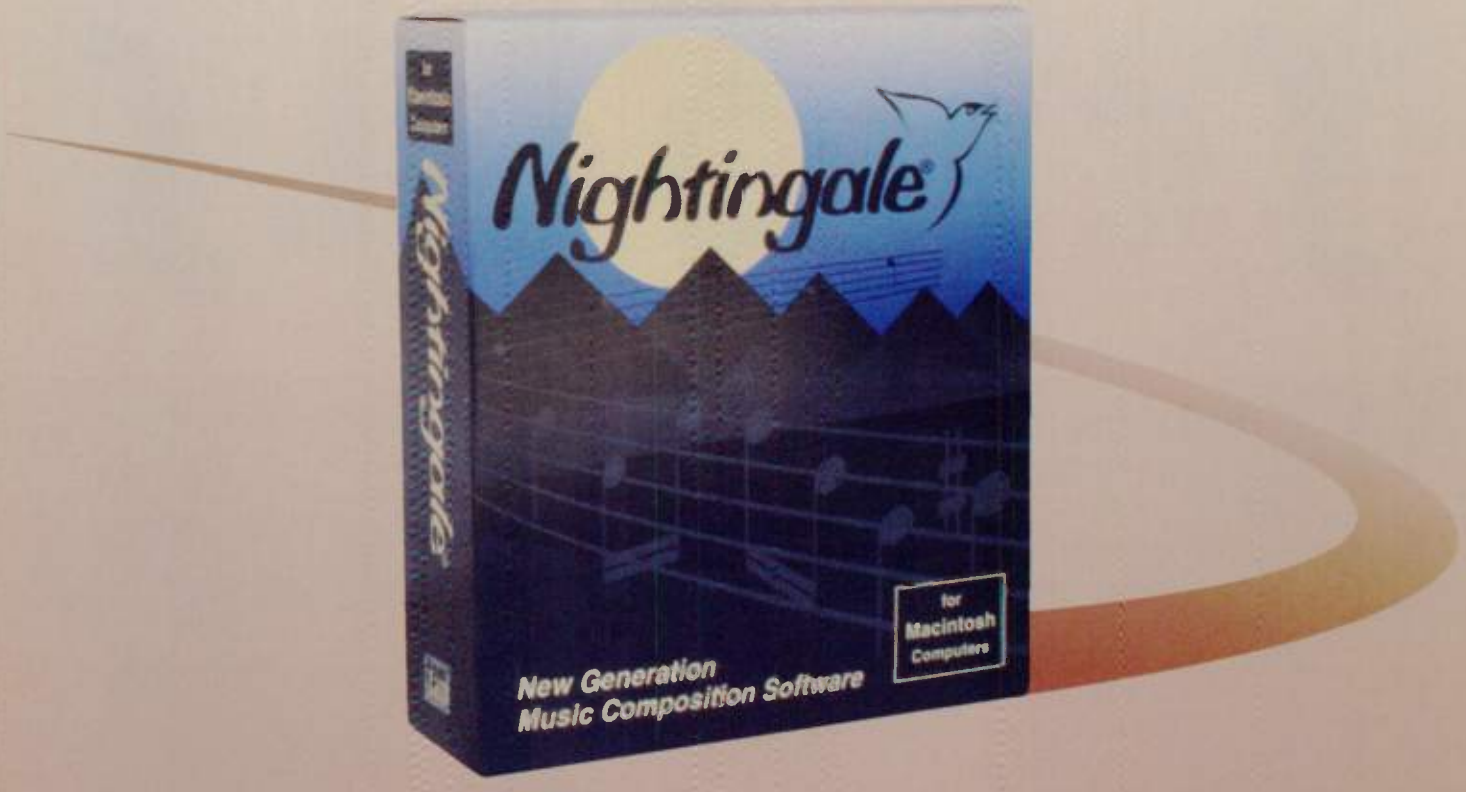

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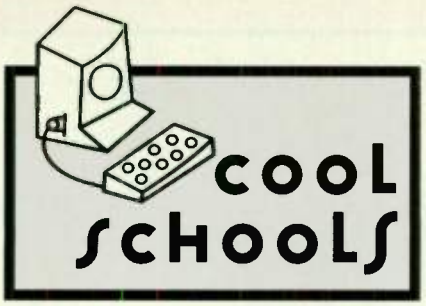

addresses musicianship and technology at equal levels.

"The latest technology (and the facilities to house it) costs big bucks, and that money is becoming harder for educational institutions to find. Grants seem to be the best avenue for schools to acquire the equipment necessary to mount a music-technology program. No one knows this better than Gene Aitken, who is director of the Music Technology Center and Jazz Studies, as well as associate director of the School of Music, at the University of Northern Colorado (UNC), in Greeley.

"Our music-technology program was originally conceived for a grant proposal to the Colorado Commission On Higher Education in 1989. They selected five programs of excellence, including ours, which was funded to the tune of $2.6 million. On the heels of that grant, we submitted a proposal to the National Endowment for the Arts, which brought us a $600,000 matching grant in 1990. From that point, we began to construct a program and a new building on campus." UNC's Music Technology Center also boasts its own publishing house, aptly named the UNC Music Technology Press (see sidebar on p. 35).

Although some music conservatories cling to the past, others gladly take advantage of the newest tools available. For example, Berklee College of Music, in Boston, is a four-year music school that trains musicians in the latest technology. According to David Mash, assistant dean of curriculum for Academic Technology, "Berklee has always been interested in using technology to enhance the teaching and learning processes. In 1981, I designed a series of courses geared toward using synthesizers in live performance. After MIDI was introduced, that program became the Music Synthesis department, which started offering a four-year degree in 1985."

Training in recording technology can be found at dedicated recording schools such as Full Sail Center for the Recording Arts in Winter Park, Florida, which offers a one-year intensive course of study. Gary Platt is senior vice president and director of education at Full Sail. "The school was formed back in 1978, primarily as an audio school. In 1989, we built a new facility here in Winter Park with nine complete studios. At that time, we also started a video and film program."

For many students, these schools are too expensive and time-consuming to be considered a realistic educational choice. Fortunately, opportunities to study music technology may be as close as your local two-year community college. Cabrillo College, in Santa Cruz, California, has recently developed a technology lab for its music department. According to Michelle Rivard, director of the lab, "We started it to supplement ear training and some of the basic skills for music students. We now have some PC-compatibles and Macintoshes with a variety of MIDI gear, as well as a video and audio library for students of music theory, theater arts, and music appreciation."

HIGH-TECH HIGH SCHOOL

A few high schools offer music-technology programs. One of the most successful examples is Southwest High School, in San Diego, California. In his six years as the music teacher at Southwest, Dennis Mauricio has built a program that includes five music-technology courses, a music-engineering course, and a music-business course.

"I have a typical band room and a few practice rooms. One area of the band room is set up with a keyboard lab, and one of the practice rooms holds two beginning-level, 4-track recording-studio setups. We also have one advanced 8-track studio in another practice room. We just finished an original recording. Almost all the tunes were written, recorded, produced, and mixed by the students. The music-business class markets the album. They even use *PageMaker* to do their own artwork."

Southwest High School students prepare for a lunchtime concert by the school's music-tech ensemble.

Mauricio also instituted a music-tech ensemble, which has become the school's primary performing group. "We play eight keyboards live; we generally don't use sequencing. The students also do all the sound engineering. I teach them how to solder and repair their own cables. The students did all the wiring except for the major electrical in our advanced studio."

The coursework at Southwest includes music fundamentals, as well as topics in music technology. "My 'Music Tech 1' course is a combination of fundamentals and technology. Of course, the technology helps support the music instruction in a big way. At the beginning of the first semester, we start with 70 to 80 percent lecture and 20 to 30 percent hands-on. By the end of the semester, I might do a lesson of ten to twenty minutes, and then they're in the lab practicing, or working on projects, or whatever, for the rest of the period."

Mauricio's impressive program led him to publish a curriculum guide with Dr. Steve Adams, a music educator with a strong technical background. Called *Fundamentals of Music Technology*, the book includes everything a high school or college music teacher needs to start a music-technology program, including lecture notes, quizzes, and answer sheets. The book is available on a site-license basis from Consultant Help; tel. (818) 991-0110.

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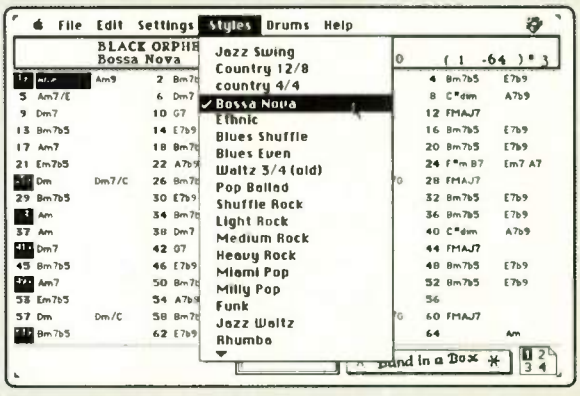

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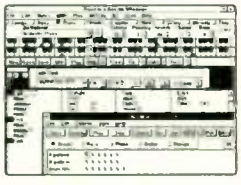

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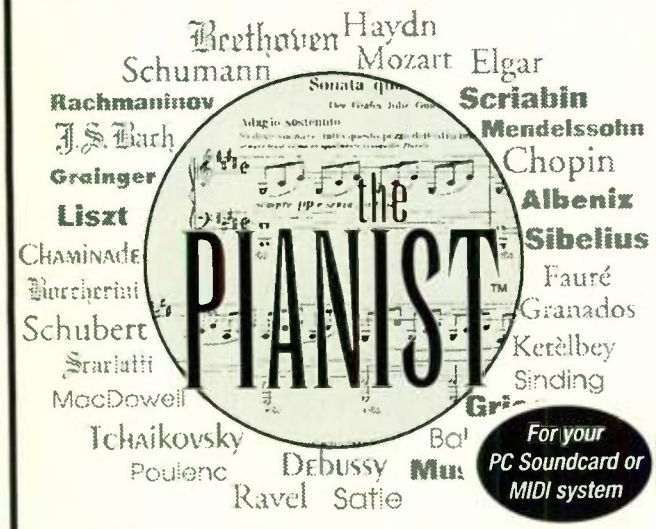

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Requirements: Windows (IBM) 2mb RAM memory, Windows 3.1, SoundCard (Roland, SoundBlaster, etc.) or MIDI system with guitar, bass, drums sound, 3.5" or 5.25" high density floppy disk, 2mb hard drive space required.
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cool schools

Another option exists in continuing education programs for working and aspiring professionals. UCLA Extension is one such program. Coordinated by Jeff Rona, the electronic-music courses have grown by leaps and bounds. "UCLA Extension is the largest continuing-education program in the country, and the electronic-music curriculum goes back quite a ways. Extension now offers certificate programs in electronic music, as well as film scoring, music business, songwriting, and recording engineering."

Part-time educational opportunities include short summer workshops. Duquesne offers several such workshops, taught mainly by the regular faculty. "Every summer, we offer a variety of 5-day workshops," says Purse. "This year, the seminars include 'Technology In Music Education' and 'Sequencing for Educators.' Anyone can attend the 'Special Topics in Music Technology' seminar, which covers multitrack recording, MIDI, and computers. We also run a keyboard camp for high-school students and a guitar workshop with an emphasis on guitar controllers."

UNC brings in music-technology professionals from around the country to teach at the 4-day Rocky Mountain Music Technology and Multimedia Workshop. According to Aitken, "One of our primary goals is to make people aware of music technology. I talked with Kawai, Korg, Kurzweil, Apple, and others about the idea, and they supported it with equipment loans and personnel. The attendees then go back to their homes and get more people involved in technology. At first, it started out with music technology, but then we saw multimedia technology becoming important, so we added that to the curriculum."

These schools are fine for those who want careers as musicians, but what about aspiring engineers who want to design the next generation of musical tools? Very few polytechnical schools offer music-engineering programs; one exception is Cogswell College in Cupertino, California. Eric Peterson is the founder and co-chair of the school's Music Engineering Technology program.

"In the fall of 1988, we identified a

Electronic-music program coordinator Jeff Rona (center) shows students how it's done in UCLA Extension's Music Media Lab.

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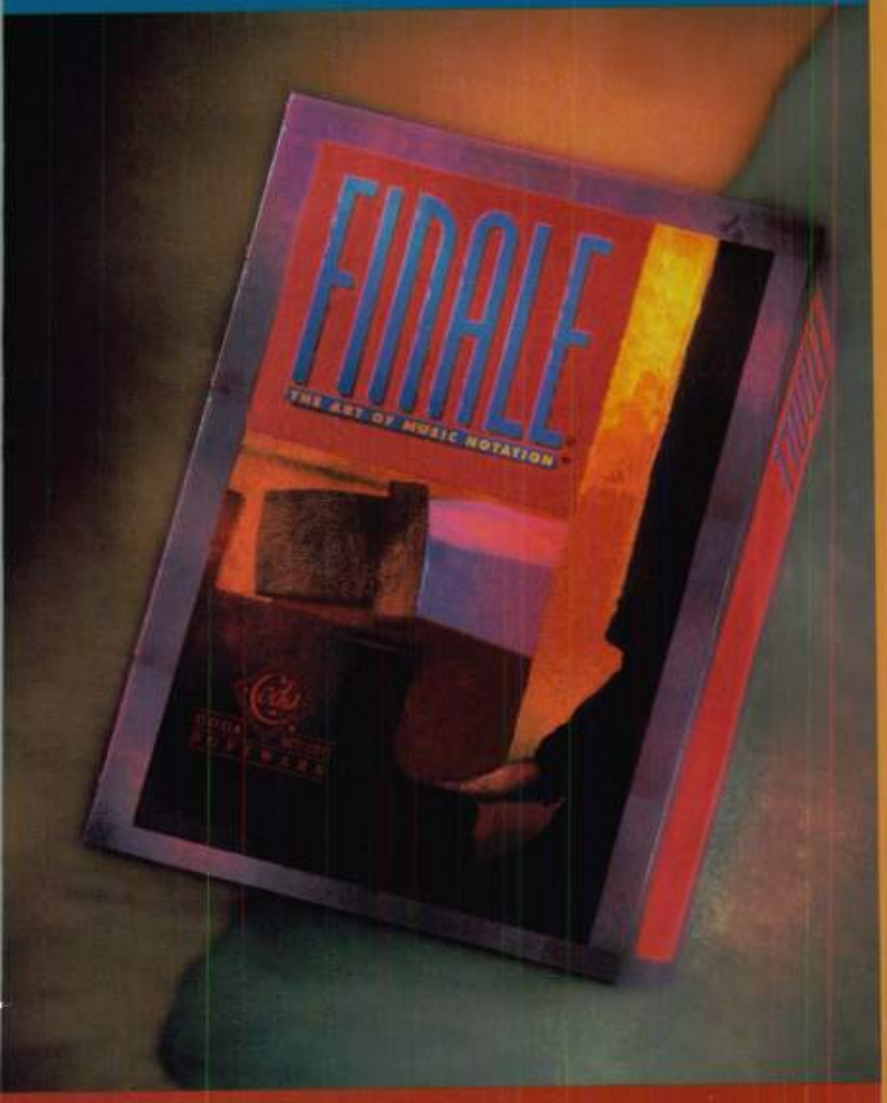

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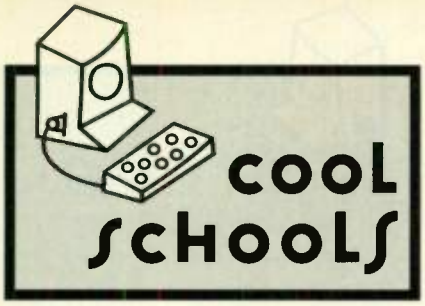


number of electronic music-related companies that were having difficulty finding qualified technical people. We formed an advisory board that included Digidesign, Opcode, Passport, Atari, E-mu, Korg, and Apple, among others. They helped us devise a curriculum that was geared to meet their needs. The music-technology program is an emphasis study within an electronics-engineering or computer-technology major."

IN THE LABORATORY

The buildings, labs, recording studios, and equipment are the most visible aspects of a high-tech music school. Most schools have one or more labs with ten to twenty workstations, each of which typically includes a computer (almost invariably a Macintosh) with the appropriate software, keyboard controller, sound modules, tape decks, and signal processors. A headphone/microphone network system lets the teacher and students communicate and hear each other's work. Other common facilities include one or more full-blown multitrack recording studios, often with 24-track machines and hard-disk recording.

Berklee is organized into four divisions, each with its own complete facilities. "Our divisions include Professional Performance, Professional Writing, Professional Education, and Music Technology," says Mash. "Each division has its own satellite facilities, including various labs with a number of computer-based workstations and lots of MIDI gear. Altogether, there are about 150 workstations in the school."

Music educator Dr. Steve Adams works on a multimedia project in UNC's Multimedia Lab.

In addition to their lab and recording-studio facilities, Duquesne offers training on the CEDAR (Computer Enhanced Digital Audio Restoration) system, which is used to remove scratches and other noise from old or poor-quality recordings. They also offer training in post-production and CD master tape-editing on the Sony PCM-1630 system.

As a dedicated recording school, Full Sail has some impressive recording and post-production facilities, including a 48-track studio, several 24-track studios, three Synclavier suites, a Lexicon Opus suite, an online CMX suite, and six Digidesign Pro Tools systems in a room with six Tascam 3500 consoles.

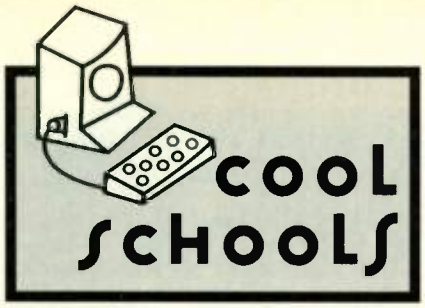
Full Sail also offers a film and video program, with the equipment to match. According to Platt, "The video and film department includes three Ariflex film cameras, and we're starting to get into telecine. We just purchased a Rank Cintel telecine transfer system for film-to-video. We also have a Montage III digital video-editing system with eight gigabytes of optical storage."

With its hard-won grants, UNC was able to construct a new building on campus, which accommodates the program's strong emphasis on multimedia technology. "In addition to a computer/synth lab, keyboard lab, and two recording studios with 24-track capability, there are several sound-isolated multimedia rooms designed for individual work and a video-editing suite," says Aitken.

At Cogswell, the emphasis is on engineering, for which students use SPARC Stations and PCs. However, the curriculum includes some musical training. According to Peterson, "We have a 24-track, analog, commercial recording studio, in which our upper-division students can take elective classes and gain studio experience. We also have a 16-track studio, two 8-track studios, and an 1,800-square-foot performance room with a 200-amp lighting grid and a stage. We have a MIDI lab with twelve Macintoshes, keyboards from Korg and E-mu, and three audio-for-video post suites."

Unlike most schools, Cogswell also has a MIDI lab with eight Atari computers. This raises a question: Why is the Macintosh so dominant in music teaching labs? Most educators champion the Mac's reputation for a friendly user interface, particularly compared with DOS. Mash remembers the early days well. "Eight or nine years ago, the Mac was definitely the best choice. Students clearly learned faster on the Macintosh than they did on the PC. If we

Music-synthesis major Kayo Wakiama experiments with one of the 25 new Kurzweil K2000RS modules at Berklee College of Music.



guitar. I have two percussionists now and a really great jazz-fusion bass player, as well as a Zeta violin player and a sax player who plays a Yamaha WX7 or Akai EWI. I do a lot of arranging and writing myself, so it's labor-intensive. But it's also very rewarding."

Predictably, the gender balance in these programs is heavily weighted toward men, typically from 70 to 90 percent. However, most schools have seen an increase in the number of women enrolled in their high-tech programs. Lynn Purse is happy to see this trend at Duquesne. "I used to be very lonely. I really encourage women to get involved in this field. It's a matter of thinking they can do it; then they do just fine."

The female population in Cogswell's music-technology program is about double the usual 10 to 12 percent found in most general engineering programs. Among other factors, Peterson attributes this to their "road show" outreach to high schools. "Our road shows include on-site visits by our faculty, and we actually teach engineering, physics, science, and math concepts using musical tools. The road show is a unique program that provides an educational experience for the kids. This approach tends to involve women at an early age, which helps avoid the stereotype about women and technology."

▼

One of the most exciting activities in high-tech music schools is participation in electronic performance ensembles.

CLASS DISMISSED

Clearly, it is important for musicians to learn about music technology if they intend to flourish in their field. There are many ways to acquire this knowledge; we've visited only a small sampling of the high-tech music schools that are found around the country. Check your local university and/or college for programs of this type. (See the February 1993 issue *Mix* magazine for a directory of U.S. and international recording schools.)

You might not know much about history, science books, or the French you took. However, if you do know about music technology, what a wonderful world this would be.

EM *technical editor* **Scott Wilkinson** *teaches at a variety of music-technology seminars and workshops.*

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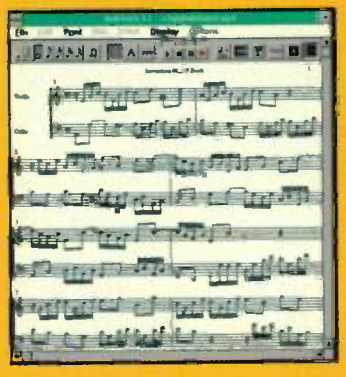

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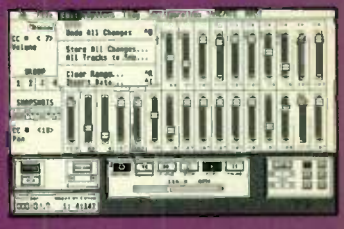

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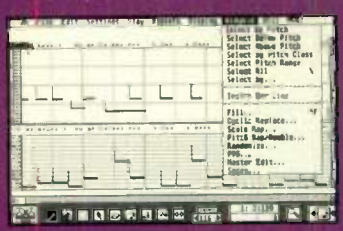

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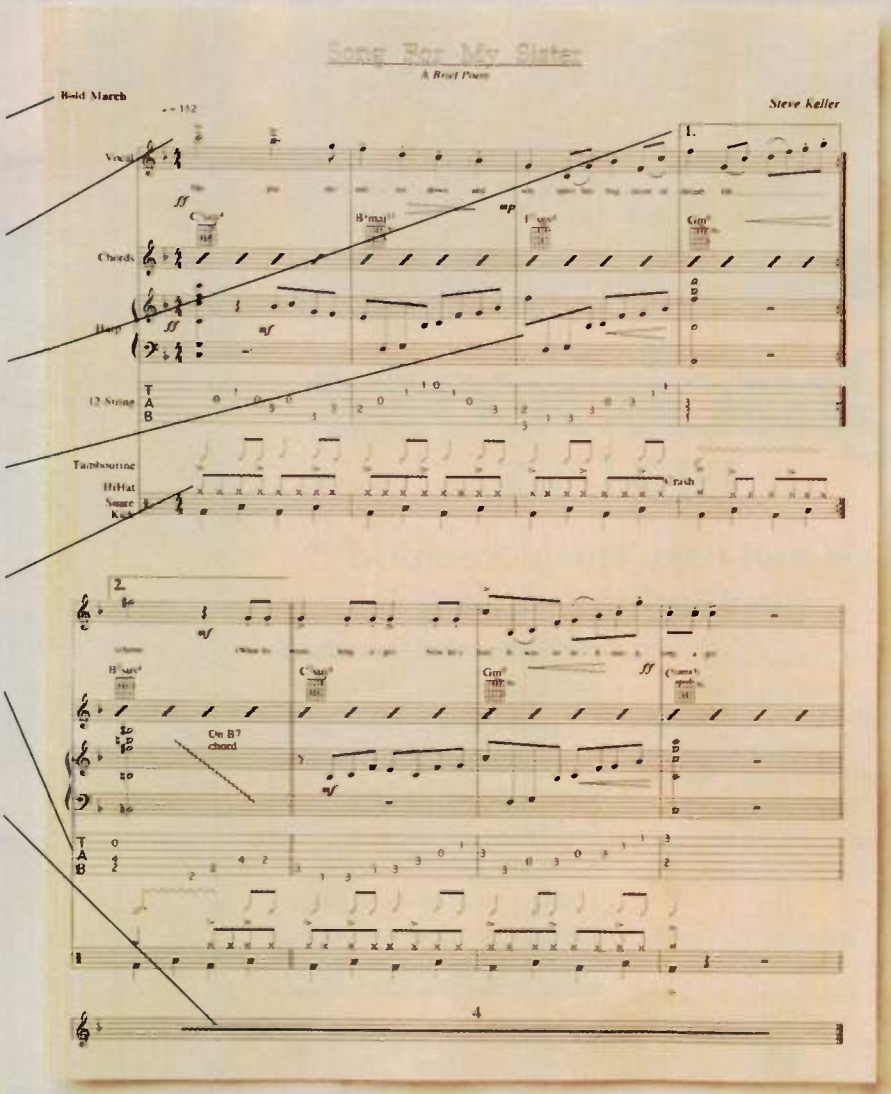

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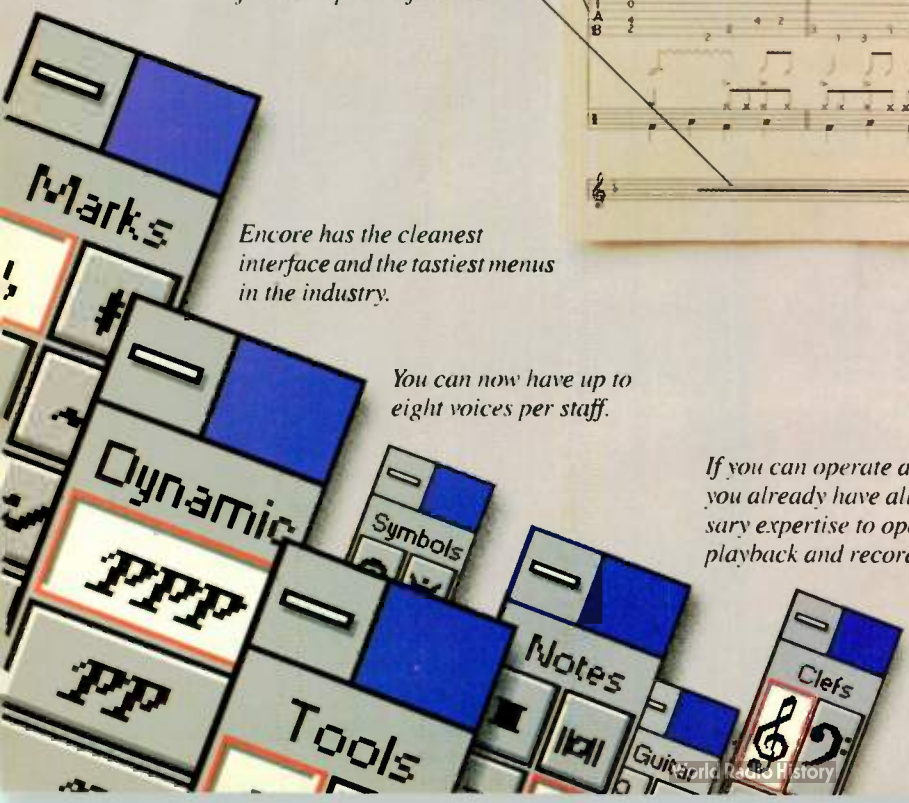

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The Electronic

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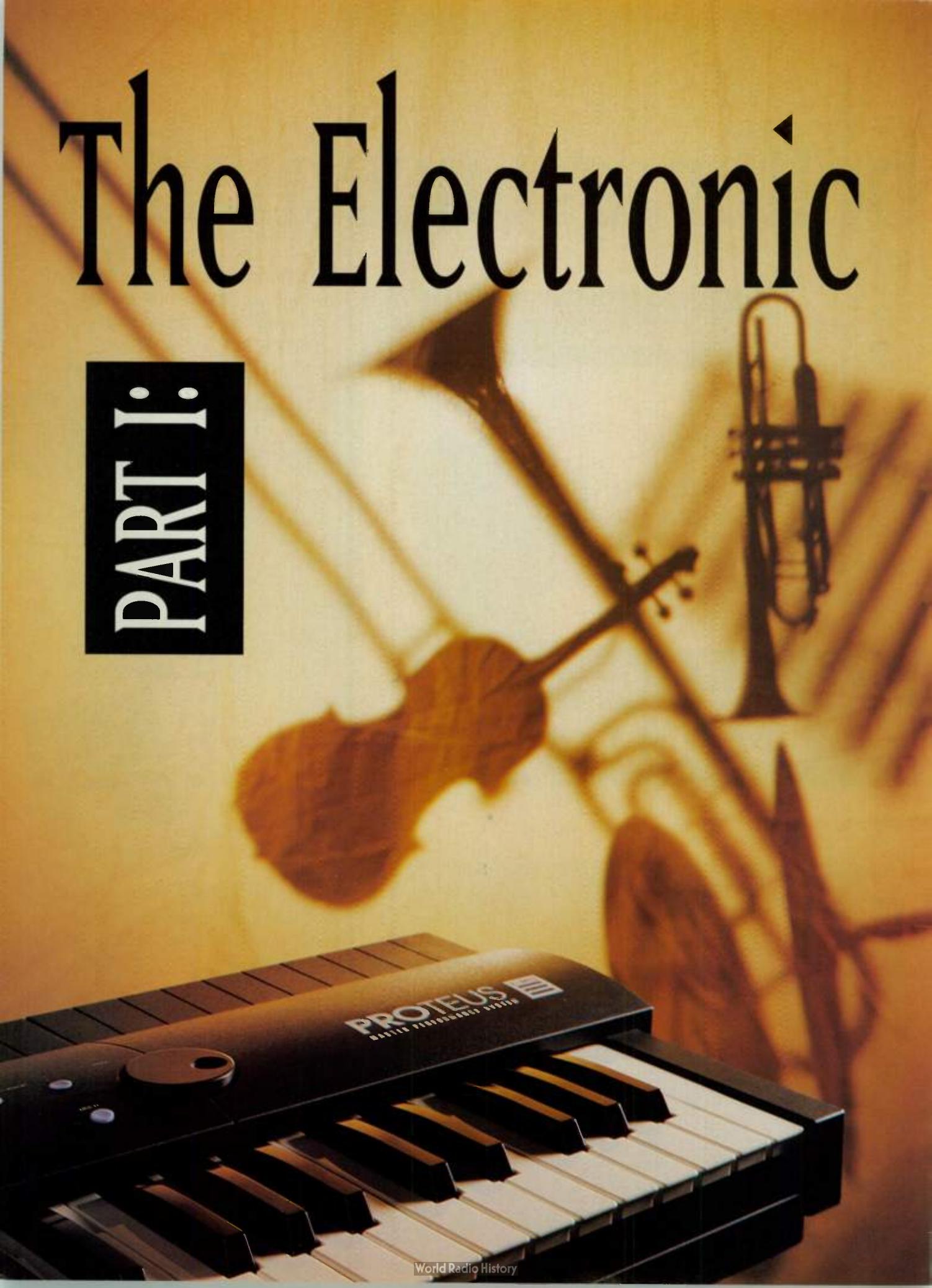

Orchestra

By Paul D. Lehrman

Photograph by Stan Musilek

A major challenge for electronic musicians eager to create their own symphonies or other orchestral material is mastering the art of making MIDI music sound "real." With the easy availability of high-quality, sample-based instruments, it's not hard to get realistic-sounding instruments. But learning how to play, control, and combine them so that they sound like the real thing is much more difficult, and without that knowledge, your electronically generated "acoustic" music won't fool anyone.

Use your MIDI gear to make convincing orchestrations.

Knowing basic principles of orchestration and how to apply them to MIDI instruments is important no matter what kind of ensemble you're trying to create. This knowledge is important even if your final product is not going to be electronic, and your MIDI rig is serving as a sketch pad for a big-budget live session. If you understand orchestration and have tested your ideas with synths, you'll have an idea of what's going to happen when the session players are in the studio.

The Electronic Orchestra

THE ORCHESTRA

The traditional orchestra consists of four main sections, or "families": strings, woodwinds, brass, and percussion.

The strings—first and second violins, violas, cellos, and double basses—are the workhorses of the orchestra. Each string part is played, not by a single instrumentalist, but by a "section," which can include from four to a dozen or more players. In most classical orchestral music, strings play almost all the time and carry the main themes of the piece. The rest of the instruments are used for color, emphasizing certain phrases, climaxes, or transitions. Early symphonic music, in fact, sometimes used *just* strings; witness the early works of Mozart, Haydn, and even Mendelssohn. As the Classical era moved into the Romantic, the woodwinds and brasses began to take on more of an active, independent role, but the strings still maintained their prominence.

The woodwind family consists of flutes, oboes, clarinets, and bassoons. Each woodwind player plays a different part. There are pairs of each instrument (for example, first and second clarinet, first and second bassoon) and sometimes three or four players, all playing different parts much of the time. The third or fourth players often double on auxiliary instruments, such as piccolo, English horn, bass clarinet, and contrabassoon, to add extra range and flexibility.

French horns are generally considered woodwinds in a symphony orchestra. Small orchestras have two horns, while medium-sized orchestras have four horns, and large ones have eight (usually playing four parts). Saxophones are a special case: Their use in the symphony was limited mainly to early twentieth-century French and Russian music, and in those contexts, you usually find only one or two altos or tenors.

The brasses are two or three trumpets, two or three trombones, and sometimes a bass trombone, and usually one tuba.

The percussion section always consists of at least one timpani player and often two or three other performers handling bass drum (a big, boomy thing struck with a large, soft mallet), cymbals (a pair of them, struck against each other), snare drum, military drum (a deep snare), and triangle.

When you get into late Romantic and twentieth-century orchestras, you might also find one or two harps, a piano, a celeste, and an arsenal of fun percussion instruments, such as wood blocks, temple blocks, whips or slapsticks, and sleigh bells. Pitched or "mallet" percussion instruments include xylophone, marimba, vibes, glockenspiel, and chimes (tubular bells). Go back to the Baroque era, and you'll often find a harpsichord or organ used to round out the sound of the string section (which was smaller in those days) and play solo lines.

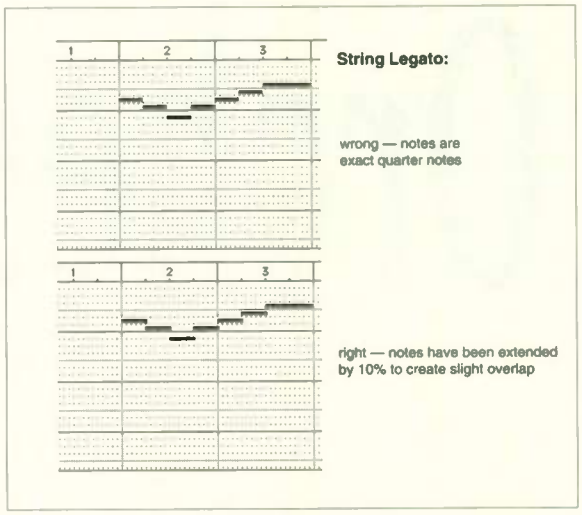

FIG. 1: To create legato string parts in your sequencer, each note needs to have a duration about ten percent longer than notated so that the notes slightly overlap. Non-overlapping, exact lengths, as shown in the top example, will sound wrong.

ELECTRONIC ORCHESTRA

Just as the real orchestra is the sum of its parts, many things go into creating an electronic version. Each player in a real symphony knows exactly what his or her instrument is capable of doing and how to interpret the squiggles on the page. As an electronic composer/orchestrator your task seems daunting, because ideally you need to know everything that all of the players know.

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BIBLIOGRAPHY

The best study materials for orchestration are orchestral scores. Find recordings of pieces you like, and get their scores from a music store or a library to see how the masters did it. Don't use piano reductions, and please don't mark up the library score! Most music dealers can order scores they don't stock, and if you're looking for older pieces in the public domain, there are probably bargain and/or pocket editions that won't cost an arm and a leg. (Be prepared to spend big bucks for twentieth-century orchestral scores, however.) An exceptionally useful anthology of orchestral writing through the centuries is *The Norton Scores* (New York: W. W. Norton & Co.).

A number of classic books on the subject of orchestration also are available, although some may be hard to find. The simplest of these is *Orchestral Technique,* by Gordon Jacob (London: Oxford University Press), which is a crash course in instrumental ranges and characteristics. More comprehensive are (in order of increasing complexity) *The Technique of Orchestration,* by Kent W. Kennan (Englewood Cliffs, New Jersey: Prentice-Hall); *Principles of Orchestration,* by Nikolai Rimsky-Korsakov (New York: Dover Publications); and *Orchestration,* by Walter Piston (New York: W. W. Norton & Co.).

Two modern books worth looking into are *Orchestration: A Practical Handbook,* by Joseph Wagner (Newbury Park, California: Katamar Publishing, formerly Peter Alexander) , and *Instrumental Arranging,* by Gary White (Dubuque, Iowa: William C. Brown Publishers). If you're particularly interested in music for visuals, take a look at *Film Music,* by Roy M. Prendergast (New York: W. W. Norton & Co.).

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The Electronic Orchestra

conservatory training to learn enough to make a good orchestral sound (although it wouldn't hurt). Today's synths, thanks to their stability, sound quality, and expressiveness, take care of a lot of the basic chores. You don't need to worry about how to keep a bassoon's low F on pitch, how to jump octaves on a tuba without splatting, how far into the bell of a French horn to put your fist to mute it, or where exactly on the violin's neck your finger needs to go to nail that high G#.

But you do need to know how to make things blend. That involves choosing the right sounds and using them properly. The greatest string-ensemble patch in the world will sound dumb next to a flat, wimpy horn section. A timpani roll in the wrong octave will wipe out your beautiful cellos. A flute sampled in a huge room played next to an FM clarinet will sound like a duo on different planets. A long violin passage that is step-entered, no matter how florid and brilliantly written, will put the listener to sleep in seconds.

Perhaps the most important habit to develop if you want to re-create orchestral instruments is to listen to the real thing. Notice how the players, by themselves and in ensemble, control phrasing, note lengths, accents, the application of vibrato, and how notes decay. Try to figure out a way to make your fingers do the same thing, using Velocity, Aftertouch, Pitch Bend, and controllers. As you record your music, try to input the non-note data at the same time as the notes. If you can't, add them on a subsequent pass. If your keyboard chops are not good, play the parts in slowly; even if you play them in at one-tenth the actual tempo, they will sound much more expressive than if you step-enter them.

When looking at existing orchestral scores, it's important to remember that many instruments don't play the pitches that appear on the page. These are called "transposing" instruments, and for various historical reasons, they play higher or lower than the printed notes. That is why you may see a score in which the string parts have one key signature, the trumpets have a different one, and the horns yet another.

The "key" of a transposing instrument is the pitch it produces when the person playing it thinks he or she is playing a C. So when a B*b* soprano sax plays middle C, it actually transposes down a whole step and sounds the B*b* just below middle C. An F horn transposes down a fifth. An A clarinet transposes down a minor third. There are also instruments at the extreme top and bottom of the ensemble that are written an octave below or above their actual pitch so that players don't have to fight through a forest of ledger lines. If you generate notation for any of these instruments, make the appropriate transpositions. If your piece is in D, for example, the trumpet part should be in C.

As you assemble your orchestra, you should be concerned with these main areas:

- Patch design: dynamics, envelopes, and vibrato depth and rate;
- Performance: articulation and duration;
- Arranging: chord voicing and instrument doubling;
- Recording: panning, processing, and mixing.

STRINGS

Although your goal on a project may not be to exactly reproduce the sound of a Haydn or Mozart symphony, it's helpful to know how that instrumental style is created. For starters, a string *section* is a different animal from a solo string player. Many synths provide both solo and ensemble string sounds, and knowing when to use each is important.

You *could* create a string section out of a large number of solo instruments, with each instrument on its own MIDI channel. Playing each instrument's part individually would produce an ensemble with slight variations in timing, Velocity, and vibrato among all of the instruments. The advantage is that it could sound extremely realistic. The disadvantage, of course, is that it would take a long time, and you would probably run out of synth voices (and MIDI bandwidth) long before you were done. Therefore, string ensembles are best left to ensemble patches. If they are any good, they will already contain the slightly smeared attacks and randomized vibrato of a real string section.

However, you still need to be careful, even with a great ensemble patch. Step-entering an orchestral string part is not a good idea. Sometimes you can get away with it during fast passages, especially if you "roughen the edges" a bit by slightly randomizing the start times and durations, but don't make it a habit. (*Never* step-time a solo string part.) Break up the strings into as many voices and channels as you can afford (e.g., try to put the first and second violins on different channels). Record them all separately, even if the different sections are playing unison parts, to get a variety of attacks, durations, and vibrato.

Variations in vibrato are important in producing a convincing string sound. Many synth string sounds have vibrato built into them, either because they were sampled or looped that way, or

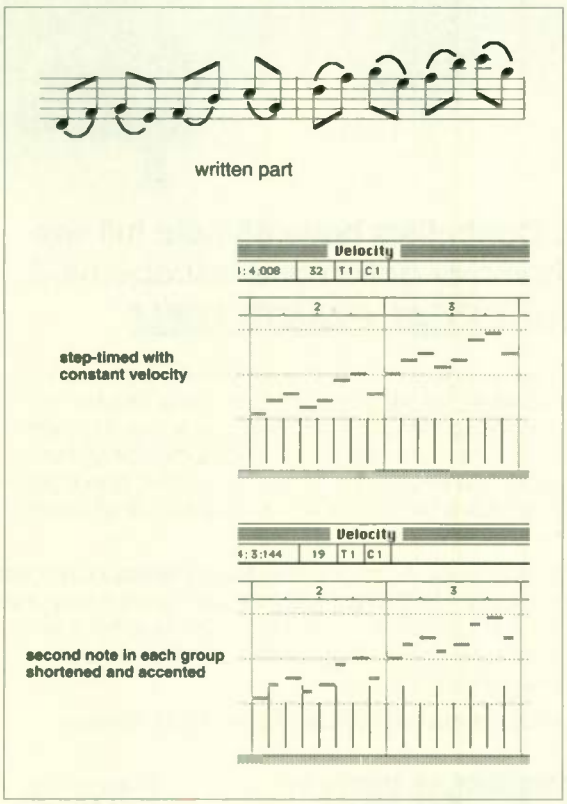

FIG. 2: To effectively re-create a 2-note slur in a sequencer, shorten the duration and increase the Velocity of the second note in each group.

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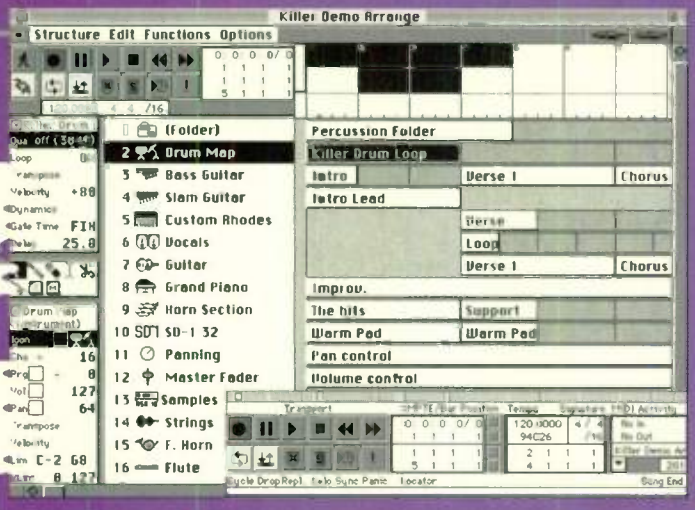

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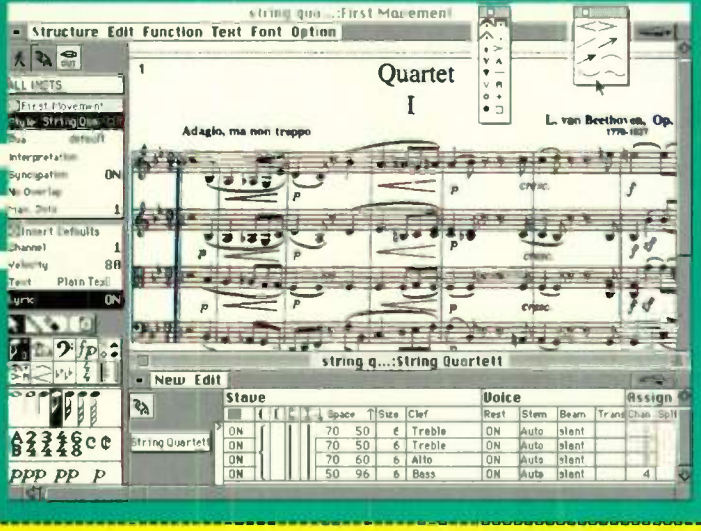

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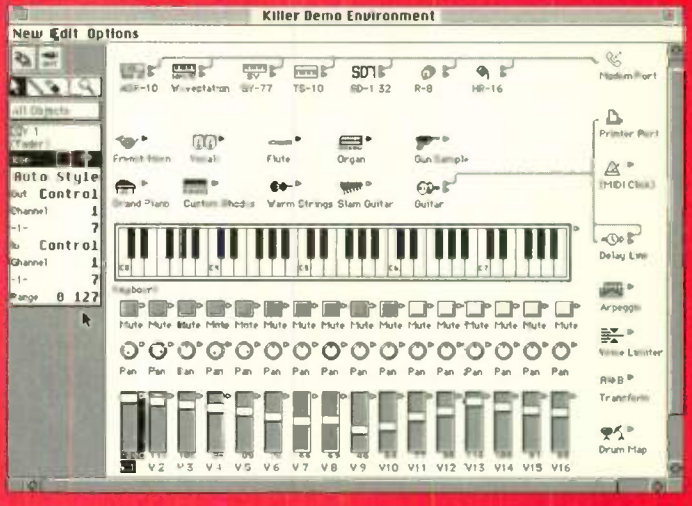

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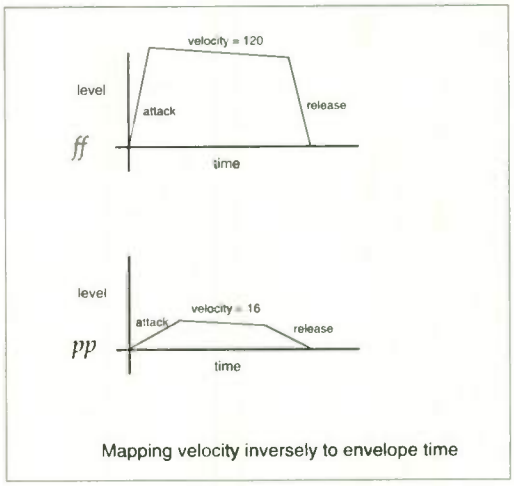
from an LFO. If it's the first case, you can't do much about changing it unless you have control over the loop points. If it's an LFO, by all means change the rate slightly on the different tracks and vary the start time of the vibrato by altering the delay parameter. If your synth lets you do these in real time, so much the better; use Aftertouch to vary the rate, and scale the delay time inversely to Velocity, so that softer notes start their vibrato later. Some synths offer a marvelous "rate randomizer" feature for livening up ensemble sounds (of all kinds, not just strings). This automatically varies the vibrato rate from note to note, not just from track to track.

Note articulations—that is, their relative durations and velocities—have a major effect on how real a string line sounds, particularly on a solo instrument. For example, legato quarter-notes should not be exactly one beat long; besides getting boring quickly, in most cases (unless the release portion of the envelope is quite long), it will not sound particularly legato. Setting the durations to about 110% of a quarter-note makes the effect more convincing by overlapping the notes a little bit (see **Fig. 1**).

String players play up-bows (moving the bow from the tip to the handle, or frog) and down-bows (frog-to-tip), and there are subtle differences between them. In fast, detached passages, alternate notes often use alternating bows: down for the first eighth-note, up for the second, and so on. A good way to achieve this is to change the duration of each second eighth-note to about 80%, and increase its Velocity by a small factor, say 5%. This gives a little "lift" to the up-bow note, similar to the bow going up in the air and reversing directions. If the music specifically calls for 2-note phrases (by putting slurs over the notes



Mapping velocity inversely to envelope time

FIG. 3: String patches sound more realistic if your synth allows you to inversely map the sound's envelope times to the MIDI Velocity of each note. This gives notes with lower Velocities slower attacks and releases, and notes with higher Velocities faster attacks and releases.

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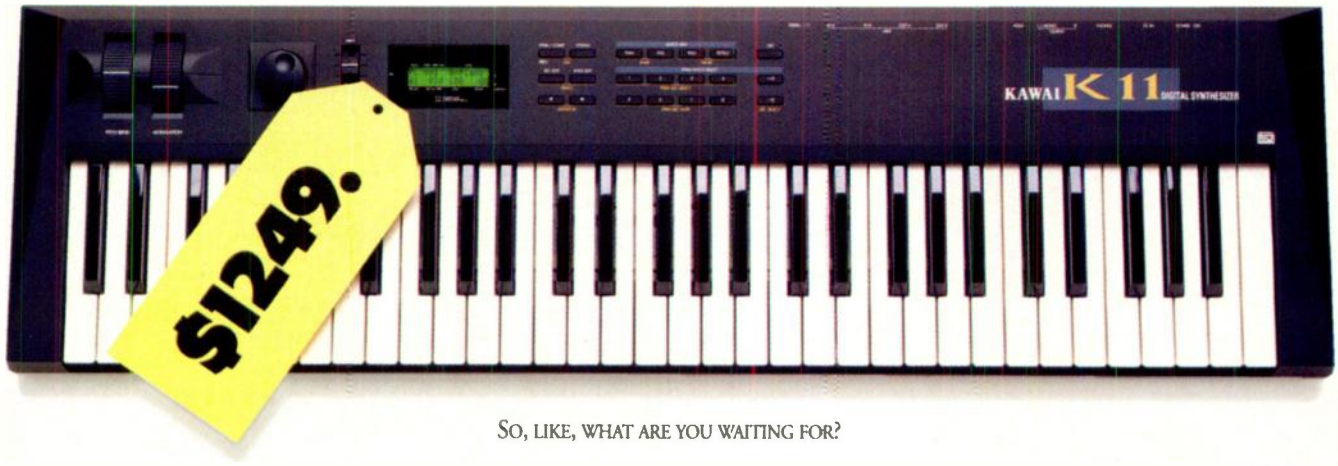

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in groups of two), take this effect further by setting the second note's duration to 60% and increasing its Velocity by 10% (see Fig. 2).

Designing sounds to follow the natural articulations of string instruments helps enormously. String instruments, not surprisingly, have different timbres at different dynamic levels: *Fortissimo* playing often has more attack noise and high harmonics than *pianissimo* playing. There are also differences in the envelopes: A *pp* string note normally has a much slower attack (and often, release) than an *ff* note. Scaling envelope time inversely to Velocity, similar to what was suggested earlier with vibrato delay, adds a lot of realism to string patches (see Fig. 3). Be flexible, though, because strings can play staccato at soft volumes (particularly in *spiccato* passages, in which the player literally bounces the bow off the string) and legato in loud passages.

If you don't have enough sampled string voices available to cover all the parts in a complex orchestration, you can often cheat by filling in ensemble parts with analog, L/A, or FM string patches. Keep the sampled voices on the top and bottom, and use the synthetic sounds for the inner voices. Synthetic strings, particularly analog, are also useful for fattening up the sound.

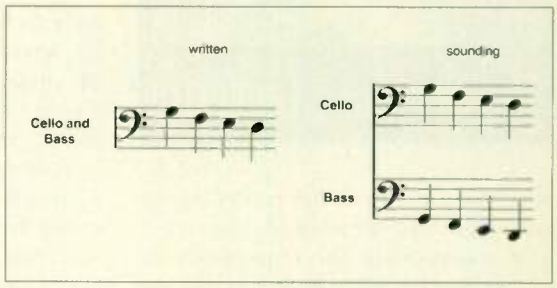

FIG. 4: Cello and Bass parts are written in the same octave, but the bass line actually sounds an octave lower.

Special string techniques require special patches. *Pizzicato*, or plucked strings, are difficult to synthesize (particularly in ensembles) and are best sampled. In a pinch, you can use a guitar or harp patch if you add a little noise to the attack, make the delay very fast, use no sustain at all, and put in a small amount of ringing for the release. String harmonics, which are notated in many scores by diamond-shaped notes, are bowed, not plucked, unlike guitar harmonics. They often don't sound as written, but are an octave or a twelfth higher; check the score carefully for instructions. You can't use a normal string patch for harmonics unless you are sure it has no vibrato of any kind. You might try creating a harmonic patch by grafting a fast, noisy string attack onto a slow-attack sine or triangle wave. The release should be slow, too.

Finally, keep in mind that cellos and basses are often notated on the same staff, but the basses transpose their part down an octave (see Fig. 4). You can

sometimes get away with recording the cello part and then simply copying it and transposing the copy down an octave, but it's often better to play the bass parts separately to add variety.

WINDS AND BRASS

One significant difference in writing for winds as opposed to strings is that you have to keep the ranges of the instruments in mind. String patches tend to take care of themselves in terms of sounding good across the pitch spectrum: If they're designed well, you don't need to know where the violin samples end and the cello samples begin. (Solo sampled strings, however, are a different story: A cello that goes too high can sound like a choking goat, while a violin that's too low might turn into a flabby rubber band.)

Wind instruments sound odd if you force them out of their ranges. For example, Stravinsky started the *Rite of Spring* on a C above middle C on a solo bassoon—a note close to the top of that instrument's range, and known fondly among bassoonists as "that @#$%& high Z-sharp." But he was deliberately going for an unusual effect, something his audience had never heard before. Because your purpose is to make sounds *familiar* to your audience, it makes little sense to use a bassoon up in the stratosphere like that. (Stravinsky worked with the instruments he had. If you want weirdness, you have a wealth of synth sounds.)

Flutes in the bottom octave of their range get buried in ensembles. Oboes, however, get strident in that range. For a softer oboe tone in the low register, use an English horn. You *can* use a low flute as a solo instrument, and for really low parts, alto or bass flute is effective. Clarinets work well all across the range, as solo or ensemble instruments, but use bass clarinet for really low parts. (High bass clarinet, however, doesn't mix well at all.)

Bassoons can go higher in an ensemble than you might think, but stay out

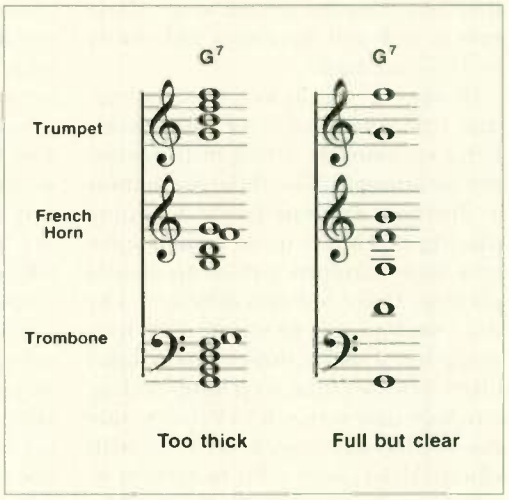

FIG. 5: Brass chords need to have an open voicing, as shown in the right half of the example, or the sound will be very muddy.

of the *Rite of Spring* range; G above middle C is a good ceiling. Contrabassoon should only be used to reinforce the bottom of a wind ensemble, usually doubling the bassoon an octave down. A solo contrabassoon is bad enough in real life; using a sampled version all by itself is inexcusable (and I'm a former contrabassoonist). If you need solo notes that low, *please* use a tuba, double bass, or organ pedal.

French horns are considered both woodwinds and brass, in large part because they blend well with both. Horns have an enormous range, from pedal tones almost three octaves below middle C to squeals an octave and a fourth above middle C. The extremes of the range should be avoided however, except for loud ensemble blasts, when the sound of charging elephants is called for. In more moderate circumstances, horns make excellent midrange and low-mid chord fillers for any kind of wind group.

Because the winds are played by only one or two players, when you make up ensembles, you have a lot of freedom to mix and match different instruments to create different colors. Doubling instruments at the same pitch or an octave apart can bring variety to the sound. Odd doublings can be effective, e.g., piccolo and tuba three octaves apart, or an alto flute an octave below an oboe. Be careful not to do anything that wouldn't work in a real orchestra; combining a low-register flute with a trombone at the top of its range won't leave much room for the flute.

In any kind of orchestral writing, but especially with winds, be careful how you lay notes across the pitch spectrum. Thick, triadic chords below middle C sound like mud if you're not careful; the lower you go, the farther the notes in a chord need to be spaced (see Fig. 5). Trombone chord voicings, therefore, tend to be open, while French horns in the middle register can be close together. Bassoons, not too loud, are okay for low chords, especially if they're moving fairly quickly. On the top end, feel free to put instruments as close together as you like, except for trumpets (unless you're going for a fanfare sound).

Be aware of the strengths and shortcomings of each instrument. It's just as easy to make a synth trombone leap about quickly in its upper register as it is a synth flute, but the trombone will

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sound weird, while the flute will sound normal. On the other hand, long, low notes on a flute are boring and get buried easily, while they sound fine on a trombone or tuba.

The same basic principles of articulation discussed earlier apply to winds. Tongued notes (not slurred, not staccato) should have a duration somewhere between 50% and 90% of the written value. Two-note slurs should use a ratio like 100%:60%. Staccato notes should be 30% to 50% of the duration.

For true legato, with no new attack, make sure the notes are at 100% of the duration (no overlap between adjacent notes). In fact, the best wind legato is achieved by putting the synth in Mono mode. If you want a new attack on a note, set the previous note to 95% duration. (If your synth demands that you turn on portamento to move smoothly from one note to the next, be sure to set the portamento time to 0.) For obvious reasons, this technique is not to be used when a synth is playing more than one part (e.g., both first and second clarinets) at a time.

Don't forget to breathe. Real wind players do, so be sure there's some silence between phrases and that phrases don't go on forever. Continuous, uninterrupted woodwind lines not only sound inauthentic, they cause the listener to tune out.

Vibrato is as important with winds as it is with strings. Variations in vibrato between closely related voices is crucial; nothing gives away the fact that you're using synthesizers more than an entire brass section whose vibrato is in perfect lockstep. Vibrato is also an excellent way to accentuate a voice without making it louder: Add a thick LFO on a held note, and it will seem to swell, even if there's no volume change. Use vibrato in the ways that real wind players do: Long notes benefit from a vibrato that increases after the attack, changes slightly in speed over the sustain, and goes away as the note dies. Quick and short notes on winds, however, should have no vibrato at all.

Control over envelopes should also be part of the expressive mix. Even more than on strings, soft notes on winds have slower attacks and less breath-noise or "chiff" than fast notes. If your synth has a Sample Start Time parameter, set it up so that lower velocities cause the sample to start later, thereby minimizing the chiff.

Next month, Part 2 will cover when to use Velocity and when to use Volume; other kinds of real-time control; voicing chords; the percussion family; and creating a realistic orchestral image in your mix. Stay tuned.

Paul Lehrman *studied composition, orchestration, electronic music, and bassoon (in that order) at Columbia University and the State University of New York at Purchase. His first orchestration with a computer was a movement from a Mendelssohn symphony, performed on an Alpha Syntauri. Although it sounded awful, he's learned a lot since then.*

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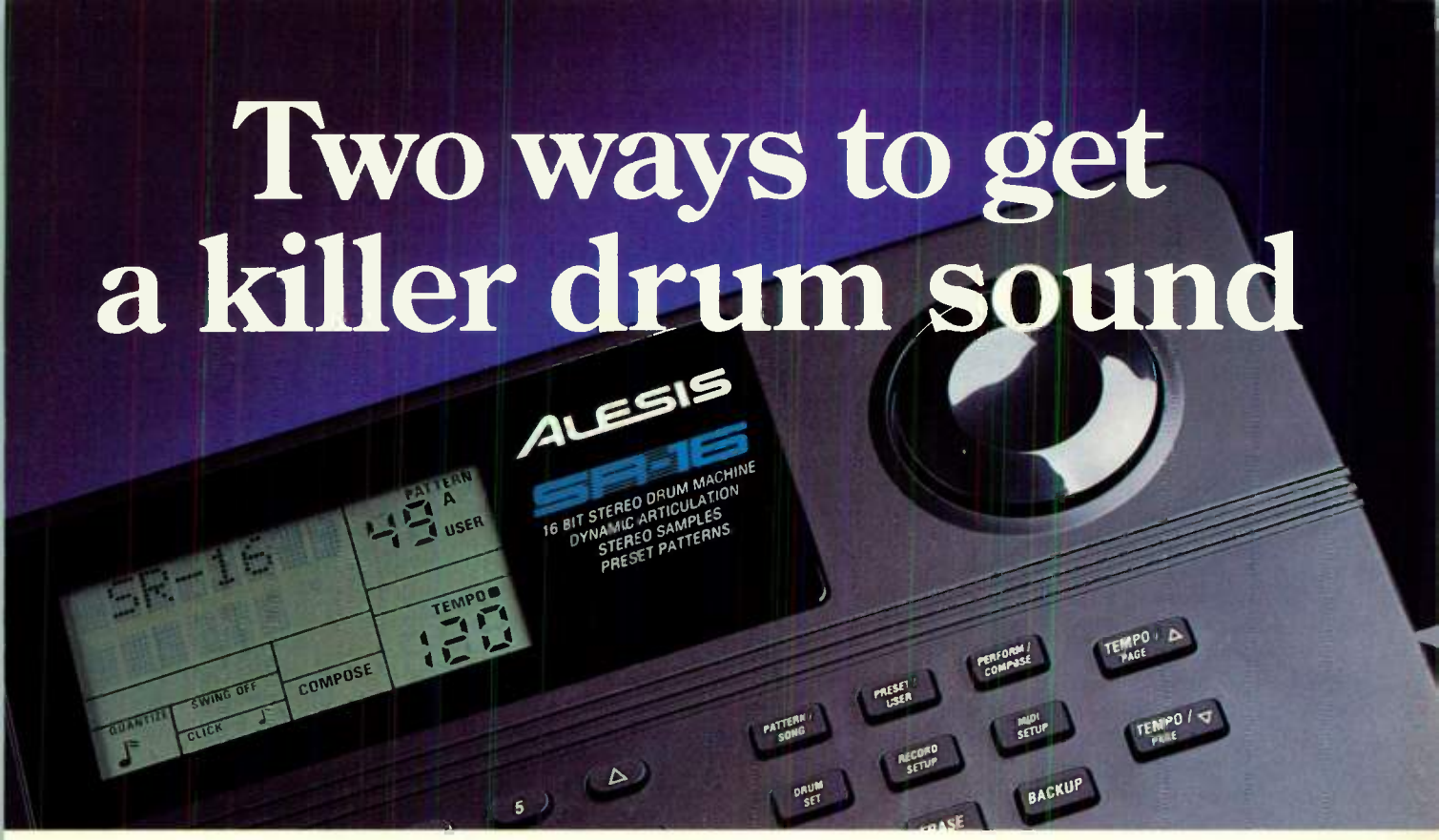

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Like money, happiness, good music, and hard-disk space, RAM is one of those commodities most people just can't get enough of. Whether you're working with computers or samplers, you'll always find ways to use whatever amount you have and end up wanting more. Thankfully, the latest generation of turbocharged samplers and sample RAM-equipped synths support up to a whopping 64 MB of memory. In contrast, the Sequential Prophet 2000 and E-mu Emulator II supported only 512 KB of RAM, the Korg DSS-1 limped along with 256 KB, and the Ensoniq Mirage had a mere 128 KB. Even the high-priced Kurzweil K250 came with only a half-megabyte of RAM. Given the technological limitations of the time, sound designers worked wonders.

Today, vast amounts of RAM are available, but there's never enough to waste. It's still important to maximize your

Photograph by David Wasserman

MAX RAM

memory whenever possible, for several reasons. First, RAM isn't cheap, so most people opt for much less than the maximum amount available. Second, a lot of people still use older instruments. Finally, working musicians who take samplers on stage every night need to be as efficient as possible. Back when sample memory was minimal, keyboard players sweated out the painfully slow process of loading in a set of sounds from disk between songs (while another band member kept the audience distracted), praying they wouldn't get the dreaded "disk error" message halfway through the load. The advent of samplers with SCSI made the process faster, but no less nerve-wracking, especially given the fragility of hard-disk technology at the time.

In my recent work, I've picked up quite a few RAM conservation tips. In fact, many of the things I learned from these efforts have helped me create better samples, even when I don't have any space limitations.

GETTING SMALL

As I discussed in "Sampling Master Class" (June 1993 EM), certain sounds work well as small samples. For example, most brass, reeds, and woodwinds take up little RAM, provided there's not too much "breathiness" in the original recordings. For instruments such as trumpet, French horn, sax, clarinet, and bassoon, the waveform becomes fairly steady (sound designers use the term "static") almost immediately after the initial attack transient. As a result, samples of these instruments only need to be about a quarter of a second long.

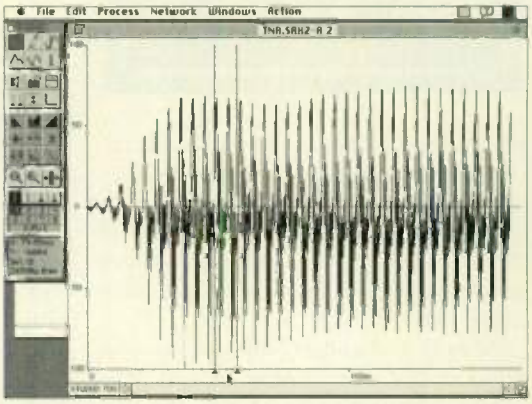

FIG. 1: Many instruments can be accurately captured using small samples. The tenor sax sample shown here was originally 200 ms long, then looped at about 50 ms, without any noticeable difference in timbre or sacrifice in quality.

The same is true for certain plucked instruments, such as harp, and tuned percussion, such as marimba and xylophone. These instruments' waveforms rapidly approach the shape of simple sine or triangle waves after they are plucked or struck. Even electric pianos and organs become fairly pure waveforms if you sample them without any chorusing or detuning. (In most cases, it's better to add fattening/sweetening to the finished samples anyway.) Fig. 1 illustrates how tightly some of these sounds can be looped.

If your sampler gives you a choice of sampling rates, you can also keep your file sizes manageable by sampling at lower rates. I have sampled electric

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guitars and basses at rates as low as 22 kHz. Even though they sound bright, electric guitars (even Stratocasters) have little high-frequency energy above 10 kHz. In fact, the speakers in most guitar amps can't produce frequencies higher than this.

Most drums and percussion, such as toms, kicks, and congas, sound fine when sampled at 32 kHz. Even the instruments I mentioned previously—trumpet, French horn, oboe, and the like—sound excellent at 32 kHz. The instruments I prefer not to sample at lower rates include cymbals, harpsichord, bright 12-string guitar, and certain percussion (such as tambourine and glockenspiel). Most samplers offer a good selection of sampling rates, or provide the user with a way to internally convert samples to a different sample rate. Take advantage of these features.

If you have RAM to spare, sample at the highest available rate. But sampling at lower rates saves critical space when you need to conserve memory. In most cases, the trade-off in sonic quality is virtually inaudible. Try it yourself: Sample an electric guitar, or even an acoustic guitar, at different rates, and see if you can really hear the difference. If you've never tried this, you're in for some surprises.

By keeping your sample files small, you can include more samples across the keyboard, which is a real luxury. This lets you minimize the timbre shifts and bad split points that occur when transposing samples up or down by too many notes. Small files also load into your sampler faster and give you room to fit more instruments at once, which is particularly important if you own an older machine that places a strict limitation on maximum RAM.

SQUEEZING DOWN

Violins, cellos, and other bowed instruments are much harder to work with and tend to eat up more space because the waveforms never become as static as the instruments mentioned earlier. The same goes for breathy instruments, such as flutes and piccolos, and for complex, decaying sounds, such as acoustic pianos. These instruments are notoriously tough to loop, even when you have plenty of RAM. If you're fortunate enough to have 16, 32, or 64 MB in your sampler, and you've maximized your other samples, you can afford to allocate more memory to these sounds.

If you're working within a tighter memory constraint, here's a trick that seems to work most of the time. The idea is to loop the sound much earlier than you normally would to fool the ear into not expecting the sound to evolve further. In the case of a bowed string, loop the sample immediately after the bow has "excited" the string into motion. **Fig. 2** illustrates a bowed cello played without vibrato. Because you can't hear this sample (at least, until the interactive version of **EM** is developed), I'll tell you that the timbre continually shifts as the bow is drawn across the string. Even a long loop that uses liberal crossfading would be obvious if the sample is heard by itself.

In **Fig. 3**, I grabbed a small number of samples right after the string had settled into a constant pitch, and I did a bit of crossfading. This technique creates a short sample that loops well before the ear hears any evolution of the tim-

bre. The bow scrape during the attack portion of the sound and the overall pitch and tone are enough to give the listener the sonic information that says, "This is a cello." By closing the filter slightly during the portion of the sample that goes into the loop, you can often mask the fact that you're using a short loop. The ear hears a subtle change in overall timbre during that part of the sound, and often it's enough to adequately disguise the loop points. You may also want to modify the amplitude envelope to decay a bit, but at a slightly different rate than the filter envelope. Adding vibrato via an LFO also gives your minimized sample more animation and helps disguise the loop points.

The same basic technique also can be applied to naturally decaying sounds, such as pianos and guitars. The Korg M1 acoustic piano is a good example of a fairly short set of samples that were looped early, but still sound good because the ear hears the distinctive sound of the hammer hitting the string. As a result, you clearly identify it as a piano. In most of today's music, few samples are exposed enough for most listeners to discern where the loop points are.

You can also get surprisingly small sound files from instruments that were sampled with vibrato. If you get an opportunity, listen to the PlusONE's Solo Flute and Solo Violin. Despite the fact that there are a lot of samples in each multisound (particularly for ROM-based sounds), the total memory required for both is just under a megabyte. I recently recorded another violinist whose vibrato technique was so strong and consistent that I was able to loop the samples on the first cycle of the vibrato. As a result, each sample is about half a second long. This allowed me to digitize nearly every note across the full range of the instrument and still fit it into about 2 MB of memory. Had I chosen to do so, I could have digitized every other note at less than the 44.1 kHz rate I originally used and fit everything into less than 1 MB. Stretching this to every third note probably would still sound good for most applications and would

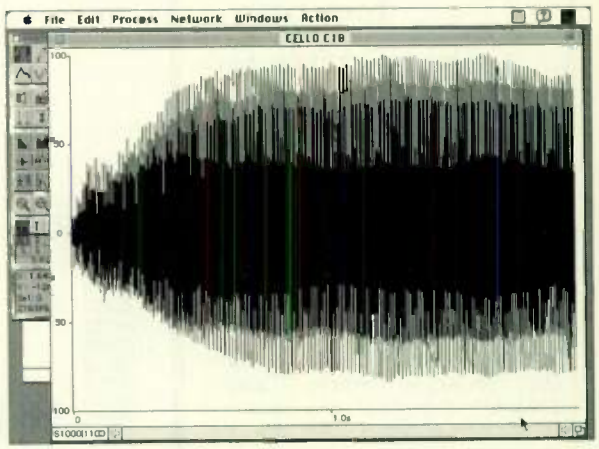

FIG. 2: A 2-second sample of a bowed cello without vibrato. If your sampler has 2 MB of RAM, you can expect to fit about eleven samples recorded at a 44.1 kHz sample rate.

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take up even less room.

This example brings up another point: If you want to create samples from scratch that maximize your available RAM, it's important to start with excellent recordings of good musicians. The sooner your player can stabilize his or her tone and accurately settle into the correct pitch—many instruments exhibit some amount of pitch shift during the attack portion of the note—the smaller the samples can be. I cannot overemphasize the abilities of the musician in the production of a great set of samples.

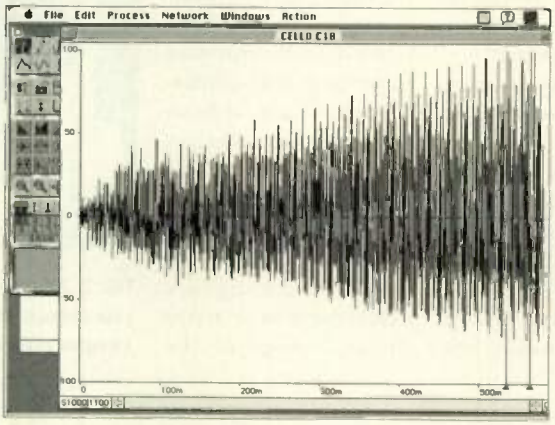

FIG. 3: By using a tight crossfade loop on the cello sample shown in Fig. 2, the sample has been reduced to just over 0.5 seconds in length. Further manipulation, such as boosting the amplitude of the attack portion of the sample, can improve it further. Eleven samples at this size would only take up about 5.5 seconds of sampling time, or less than 0.5 MB of memory.

LOOPING TOOLS

One other key element is involved in generating good, small samples: your looping tool. Many samplers, such as the Akai S1000 and S3000 series and Kurzweil's K2000S, have excellent graphic displays that make looping a lot less painful. In addition, most recent models include some form of crossfade looping. While I haven't tried every sampler on the market, Akai's S1000 version 1.0 software provides some of the best short crossfade loops I've heard. Almost every sound in the InVision PlusONE was looped using this machine and software. Oddly enough, later versions (2.0 and up) of the S1000 software don't do as good a job.

For longer crossfade loops in sounds such as string and brass sections, I've found that Kurzweil's K2000S does a superb job. Five different kinds of crossfades are available on this machine: linear, exponential, equal power, cosine, and mix. Linear works best on decaying sounds, such as guitars; cosine works great on samples with vibrato (or even Hammond organs with a fast Leslie); and equal power is perfect for most section material, such as brass or string ensembles, or complex synth tones with lots of chorusing and detuning. The mix algorithm is best suited for blending one instrument into another (i.e., a flute becoming a violin), while the exponential algorithm is suited only for specialized applications, because an exponential curve simulates the natural decay of acoustic instruments, such as harps and bells.

If your dream is to become a real sampling dynamo, consider stand-alone sample-editing software for your computer, such as Digidesign's *Sound Designer II* or Passport's *Alchemy* (which unfortunately has been discontinued) for the Macintosh, or Turtle Beach's *SampleVision* for the IBM and compatibles. Jupiter Systems' *Infinity* looping software for the Mac, which will be available by the time you read this, has but one goal in life: to produce great loops without a lot of hassle. It's not exactly cheap (especially because it runs like a wounded snail if you don't have a DSP-equipped Digidesign sound card to do the math), and it doesn't provide any other sophisticated sample-editing capabilities, but your investment will pay for itself in short order if you're creating a lot of your own samples.

Having said all this, only one thing is left to mention on the subject: There's still no easy way to get great samples, maximized or not. The process requires patience, large quantities of time, and an enormous amount of trial and error. Once you've finished, though, there's a great sonic reward. So get back to work on that tubular bell sample; the gig's this Friday!

Jim Miller *is co-owner of Stratus Sounds, senior sound designer for InVision Interactive, and the author of a number of sampling articles in* **EM**.

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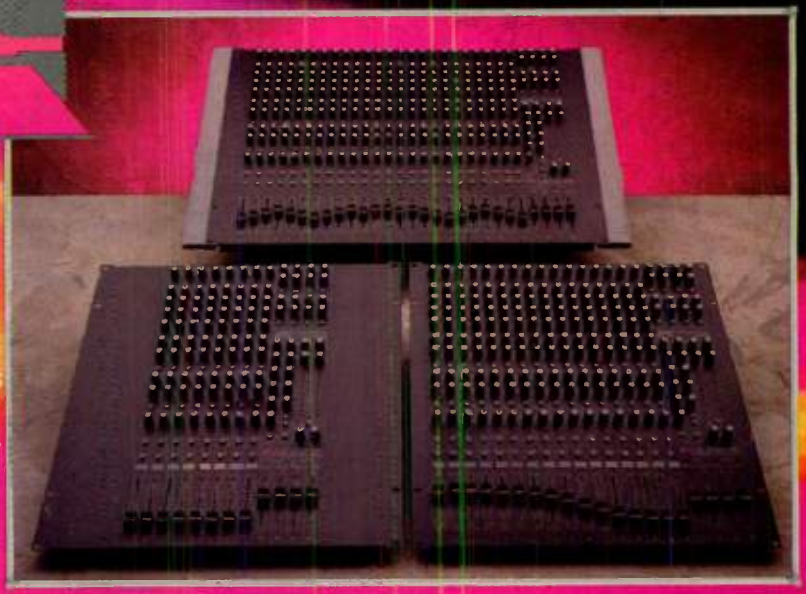

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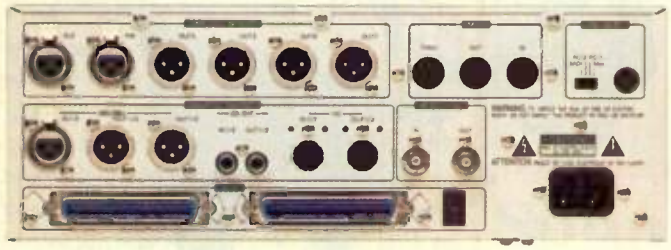

detail of back panel

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YAMAHA

Speed Sequencing

work, there was an equally positive synergy helping to dream musical thoughts into sound. This led to a big revelation: Sequencing *is* composition. Or at least, the composer in me had assimilated the sequencer into a seamless and natural way of working.

A necessary ingredient of this evolution was speed. In the past, I'd always dawdled, teacup in hand, nudging this and bumping that, taking a sip, undoing everything. Then deadlines appeared, and it was time to get MIDI-buff, transforming musical ideas faster and faster into sound. This process not only increased my output, it more faithfully represented what was in my head.

The idea of speeding thought to medium is nothing new to artists. Some Beethoven sketches show the stems of his notes at acute angles to the staff, indicating a desperate desire for his hand to keep pace with the progress of the music in his head. Our limited ability to bring the stuff we imagine into sonic reality still remains the major creative bottleneck, even with digital sequencers. Speeding up your sequencing is the best way to become as creatively fluent as possible.

GENERAL

The first step is to control how much technology you inflict on your talent at a time. For instance, today's sequencers are heavily forested with features. Manufacturers feel they need to do this to attract a lot of different customers. But you don't have to learn the whole package to get started making music. You may only need to use 25 percent of a computer program or dedicated sequencer (the other 75 percent may be for other people doing other things). Get up and running with the stuff you need to know, and then keep the manual handy every time you want to do something new.

A lot of software sequencers also keep the screen crammed with stuff you never, or only rarely, use. Close these windows if you can, make them smaller, or move them out of the way (see Fig. 1). Many programs let you save this look; every time you begin a new file, your customized screen arrangement appears. Many products also let you save templates of personal preferences such as click options, recording modes, input filtering, instrument assignments, and even quantization settings. How many times have you selected the same options, and enabled or disabled the same controls every time you begin another piece of music? Don't do it any more.

Another way to accelerate sequencer facility is to make sure both hands operate the user interface. Most programs provide both mouse controls and keyboard commands, but the majority of users settle for one or the other. Typically, the mouse is way overused, leaving the other hand dangerously unoccupied. Learning keyboard commands, especially transport controls, can double sequencing speed. Some programs can even be controlled from your MIDI controller, which really lets you fly.

Finally, the very aspect that makes MIDI sequencers so powerfully attractive—the endless gallery of elegant editing tools—can slow you down to one track per night if you insist on cleaning up, tucking in, or otherwise loitering with a part right after it's recorded. Of course, the temptation is tantalizing and quite innocent; you simply want to make it sound as good as possible. However, you don't even know if it's worth keeping yet. At the least, there's a good chance you will punch in to fix a section, or re-record the whole thing again once more parts are added. I could probably turn out a complete CD's worth of material for all the time I've spent tweaking unused MIDI tracks.

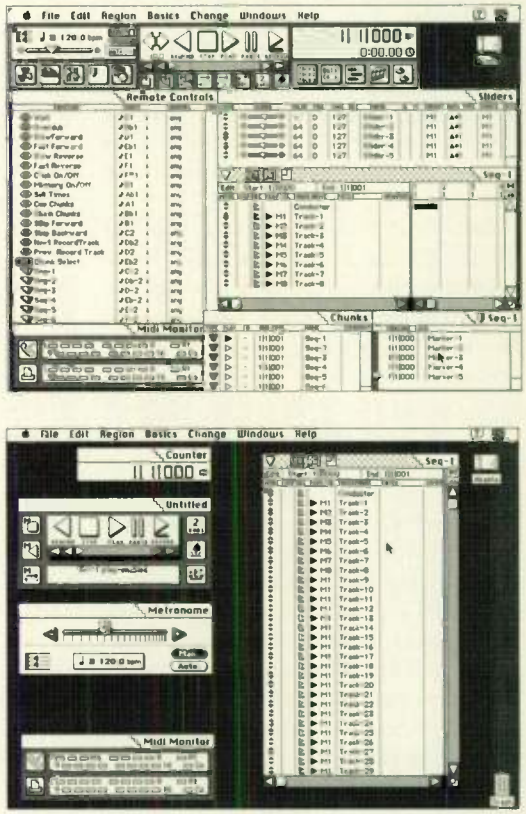

FIG. 1: It's tempting to keep multiple screens open while using your sequencer (top), but you'll work much more quickly if you reduce screen clutter to only what you need (bottom).

RECORDING

The urge to power-edit everything also leads to lazy recording habits. How many times have you seen an excellent player settle for the first take of whatever they played, no matter how off it might be, just because they were "entering data"? In studios, producers spend a lot of time coaxing great performances from singers and players. As a combination performer/producer in your own MIDI studio, you need to do the same thing; the more care you put into recording the tracks, the less you need to edit.

Recording is one of the areas where sequencers shine over tape. First of all, most programs sport an obscenely large number of tracks. It's tantamount to having a 24-track for every member of your band! But do most people use more than ten or twelve tracks? No. I find that amazing. Good players can benefit from recording many takes of the same part because they can easily store and recall different versions for the final mix (or mixes). Average players can use many MIDI tracks to work on sections of a part, piecing them together later. It's vital to name each track and move them so the important ones are at the top of the track list, and the work tracks and alternate takes are at the bottom.

One of the most difficult things to pull off in MIDI land is a solo. If you try

Speed Sequencing

to simulate an acoustic instrument playing in the foreground of the musical texture, you need to visualize the player and hear the sound clearly before beginning. Hearing the real instrument in your head reveals what *not* to do. Flutists don't play notes that continue to ring out as they play more notes, sax players don't vibrate and bend notes as if the mouthpiece were made of silly putty, and guitarists and drummers (even the great ones) don't play things that are physically impossible. Getting the acoustic model solidly in your head helps you avoid these blunders.

Deciding what to play is another game. If your sequencer has a loop-record mode, use it liberally. Set the Record mode to "replace," and jam over the loop for a while; then mute that track, record-enable another, and do it again. I can easily eat up eight or more tracks in this way before reviewing it all. At that point, either choose the one you like, or take the best bits from each loop and copy/paste them together into a new track.

Recording MIDI drum tracks with a keyboard controller can be quite abstract, because it's hard to reconcile the physical image of the drummer with our own hunting and pecking. Nevertheless, try to model drummers as much as possible. For example, they play different drums of the kit together. As much as possible, do the same. Choose two or three drum sounds to record together; the rhythm of the sequence will be much groovier than if you try to overdub each drum individually.

Drummers also set up the drums so they are all in a comfortable playing position. You can do the same. Remap the keyboard layout in your module or sampler, or do it in the sequencer with the help of an instrument map. If your sequencer supports templates, you can develop some that transform the percussion layouts in different sound modules into setups that fall easily under your fingers.

One trick I use to get realistic drum flams and rolls on a keyboard is to map the same sound, with the same transposition and maximum Velocity sensitivity, on consecutive keys. Then I can roll my hand across the keys for interesting "stick bouncing" and "ghost note" effects. (Just don't hit the keys simultaneously unless you want to flange them on purpose.)

EDITING

The power and glory of digital sequencing is found in the editing tools. In spite of what I said earlier, I'm a dedicated tweaker and would gladly take back every project for at least another five hours of nudging, pushing, stretching, and scaling. And then another five hours. And so on.

There are a few ways to speed up the work along the way, however. One useful technique is to copy a full track to an empty one before beginning a complex multiple edit, something you can't undo. Also, housekeeping chores such as naming tracks intelligently and organizing them into sections take some time initially, but they easily pay off over long editing sessions. I use blank tracks with some character graphics (stars or hyphens) to separate groups of tracks in large track lists (see **Fig. 2**).

Pitch-domain editing is straightforward in most sequencers. Most people create tonal music with twelve chromatic pitch classes, and mistakes can be quite obvious. In list- or graphic-editing windows, wrong notes are easily moved or reassigned, and extraneous notes (keys touched inadvertently by the player) are easy to spot because of their low Velocity and short duration. Surprisingly, I have reviewed many excellent sequences that still contain this subliminal clutter, and it affects the material like noise. "Scrubbing" is the fastest way to clean tracks. In a sequencer that offers this feature, use the mouse or inc/dec keys to play the track event by event, instead of starting and stopping the transport over and over.

Time-domain editing is something else again. Modern sequencers have more resolution than ever—480 pulses per quarter note is typical for a professional sequencer—so the feel of, say, a horn solo can be faithfully captured in the MIDI track. However, make sure you only edit a copy of a track like this, so you can try again if something goes wrong.

The most powerful urge to fight when it comes to time-domain editing is instant quantization. Too often, we immediately tighten up the time in a sequence track, only to take more time adding artificial "humanization" later. Even with the worthy customization tools sported by many sequencers (such as bringing notes part way to the grid, or leaving notes already near the grid alone, or randomizing rhythmic positions), global commands that regulate time events can cost your music soul. They have their uses, particularly for drums and percussion, but I suggest you edit your timing consciously and specifically.

For example, if the solo horn part has four phrases, maybe the first one must be completely step edited, the second one can be 80-percent quantized with some swing, the third one only needs to be shifted (offset) six or eight clicks, and the last phrase can be left alone except for two notes. In this way, you're keeping much of the original performance intact, and using various techniques to improve the timing of the rest.

If you're familiar with your own work habits, you can edit faster without resorting to over-quantization. For

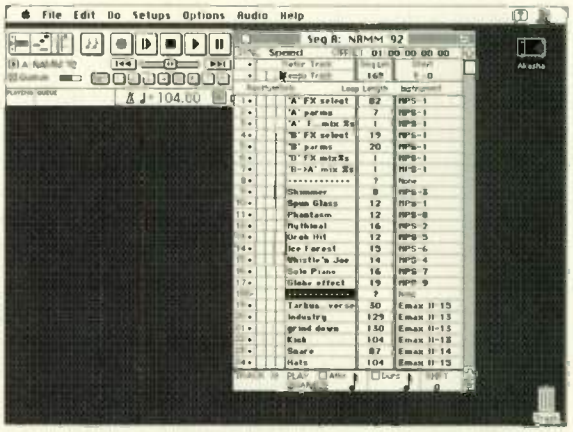

FIG. 2: If you have long track lists or want to separate alternate takes, name blank tracks with hyphens to organize your tracks into logical groups.

example, when I play a sax solo part, I invariably play behind the beat, use way too much pitch bend and mod wheel, and overplay in general. So, before doing any other edits, I offset the track earlier, scale all pitch modulations to about 40 percent, and cut out the notes that lie between phrases. When the sax isn't behind the beat, there seems to be no reason for quantization, so I step edit stuff like "heavy thumb" Velocities, clean the track, and leave it at that.

Percussion is an exception to this rule because it functions as a time keeper for the listener, so its timing must be accurate. Also, drummers simultaneously play multiple instruments, so it's possible to treat each instrument with different types of global time correction. This maintains solid timing but allows for interesting ensemble fluctuations.

The best way to achieve this is to separate each drum onto its own track. For example, if you play the hi-hat part first and then add a second pass with kick, snare, and toms together, select all notes of each drum and copy them to separate tracks. For variety's sake, try using different quantization techniques for each one. Maybe the whole kick track is strictly quantized, while the snare quantization is around 80 percent, the toms are hand-tweaked in the edit list, and the hi-hats are quantized with swing. Having each drum on a separate track also lets you shift each one differently; maybe the hat can push just a little by offsetting it two clicks early, and the snare can really pop ahead of the beat by offsetting it six clicks. Some sequencers let you shift tracks in real time, which helps you find the right feel while the music is playing.

Sampled hand percussion and hi-hats tend to sound extremely mechanical and edgy in MIDI sequences because of the constant, unvarying attack transients. To keep the hats from screaming "SAMPLE!" try modulating the attack of the envelope in your sampler or sound module so that soft Velocities produce less attack and more "swish." This can sound a little unreal when the track is soloed, but just right in the mix.

Creating realistic drum grooves can be extremely time consuming. I often develop a pop song over a simple, repeating, 2- or 4-bar drum pattern, thinking there will be time to jazz it up later. If there isn't time for elaborate drum programming, I usually take the snare track out of Loop mode and record it through the whole song, playing the breaks and making it sound as live as possible. This has the almost unbelievable effect of making all the drum parts sound interesting and nonrepetitive.

Maybe the single most important thought in producing real-sounding sequences is that you *are* tracking. When you choose the sounds, you're choosing the band. When you record, you're coaxing the best performance from yourself. When you visualize the space, you're placing the players in it.

MIXING

MIDI Control Change (CC) messages are usually meant for continuous parameter changes, but they can also be used as static commands. For example,

Speed Sequencing

I typically place one value for CC10 (Pan) at the head of each track along with the Program Change number that sets up the sound. With separate drum tracks playing on a multitimbral drum module, you can easily spread the drum kit around the center of the image and place all the other instruments exactly as you visualize the band setup in your mind.

Another important element in a musical mix is dynamic volume control. This is easily achieved using CC07 (Volume). Many sequencers have soft faders that can be operated and programmed using a mouse, but I haven't met a mouse I trust to change the gain during the music. I recommend assigning a keyboard wheel (the mod wheel is ideal) or MIDI fader box to this duty. Depending on how many MIDI channels you have in your studio, you can achieve really nice effects by assigning the same patch to two or more channels and controlling their volumes separately. This works well for strings, because it suggests individual players who make up the ensemble.

Many synths and sound modules let you control different parameters via MIDI. In fact, the sequencer can make a lot of music with a few sustained notes and some filter sweeps and LFO effects in addition to volume, pan, and pitch control. Try a subtle filter sweep on an otherwise static synth pad backing a pop/rock sequence. Subliminal motion like this helps to animate the whole sound.

Controlling ambience from the sequencer is definitely worth the price of admission. Get a reverb or multieffects box that allows continuous control of parameters such as decay and delay time, effect selection, and modulation functions for chorus or flanging. Make sure the unit doesn't glitch too badly under MIDI control. Set up certain faders in your sequencer for the appropriate MIDI controller numbers, and try making effects patches from the sequencer. When you find something good, step enter the values into a track, and name it descriptively. This way, you can build a library of ambient effects and load (copy/paste) them into any sequence for reuse.

FINALLY

Perhaps the most important relationship in electronic-music composition is between composer and sequencer. Learning the most esoteric aspects of your sequencer can be fun, but it may not automatically lead to more musical sequences. However, using some of the basic features (customized screens and graphics, lots of tracks, loop modes, deliberate quantization, and MIDI mixing), along with some imagination of your own (hearing the players, seeing the band), can speed up the interface between your muse and the world, letting people hear what you hear. And that is one of the final frontiers.

Oops, gotta go—it's time for therapy. Today we're going to talk about those crashes I've been having....

Gerry Bassermann *is a musician living in San Francisco, producing electronic music and doing sound design with Opus Nine Productions.*

Alex

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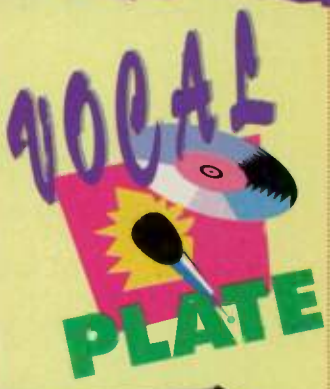

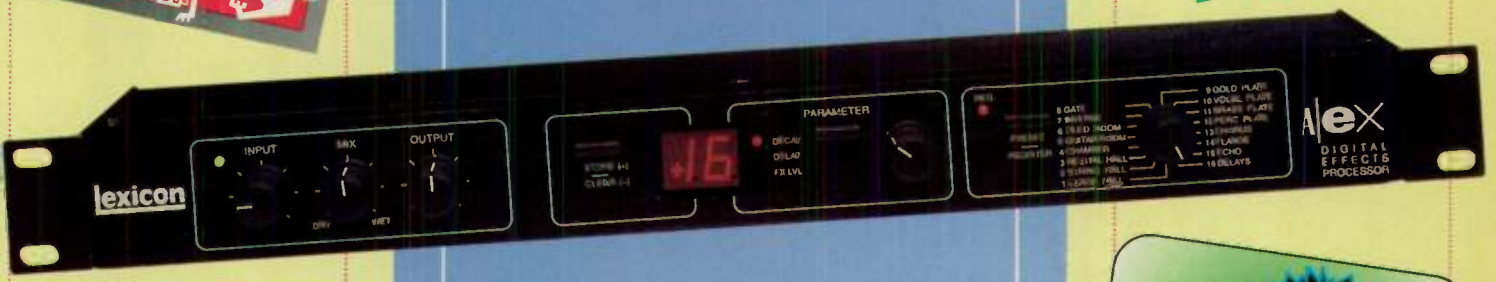

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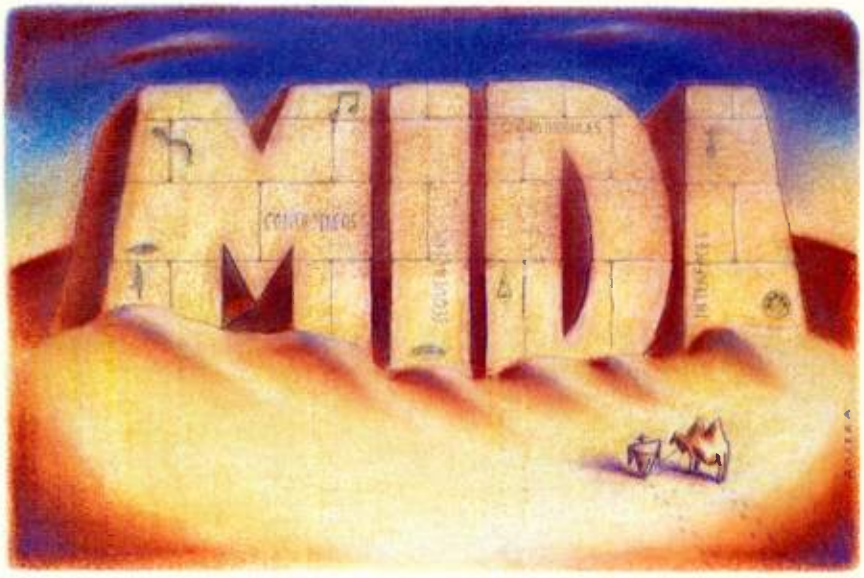
MIDI Basics, Part 2

By Scott Wilkinson

Explore the meaning of MIDI by looking at various system designs.



MIDI holds great potential for musical expression in the electronic medium. However, it is also fraught with pitfalls that can frustrate the uninformed. If you're new to MIDI, it's easy to get caught up in the theory of what MIDI is. While delving into the details of different MIDI messages has educational value, it's more important to know how to make MIDI work for you.

The best way to get practical information is to learn how MIDI systems operate and how you can start using them to make your own music. (If you're still unclear on the basics, I suggest you read last month's installment, "From The Top: MIDI Basics, Part 1.")

MIDI DEVICES

Before you start designing a MIDI system, it's important to understand four basic types of MIDI devices: controllers, sound modules, sequencers, and interfaces. The most common controller is a keyboard, but other types are available for players of different instruments. For example, guitar controllers let guitarists send MIDI messages to external sound modules or sequencers. There are also percussion, woodwind, brass, and violin controllers, as well as alternative controllers that don't necessarily resemble traditional instruments. A special device called a *pitch-to-MIDI converter* detects the pitch from a microphone and translates the information into MIDI messages. This lets vocalists and other acoustic instrument players control MIDI sound modules and record sequences.

Sound modules are rack-mount or tabletop MIDI sound sources that lack a controller. A basic MIDI system consists of one or more controllers of different types and one or more sound modules. (Keyboard synths and samplers combine a controller and sound module in one device.) The controller sends MIDI messages on a specific MIDI channel or channels, and the sound modules are set to receive on specific channels. Each sound module responds only to incoming MIDI messages on its specified channel(s). We'll examine some implications of this arrangement shortly.

SEQUENCING

Sequencing is the most common MIDI application. A sequencer records MIDI messages generated by a master controller. When played back, these messages are sent back to the MIDI instruments in the system, which respond as if their controls were being manipulated directly.

There are two types of sequencers: hardware and software. Hardware sequencers are small computers dedicated to sequencing. These devices are convenient for live gigs and road tours because of their portability. However, they generally have small displays and can be difficult to operate. Drum machines combine a hardware sequencer and a sound module into a single unit dedicated to creating drum and percussion parts.

Software sequencers are programs that run on personal computers. They offer the advantages of large displays (the computer screen) and easy upgrades. Unlike hardware sequencers, computers running sequencing programs require a separate MIDI interface to translate between the language of MIDI and the internal language of the computer. The only exceptions to this are the Atari ST, TT, and Falcon030 computers, which have an internal MIDI interface.

A simple sequencing system consists of a controller, sequencer, and one or

BRIAN RASZKA

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more sound modules (see **Fig. 1a**). In this case, the sound modules can be connected via MIDI Thru jacks in a *daisy-chain* configuration, making it easy to assemble the system. Most sound modules are *multitimbral*, which means they can play several different instrumental sounds at once. In other words, one electronic instrument can simultaneously produce piano, bass, drum, strings, brass, or any other combination of sounds. Each sound responds to messages on a different MIDI channel, so each of the parts can be independent. To record a part using a particular sound, you set the controller to send on that sound's channel. Many MIDI musicians find that one multitimbral module is all they need, which streamlines things considerably.

Many keyboard instruments include an internal sequencer and effects processor in addition to a multitimbral sound module. These *keyboard workstations* let you create entire orchestrations with a single device. They also allow you to record parts for external sound modules, using the workstation's onboard sequencer (see **Fig. 1b**).

If your system includes many devices, it's more efficient to connect them in a configuration called a *star network* (see **Fig. 2**). In this design, the MIDI messages from the sequencer are distributed to all MIDI devices by a central *MIDI patch bay* that controls the routing of messages to and from all MIDI devices in the system.

▼

One of the hippest aspects of MIDI is its expandability.

Drum machines are often used in sequencing systems, as illustrated in **Figs. 1** and **2**. In many cases, they simply play drum sounds in response to MIDI Note On messages. The notes that define the drum part (middle C might be the bass drum, D might be the snare, etc.) are recorded in the sequencer and sent to the drum machine, which responds just like any other sound module. The role of drum sound source is often played by a multitimbral sound module, using one of the instrument's drum "kits."

A drum machine can also record and play the drum part all by itself, using its internal sequencer. This frees the primary sequencer to record other parts, but it also raises a problem: How do you get the drum machine and primary sequencer to play together? It's almost impossible to press the start buttons on both devices at precisely the same instant, and even if you could, they would probably drift apart after awhile.

SYNCHRONIZATION

Once again, MIDI provides the answer. One sequencing device (usually the primary sequencer) is the master, while all other such devices, called "slaves," are synchronized to it. The master sequencer sends synchronizing messages that tell the other sequencing devices what to do.

For example, the Start message instructs all sequencing devices to start playing at the beginning of the sequence; Stop tells them to stop playing; and Continue tells them to resume playing from where they stopped. When all devices are playing, they remain in sync with the master, which sends out a stream of Timing Clock messages 24 times per quarter note to indicate the tempo.

If you want to start all devices in the middle of a sequence, you simply tell the master device where to start. The master sends a message called *Song Position Pointer*, which tells the slaves where to begin playing within the current song. Thus, recording and playback can begin anywhere in the song.

Many musicians want to record vocals and other acoustic instruments along with sequenced tracks. MIDI sequencers cannot record audio, so these parts are usually recorded on a multitrack tape deck. But how do you synchronize a tape deck with a sequencer? This requires another type of device called a *sync box*, which translates between the sync messages of MIDI and a special sync signal that is recorded on one tape track (see Fig. 2).

Once the sync signal is recorded on the tape, it is played back through the sync box, which converts the signal into MIDI sync messages that can be sent to any sequencing devices in the system. This process keeps all sequencing devices synchronized with the tape. In most cases, you can stop the tape, rewind or fast forward to any point, and resume playback; the sequencing devices will start playing at the appropriate point, thanks to the Song Position Pointer message.

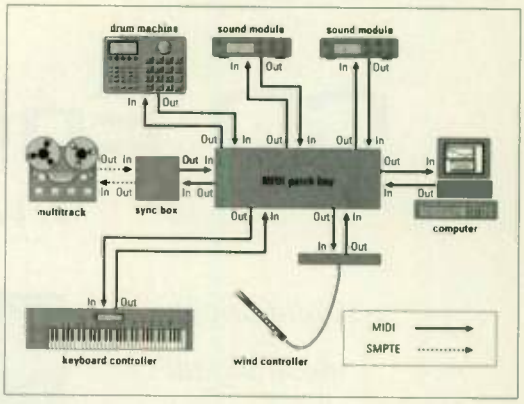


FIG. 2: Complex sequencing systems use a star configuration in which a MIDI patch bay distributes MIDI messages throughout the system. Combining a multitrack tape deck with a sequencing system requires a sync box that translates between MIDI messages and the sync signal recorded on the tape.

SOUND EDITING/ ORGANIZATION

Another important application of MIDI is sound editing and organization. Most synths provide a relatively small display, which makes it difficult to edit their sounds from the front panel. Computers come to the rescue with large displays and programs called *editor/librarians*.

The librarian part of these programs retrieves sound-parameter data from your synths, and the editor lets you alter the sounds in the computer. After you finish editing, the computer sends the parameter data back to the appropriate devices. The librarian's main function is to let you organize your sounds. For example, you might create one library of all your bass sounds, another library of all your string sounds, etc. Alternatively, you might create a separate library of all the sounds you use in each song.

This application requires *bidirectional communication* between each device and the computer, i.e., each device must be able to send and receive MIDI messages to and from the computer. A MIDI patch bay provides this capability. The MIDI Out from each device is connected to a MIDI In jack on the patch bay, and the MIDI Outs on the patch bay are connected to the MIDI In on each device. This lets you route MIDI messages anywhere.

The patch parameters are carried by *System Exclusive* (SysEx) messages. Instead of representing something common to all devices, SysEx messages represent the unique characteristics of each device. For example, Yamaha instruments create sound in a totally different way than Roland instruments; SysEx messages let you address parameters that are specific to each instrument.

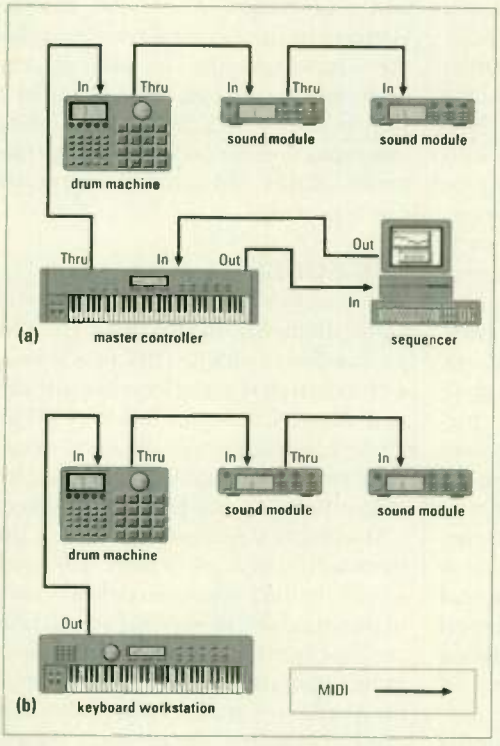


FIG. 1: A simple sequencing system (a) uses a daisy-chain configuration. A keyboard workstation (b) includes an internal sequencer that can record parts for external sound modules.

EXPANDING APPLICATIONS

One of the hippest aspects of MIDI is its expandability; the specification that defines it is open-ended. Over the last ten years, many new messages have been added to provide an ever-increasing range of applications. MIDI Time Code is one example of such an addition; it provides more sophisticated synchronization messages.

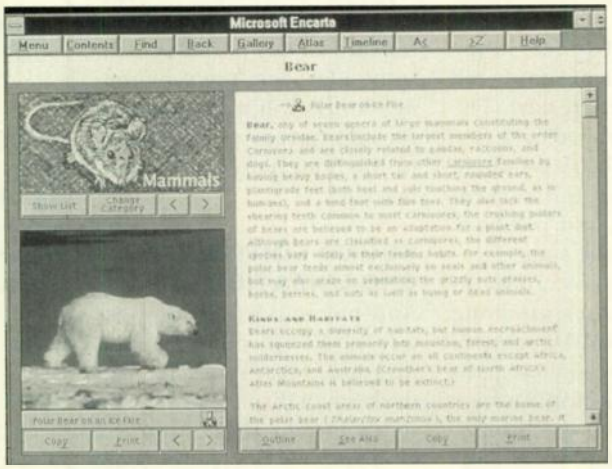
Other additions include Standard MIDI Files, which represent sequences in a standard way that can be shared by different computers, and the Sample Dump Standard, which represents sample data in a standard way that can be shared by different samplers. MIDI Machine Control is designed to control tape decks and other studio equipment from a sequencer or other MIDI device. MIDI Show Control lets MIDI devices control lights and other equipment used in live shows. MIDI is continually evolving, and we'll see many more additions in the future.

There's much more to learn about MIDI, but you now have a basic understanding of how it works. Hopefully, this information will help you keep up with the dizzying pace of technological development as electronic music races into the next century. It ought to be a wild ride!

CD Encyclopedias

By Bob O'Donnell

Audio brings these digital warehouses of knowledge to life.



Microsoft's *Encarta* has the most elegant user interface, and the most audio examples of all available multimedia encyclopedias.

Since their beginnings almost 2,500 years ago in ancient Greece, encyclopedias have attempted to encapsulate the world's knowledge into one convenient source. Until the digital revolution, that "one source" necessitated hefty, multivolume sets of printed books. Today, the wisdom of the ages can be stored on one feather-light CD-ROM.

Because of their enormous scope of diverse information, encyclopedias are tailor-made for the multimedia boom. In fact, many of the most popular multimedia titles are CD-ROM versions of print encyclopedias. Multimedia encyclopedias are also striking examples of the storage capabilities of CD-ROM, cramming millions of words, thousands of articles, and hundreds of audio and video clips onto a single, silvery disc.

With the advent of CD-ROM, encyclopedias have literally become, as their Greek derivative—*enkyklios paideia*—translates, a "circle of learning."

THE TREE OF KNOWLEDGE

There are three multimedia encyclopedias currently available: Grolier Electronic Publishing's *New Grolier Multimedia Encyclopedia* (for DOS and *Windows* PCs and the Mac), Compton's New Media's *Compton's Interactive Encyclopedia* (for DOS and *Windows*; sold as *Compton's Multimedia Encyclopedia* for the Mac), and Microsoft's *Encarta* (*Windows*). Microsoft, in conjunction with British publisher Dorling-Kindersley, has also produced *Musical Instruments* (*Windows* and Mac), a multimedia encyclopedia of musical styles and instruments.

The first versions of CD-ROM encyclopedias were direct translations of an existing medium; the printed page was simply digitized into text and pictures. However, technical advances have enriched the multimedia experience by adding audio, video, and animation. Users can supplement textual data with musical examples, clips from famous speeches, and environmental recordings. In fact, a well-designed encyclopedia project is a stunning example of the educational power of multimedia.

Using an electronic encyclopedia can be frustrating because CD-ROMs are slow (in the case of the current Compton's for the Mac, excruciatingly so). But audio and video examples often improve one's understanding and appreciation of a subject, and the richness of the material usually makes the wait worthwhile. In addition, the convenience of cross-referencing by a simple mouse click, instead of finding the other volume(s) and appropriate pages, makes you quickly appreciate random-access.

THE AUDIO

The number, variety, and quality of audio elements on the three encyclopedias differs widely. (Because it's not a conventional encyclopedia, I'll discuss *Musical Instruments* later.) All include historical audio, musical examples, and nature sounds, such as bird songs. But then the products diverge.

Microsoft's *Encarta* has by far the most audio, with more than 4,500 audio files totaling approximately six hours of playing time. Most of the sound bites are short word pronunciations—*Encarta* incorporates samples of 45 foreign languages—but there are also 350 musical examples. In addition, *Encarta* is the only product that uses MIDI, offering approximately 250 General MIDI-compatible Standard MIDI Files. These files can be used to play back

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INFO WORLD, September 1992

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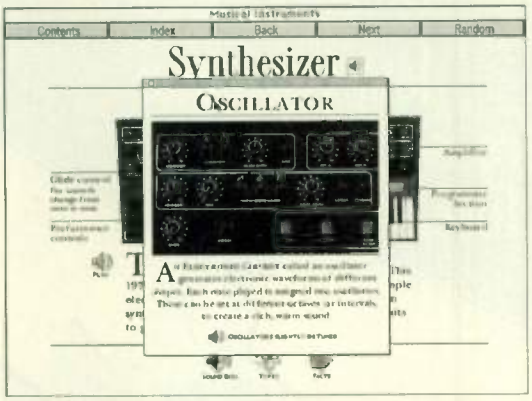


Microsoft's beautifully illustrated *Musical Instruments* has a wealth of information on different types of instruments, though its section on synthesizers could use some updating.

180 national anthems and numerous music theory examples.

Compton's 1991 Mac edition has 68 audio files that total one hour, including 26 music-related examples. Compton's also includes several audio oddities, such as recordings of a Muslim call to prayer, a San Francisco cable car, and a Geiger counter. Unfortunately, the sound on the Mac version suffers from distortion and audible hiss.

Grolier's 1992 edition has 135 standalone sound clips totaling about 45 minutes, including twelve musical examples and 35 recordings of different instruments. All three encyclopedias offer numerous audio soundtracks synchronized with video clips and animation.

"Choosing the audio clips is an editorial decision, much like selecting which articles to include, but it's also affected by the amount of free space on the disc and the availability of the material we want," says Ernie Cormier, Grolier's vice president of product planning and development. "Most encyclopedias have a large number of bird and animal sounds because encyclopedias commonly favor natural sciences. Plus, in the disc space required for one musical selection you can fit eight bird calls, so you get more bang for your buck."

All three encyclopedias use new material recorded specifically for the project and license other elements from outside sources. For example, the 53 bird songs on Grolier's disc were licensed from the Library of Natural Sounds at the Cornell Laboratory of Ornithology.

"Licensing material for *Encarta* was a bit difficult because people didn't always understand what we were doing," explains Jon Kertzer, Microsoft's audio manager for multimedia publishing. "It was definitely an educational experience. To get permission to use the music clips on *Encarta*, for instance, we worked with twenty different record companies, including many small world-music labels."

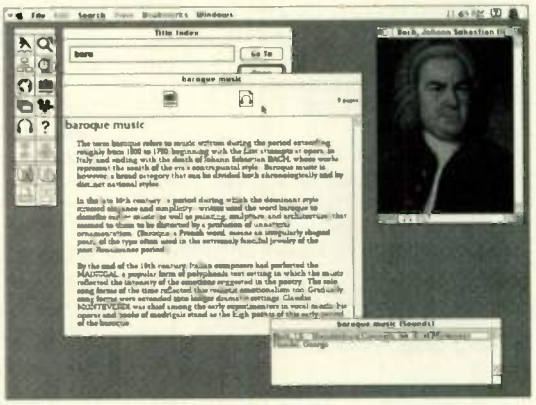
Most of the original audio for *Encarta* and Grolier's was recorded in professional studios and digitized and edited on Macs and PCs. According to Kertzer, many of the *Encarta* audio samples were originally recorded onto DAT in mono with AKG C414 condenser mics. The sounds were fed into Macs running Digidesign's *Sound Tools* hard-disk recording system and edited down to 16-bit, 22 kHz mono files. After transferring the sounds over to the PC and converting them to Wave files, they were compressed using ADPCM, a 4:1 compression scheme supported in the MPC standard. On playback, the audio is decompressed to either 8- or 16-bits, depending on the type of audio card installed in the user's machine.

The SMFs on *Encarta* are stored in the dual MPC format, where channels 1 to 10 deliver full, eight-voice arrangements, and channels 13 to 16 carry simpler ones. The files are played back through the built-in synth found on MPC-compatible audio cards.

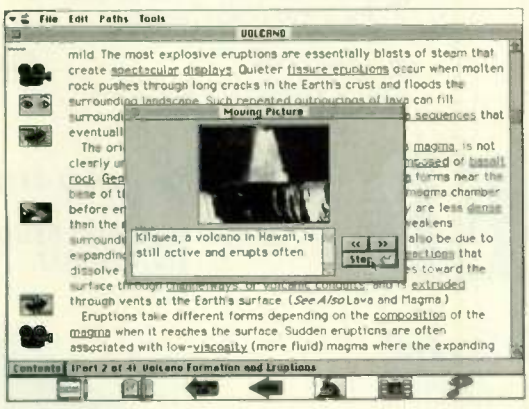
The audio on the DOS and *Windows* versions of the Grolier's CD is handled differently. Grolier's encyclopedia does not require an audio card on the playback PC, so both 8-bit sound card files and 16-bit Red Book Audio files are stored on the disc. Depending on the presence or absence of a sound card, the signals are routed through the audio outputs on the CD-ROM drive as normal CD audio, or through the sound card. The Compton's encyclopedia has a similar arrangement.

To conserve space on the disc, Grolier's splits the stereo CD audio into two independent mono files. When the encyclopedia requests an audio sample from disc, it tells the disc where to locate the data and then mutes the channel it isn't using.

The 1993 version of Grolier's incorporates a great deal more voice-overs and original music for its new dynamic maps feature, other video clips, and animation. These files were created as *QuickTime* movies on the Mac using 8-bit, 11 kHz mono audio files. The files were then translated onto other platforms.



All the encyclopedias offer interesting articles on musical subjects, many of which are enhanced with music clips. This example comes from *Grolier's Multimedia Encyclopedia*.



Much of the audio included on multimedia encyclopedias takes the form of synchronized soundtracks for video, as in this example from *Compton's Multimedia Encyclopedia*.

MUSICAL INSTRUMENTS

Microsoft's *Musical Instruments* isn't, strictly speaking, a multimedia encyclopedia, but it is a stunning reference for musicians and music enthusiasts. Produced in conjunction with Dorling-Kindersley, this high-tech version of a coffee table book includes gorgeous photographs, basic explanatory text, and sonic examples of 205 different instruments and musical ensembles.

The disc holds approximately four hours of 16-bit, 22.1 kHz mono audio

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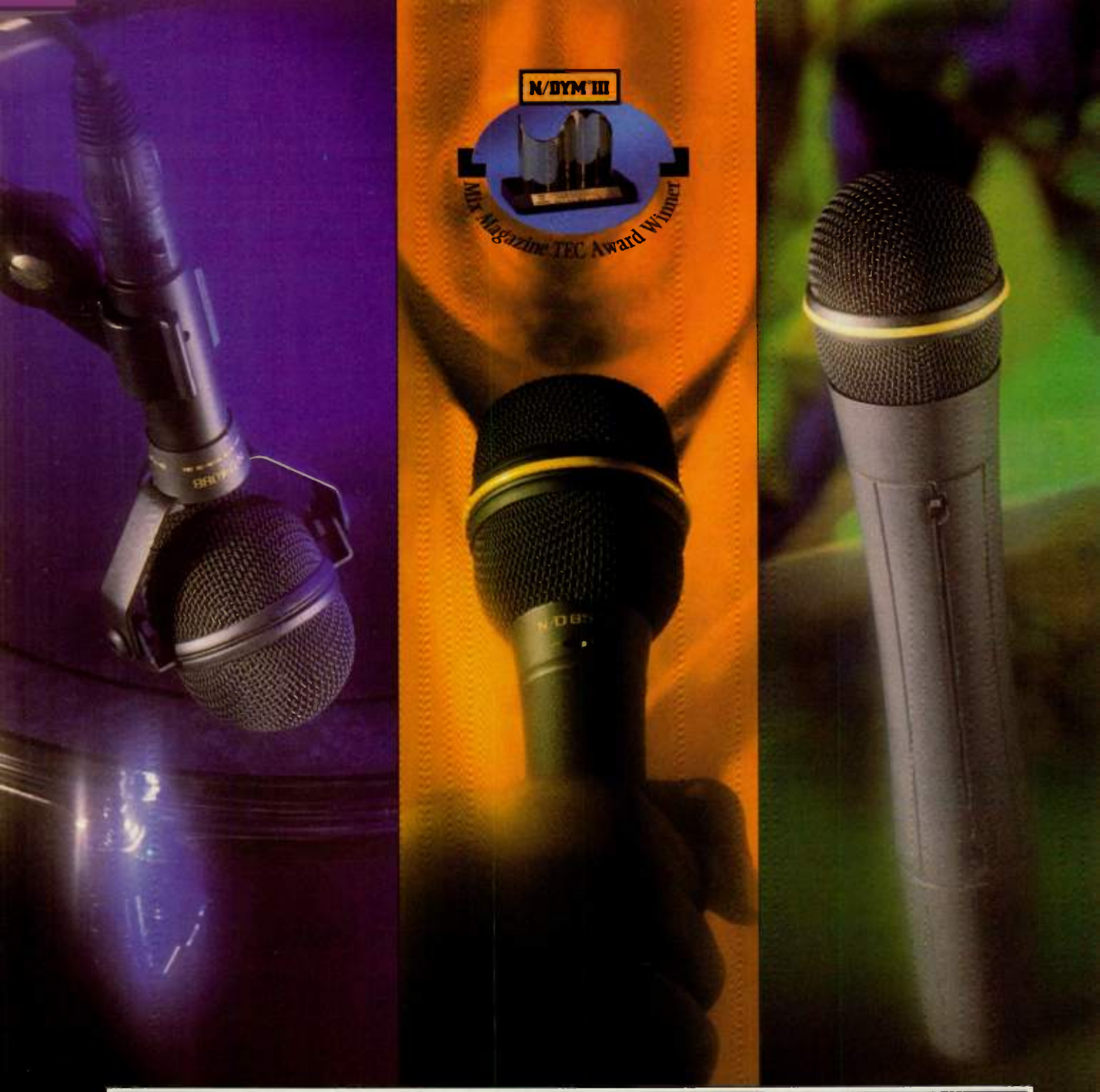

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organized into more than 1,500 files. The audio examples can be played back through 16-bit Mac sound cards, 16-bit PC cards, 8-bit PC sound cards, and the 8-bit Mac sound system.

"All the instruments were recorded at professional studios in the U.S. and London, with more than 100 musicians contributing to the project," says Kertzer, who is a trained ethnomusicologist. "Many obscure ethnic instruments are included on the disc, and we made sure we hired native musicians to play native instruments whenever possible."

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THE CULMINATION

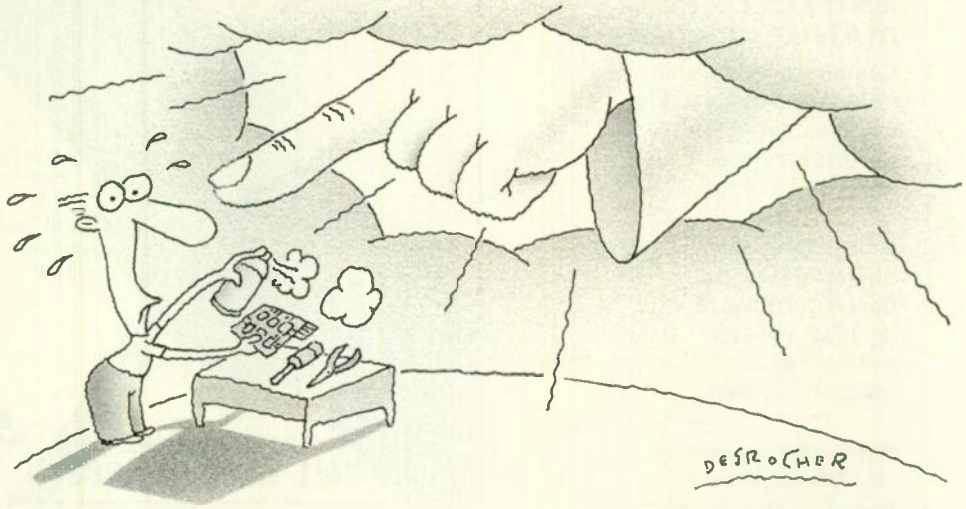
As large a role as music and audio play in current versions of these products, there's room for more. I found that once I read through the articles with audio examples, I kept thinking of other examples that could have been included. Obviously, the publishers of these discs feel the same way: They're all working on incorporating even more audio into future versions. According to Cormier, "Audio is an extremely important element for all multimedia because it brings you into the experience." In the case of CD encyclopedias, comprehensive audio is essential for inviting willing scholars into the "circle of learning."

Bob O'Donnell, *the editor of* **Electronic Musician**, *is still waiting for a multimedia adaptation of the Great Books.*

Questions & Answers

By Alan Gary Campbell

The mayor of Techville clears the air about CFC alternatives, endorses desoldering stations, and delivers the lowdown on K2000 upgrades.



Q. As an electronics technician, I use products containing CFCs sparingly for vital tasks. I keep hearing that CFC-based products will soon be removed from the market, but all the products I use are still available, though they've become more expensive. Which products will be withdrawn, and what will replace them?

A. All products containing chlorofluorocarbons, or CFCs, are being withdrawn in an effort to halt the depletion of Earth's ozone layer. For the moment, most CFC-based electronics chemicals are still available, including longtime bench companions such as the ubiquitous Radio Shack TV Tuner & Control Cleaner & Lubricant and Rawn's familiar yellow can of No-Residue Cleaner. Nonetheless, these products are being phased out, and some will probably be unavailable by press time. Most service shops have already significantly reduced CFC usage, both to protect the biosphere and to reduce costs, as CFC prices have gone sky-high (pun intended).

As a stopgap, many CFC-based products are being replaced with products based on hydrochlorofluorocarbons, or HCFCs, which are less environmentally damaging. Yet even HCFC-based products will be withdrawn, in turn, and the products that will replace them are, in many cases, still under development. Possible replacements include hydrofluorocarbons, or HFCs, alcohols, hydrocarbons, terpenes, and even a derivative of almond oil! It is likely that replacements will be much more application-specific, lacking the universality of CFCs.

Fortunately, some applications have ready substitutes: Denatured alcohol can be used as a flux remover, provided proper safety precautions are followed. (It is highly flammable.) Electrothermal devices, which are related to thermocouples, have already been developed to cool electronic components during thermal testing. For others, we'll have to wait and see. Whatever the chemistry, I hope Rawn keeps the bright yellow can.

Q. What is a desoldering station, and how does it work? What is its importance?

A. A desoldering station is, generally, a mid-sized, stand-alone, bench appliance that incorporates an umbilically connected, gun-type desoldering device with a through-bored, conical tip that is connected to both heat and vacuum sources. The tip is maintained at soldering temperatures, and the vacuum—applied on demand via a trigger switch—sucks the molten solder away from the joint and into a special collection vessel within the gun.

Like its counterpart, the soldering station, it provides a closed-loop circuit for setting and maintaining precise tip temperature. This greatly improves the speed and reliability of desoldering and dramatically reduces the incidence of PC trace and feedthrough damage. Most desoldering stations have an internal vacuum pump (some depend on an external vacuum source) that further improves the convenience and predictability of desoldering.

The desoldering tips now in use, though grossly similar to those of simple, hand-held, pump-type devices, are made of high-tech alloys with fast thermal recovery and remarkable durability. A desoldering station can last indefinitely with proper care. Scuttlebutt decrying the short service life and difficult maintenance of desoldering stations is unfounded.

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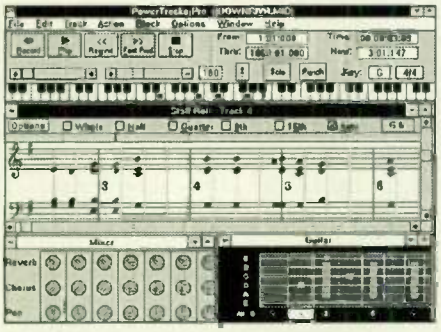

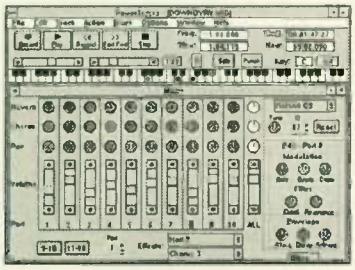

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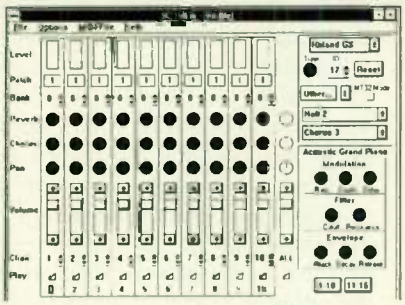

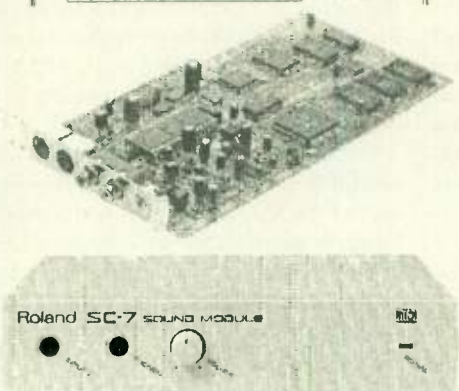

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A desoldering station is a mandatory accessory for a professional service shop. Some technicians argue that they can achieve adequate results with a squeeze bulb, or, for delicate circuits, with fine wicking braid. But the former procedure can zap static-sensitive components and leave cold-solder residue in the hole, and the latter is impractically slow and risks overheating the trace. Moreover, it is impossible to desolder high-tech, multilayer boards reliably without a quality (for example, Ungar, Weller, or OK Tools) desoldering station.

For the consumer who knows how to recognize service gear (or isn't afraid to ask), this indirectly provides a basis for quickly sizing up an unfamiliar service department or shop: Ask the manager for a quick tour of the service area. If the main bench does not have a decent (not necessarily fancy) oscilloscope, a 4½-digit DMM, a soldering station, and a desoldering station, the service center is inadequately equipped for anything beyond basic board-swapping.

A desoldering station is a necessary tool for the serious service bench. (Courtesy of CooperTools.)

Q. I want to increase the program memory of my Kurzweil K2000R to the maximum allowed. The technician says I need new software, and the salesperson says I don't. One of my friends says the memory upgrade can cause the K2000 to overheat. What's the story?

A. The program-memory (P/RAM) update increases the battery-backed RAM in a K2000 or K2000R (different kits are used for each) to the maximum of 760 KB, over six times the original memory. The update requires version 1.28 or higher firmware, but version 1.30 is included with it, hence the confusion. The DFK-1 fan kit (if not previously installed) is required to dissipate the heat generated by all those extra chips, but the fan kit is sold separately. To make this even more confusing, you can buy version 1.30 separately, but not the memory upgrade. Argh!

The suggested list of the P/RAM upgrade is $395, installed; but the DFK-1 is $69.95, not including installation. Version 1.30 firmware is $60 (why not $59.95?), not including installation, but it was $10 for the first two months and two days of release; go figure. The P/RAM and DFK-1 are available from authorized Kurzweil Service Centers only—you can't buy them, and you void your warranty by installing them yourself—but the version 1.30 kit is intended for user installation. If you find all this fine print somewhat mind-boggling, I commiserate.

Q. I'm afraid the answer regarding making a dummy load (April 1993 "Service Clinic") may have caused confusion in the selection of resistor types. In Fig. 1, all resistors are listed as 20-watt metal film, but to my knowledge, the highest wattage for this type is 1 watt (for metal oxide, 2 watts). Also, metal-film resistors are pricey (partly due to tight, 1% or better tolerance) and difficult to obtain.

Regarding the R = N x Z formula, wouldn't the closest value be 402 ohms, not 390? Moreover, wirewound resistors are a better choice, because they have higher surge ratings, maintain the same resistance over a wider temperature range, and are more cost-effective. Finally, carbon resistors should not be used.

A. These are important points. In attempting to simplify the recommendations, some ambiguity resulted.

The types of resistors available at the small, independent electronics suppliers that serve the majority of service shops have changed radically in the last decade. Blister-packed metal-film and metal-oxide 2% resistors, from RCA and NTE, are now commonplace, though still pricey. Wirewounds are stocked in much less depth, and 1% metal-film resistors are rare.

Metal-film and metal-oxide resistors can be used interchangeably in many applications. The compound description "Metal Film/Oxide," as used in the dummy-load schematic, is common, if perhaps ambiguous. Certainly, 1% or even 2% resistors are too pricey for dummy loads. But I recommended the bulk-packed, taped, 5%, metal-film/oxide resistors, which are cheap (about $4 per 100) and readily available by mail order. The example equation reflects this: 390 ohms is the closest 2% or 5% value; 402 ohms is, of course, the closest 1% value.

Recently, affordably priced, metal-oxide ("ceramic") power resistors designed specifically for dummy-load applications have become available, typically 8-ohm, 20-watt, 5% types. These are carried by Radio Shack, as I referenced.

Wirewound resistors offer advantages, but because of their spotty availability and comparatively higher cost, I did not list them. I should have reminded readers that carbon resistors should never be used in dummy loads; they are a fire hazard.

COOL TOOLS FROM THE SHACK

"Toolophiles" will agree that the average quality (and availability) of fine hand tools has declined egregiously, while the cost has increased enormously. In a marketing coup of rare egalitarianism, Radio Shack has introduced its affordable Techline series that includes (among other goodies) high-quality, miniature needlenose pliers (cat. no. 64-1807) and diagonal cutters (cat. no. 64-1808; each $12.99) manufactured by the renowned Diamond Tool Company. Kudos!

On the other hand, by the time you read this, Radio Shack's venerable Battery of the Month card will be no more. Environmental concerns, stricter EPA regulations, and waning demand for low-capacity cells have caused its demise. No doubt Tandy will engender a 21st-century equivalent; maybe a Dilithium Crystal of the Month card.

EM *contributing editor* **Alan Gary Campbell** *is owner of Musitech, a consulting firm specializing in electronic music product design, service, and modification.*

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Putting a Sparkle on Analog

By Neal Brighton

Analog recording is still a long way from an exhibit in the audiophile's Jurassic Park.

As a recording engineer, I see and hear "digital" so much that the word "analog" has taken on a strange ring. It's like talking about ice boxes or steam engines or telegrams. Well, I'm not ready to put the concept of analog recording into the Smithsonian just yet. As a matter of fact, I often *prefer* analog tracks to digital. I love the warmth of analog bass and the airiness of analog high end. Digital can sound sterile and—at the risk of sounding conspiratorial—there's something weird about its high-end resolution.

Of course, analog tape is a long way from a perfect recording medium. You've got to contend with tape coloration; fractured signal-to-noise ratios; and omnipotent, audible hiss. But as one of my teachers at recording college used to say, "Good recordings start at the sound source and end at the listener's ears."

There are many things that can be done to an audio signal before it reaches a listener's ears. Manipulate that signal properly, and your analog masters can sound just as wonderful as your neighbor's hoity-toity digital tapes. (Maybe even better!)

BACK TO THE SOURCE

If you want to record great sounds on *any* medium, you must critically assess the sound source. How does it sound up close? What do the room acoustics sound like, and do they enhance or sabotage the source sound? Are there any extraneous sounds generated by the source such as pick scrapes, pedal thumps, creaks, and so on?

Anything that detracts from what you want to hear must be dealt with at this early stage. If the room sound is poor, consider close-miking the source. If you like the ambience of the recording environment, add a room mic a few feet back from the source and mix the sound of the close and room mics together. Obviously, non-musical noises should be obliterated. Do whatever it takes—tighten down equipment hardware, pad piano (and harp) pedals with pillows or blankets, and adjust mic positions—to ensure the source sound is uncompromised.

Proper mic selection also helps ensure a good source sound. For example, if you want an acoustic guitar to sound bright and jangly, try a condenser mic rather than a dynamic type. The condenser will translate clearer, more "open" high frequencies. If you choose a mic that delivers optimum sound, you'll be less tempted to tweak the mixer EQ to get the sound you want. Resorting to EQ can be a bad idea. (More on this later.) Anytime you add EQ to the signal path, you also add some degree of unwanted noise.

If you use more than one microphone on a sound source, beware of *phase cancellation*. Basically, this sonic anomaly occurs when the sound recorded by one mic cancels out some of the frequencies recorded by another. The result is a thin, or hollow, timbre. Some mixing boards include a phase switch that allows you to hear if the source is compromised. (If your mixer doesn't have a phase switch, mute one of the mics to check for phasing problems.) You are looking for a fat, solid sound when both microphones are audible. If you get anything less, either reverse the phase switch on the offending input module (or microphone, if applicable), or change the location of the mic.

GAIN STRUCTURES

A typical audio recording path includes several small amps that boost signals up to the final level that is recorded

DMITRY PANICH

on tape. How the individual gains are set can greatly alter signal quality, because overdriving any stage of the signal chain causes unwanted hiss and distortion.

One of the best ways to attain optimum gain-staging is to set your channel fader to its "0" mark (Fig. 1). If you are assigning the signal to a subgroup, also set the subgroup fader to its "0" point. Next, turn your mic (or line) preamp up until you show adequate gain on your meters. If the meters are slamming past distortion levels, and the preamp gain is minimal, pad the mic—use either the pad switch on the mic itself or the input-channel pad—by at least -10 dB. (If you're recording through a line input, reduce the volume level of your instrument.)

The point of this exercise is to set optimum "median" levels, where the mic/line preamp and faders don't have to struggle to deliver the goods. One of the biggest mistakes a home studio engineer can make is cranking up the mic (or line) preamp and lowering the fader levels. In this situation, the preamp works harder than necessary, resulting in hiss and distortion.

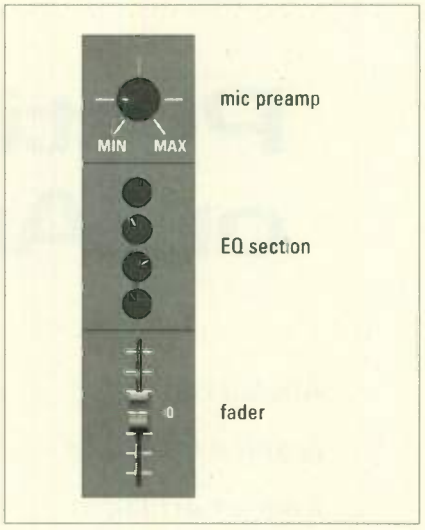


FIG. 1: Optimum gain staging helps ensure clean, robust signals. Setting up median levels on the mic/line preamp and fader may prevent accidental overdriving.

EQUALIZATION

Most mixing consoles have active EQ, which means that boosting or cutting frequencies alters the overall gain structure. Keep this in mind because if your mic/line preamp sends an excessively hot signal to the mixer's EQ section, you can overdrive the EQ. Audible pops and other distortions are your reward. I advise keeping the preamp at a low level until you get the EQ settings just right. Only then—and only if you need more signal gain—should you increase the preamp level.

Personally, I don't usually equalize source sounds to tape. It's a foregone conclusion that EQ settings are always changed and adjusted during mixdown, and I question the (sonic) value of equalizing a sound twice. Everytime you touch a knob, you risk dumping more noise into your beautiful source signal. However, if you must EQ a sound to tape, remember that it's cleaner to cut, rather than boost. My usual prescription for sharpening up dull timbres is to cut some of the bass frequencies. I seldom resort to boosting the high end.

QUALITY CONTROL

Once you optimize your source sound and gain stages, you still must deal with a medium that has a worse signal-to-

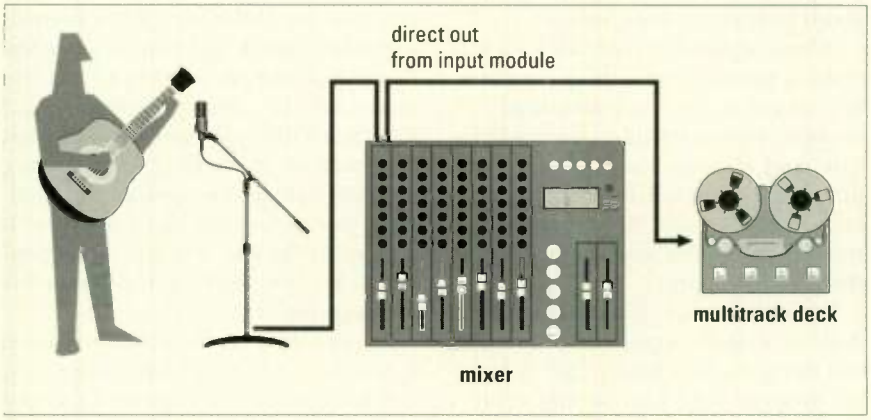


FIG. 2: Direct recording is one of the cleanest ways to get a signal on tape. Bypassing the subgroups also bypasses additional electronics that can add noise and hiss.

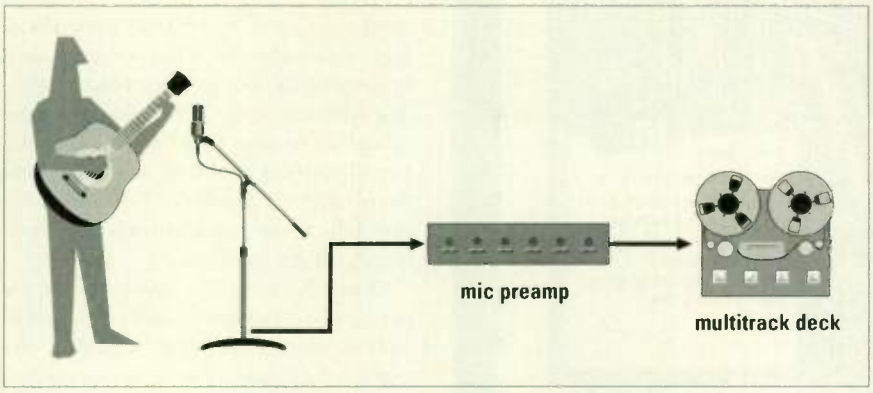


FIG. 3: Sometimes it pays to bypass the board entirely. A good microphone routed through a high-quality mic preamp can deliver almost transcendent sound quality.

noise ratio than digital. This unfortunate fact doesn't mean all your preparation is for naught; it just means that analog recordists must aggressively seek signal quality. Here's how I make my analog tapes as pristine as possible.

Take short cuts. The easiest way to maintain a clean signal is to take the shortest, most direct path to tape. The fewer electronic circuits a signal must traverse, the better. Don't assign a signal to your subgroups unless it's absolutely necessary. Always try to route the signal directly to tape *after* the EQ section on your input channel (**Fig. 2**).

▼

Dynamics processors can help "sanctify" the purity of signals.

Some mixers require you to patch direct lines, while others have handy switches that automatically bypass the subgroups.

If I don't like the sound of a mixer's mic preamp, I bypass the board completely with an outboard preamp and go from mic to preamp to tape (**Fig. 3**). This "ban the board" route is about as direct as you can get and usually delivers amazingly clean and robust signals. (Unfortunately, renting a good mic preamp can be costly.)

Go down in flames. Well, not exactly. But you *do* want to record signals to tape as hot as possible. Go right up to the distortion level, then creep back. The stronger your signal, the weaker the tape hiss.

One of an engineer's biggest nightmares is a mixdown session where he or she is stuck with a poor-sounding signal that was recorded at extremely low levels. There aren't any magic boxes that can save you from this type of double trouble. Raising the meager signal level by routing it through additional channel electronics—or a signal processor, such as a compressor, with an output gain control—often increases audible hiss. A single-ended noise-reduction device can diminish some of the hiss, but you're further compromising the integrity of an already compromised signal. What you've got is a merry-go-around of sonic shame. If you record with hearty signal levels, you'll avoid this kind of ride.

Stay on the right tracks. Digital is a sonic democracy; every track sounds as good as the next. Analog isn't so progressive. Typically, some tracks on your analog recorder *will* sound better than others. It's not unusual for the outside tracks of your deck to lose high-frequency resolution before the inside tracks. How quickly this occurs depends on a number of factors: the age of the deck, how much it is used, how well it is maintained, and so on.

If you have a test tape, you can test which tracks are starting to "slip." Avoid putting critical sonic material on these tracks. If you don't have a test tape, follow this simple rule of thumb: Use the outside tracks for drums and bass. I own a 16-track deck, so I typically put the kick drum on track 1 and the bass on track 16. Any signals that require absolutely brilliant reproduction, I assign to tracks six through twelve. Basically, keep your best tracks *on* the best tracks.

Bounce with the best of them. If you bounce or submix, the issue of which

tracks are your "best" tracks is critical. You're already somewhat compromised by analog tape's generational signal degradation, so you should route the submixes to your best-sounding tracks. I recommend avoiding outside tracks as suitable locations for bounces. This may take some pre-planning when you begin filling up tracks.

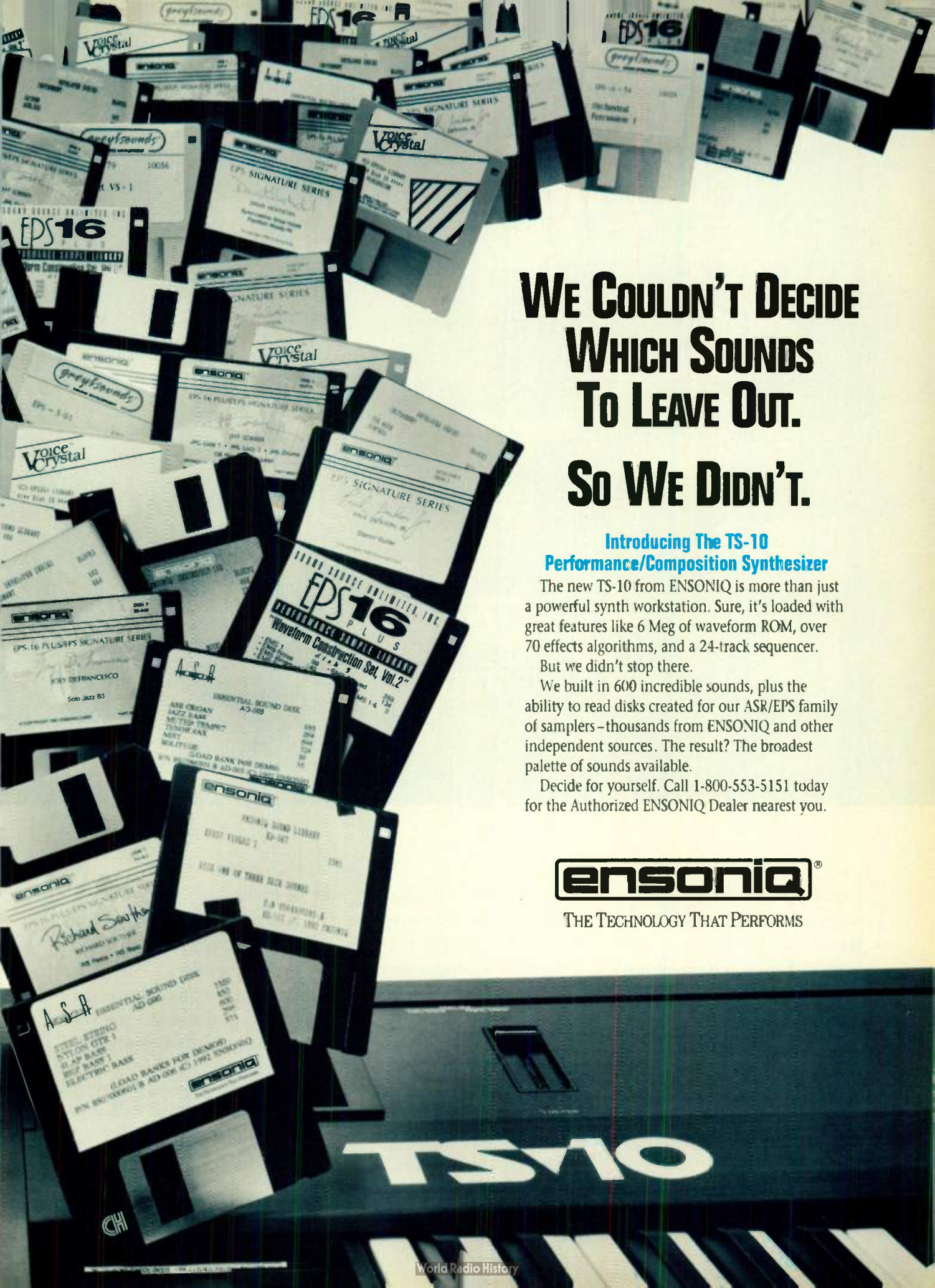
Cheat. Noise gates, compressors, expanders, and single-ended noise-reduction devices can help "sanctify" the purity of signals. (I've been saved by a noise gate countless times.) Obviously, the best scenario is to record a good, clean sound in the first place. But it's not a perfect world, is it? If you're stuck with hums, buzzes, and/or hiss, a dynamics processor may help diminish the problems. However, these processors also compromise the sound in subtle, or not-so-subtle, ways. Sometimes the effect is good, sometimes it only adds to the problem. Use your judgment.

Store the tape properly. Many recordists forget this simple, yet critical, step. An improperly stored tape can eventually exhibit signal degradation and audible drop-outs. When you're finished recording, spool the tape off the deck using a slow spooling speed. (Obviously, this is impossible for cassette ministudios.) Be sure to spool the tape "tails out" (backward), and store it in a cool, dry place.

THE FINAL PEP TALK

There's really no great trick to making great analog recordings. Just listen critically to what you're recording and make sure that the speaker at the other end of the audio chain is reproducing that sound exactly the way you heard it. If you've got that part licked, producing a marvelous recording is simply a matter of taking the proper mechanical steps to ensure that those "perfect" sounds are faithfully transferred to the multitrack and mastering decks. Of course, all of this is (admittedly) easier said than done. But if you endure the small headaches of keeping vigilant throughout the recording process, you'll spare yourself the biggest headache of all: ending up with a finished master tape that sounds awful.

Neal Brighton *is an independent engineer/producer and co-owner of Sound & Vision studios in San Francisco.*



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Carpal Tunnel Syndrome

By Anne-Marie Praetzel

Early treatment can keep this insidious disability from dropping the curtain on your playing days.

Geoff Thorpe was rehearsing for an upcoming gig when his hands suddenly became stiff. Thorpe, guitarist for Atlantic Records act Vicious Rumors, chalked up the pain to overwork and shrugged off the incident. But mid-way through the show, both of his hands went completely numb. "They stayed numb for six days," relates Thorpe. "I was in non-stop pain, even when I wasn't using my hands." Thorpe was experiencing Carpal Tunnel Syndrome.

WHAT IS CTS?

Carpal Tunnel Syndrome (CTS) is a relatively common condition that strikes when the muscles and tendons in the hand, wrist, and arm are overused. CTS appears as tingling, stiffness, or numbness in these areas. In its most severe form, CTS becomes a lifelong disability that prevents the afflicted person from performing physically stressful activities, such as typing or playing keyboards.

In recent years, CTS has received more media attention because many computer users fall victim to it. The condition presently affects over 4 million Americans and many of these are musicians. Long practice sessions, awkward fingering positions, the added physical stress of being a multi-instrumentalist, and even the shape and weight of an instrument contribute to the onset of CTS.

In CTS, the median nerve is compressed as it passes through an actual tunnel of bone and ligament at the wrist (**Fig. 1**). The carpal tunnel is formed on one side by a U-shaped cluster of eight wrist bones at the base of the palm, and the extremely hard Transverse Carpal Ligament is its roof. The tunnel surrounds the finger tendons. When synovium, the lubricating lining around the tendons that provides them with nutrients, is irritated from overuse, it swells and presses the nerve against the walls of the tunnel. This pinching of the nerve causes numbness and tingling in the fingers. Once symptoms appear, the condition generally worsens and permanent nerve damage may occur. Fortunately, CTS is treatable if caught early.

TREATMENT

Geoff Thorpe was lucky—and smart. Soon after his painful gig, he sought treatment. But deciding upon a treatment for CTS is no easy task. Thorpe discovered that the scope of conflicting advice was overwhelming.

"I talked to four different doctors and heard everything from, 'You'll never play again,' to 'you just have a pinched nerve in your neck,'" he relates. "I also investigated alternative options, such as acupuncture and diet change. Eventually, I opted for surgery."

The principal behind CTS surgery is simple: If you cut the transverse ligament, it releases pressure on the median nerve. The conventional surgical approach, open carpal-tunnel release surgery, has been the primary treatment since the early 1940s. Thorpe had both hands operated on at once.

"It was a frightening experience. I was lying on the operating table with both arms stretched out on either side. I felt like I was being crucified," he says.

The surgery took about an hour, and Thorpe was able to leave the hospital later that day. He had casts on both arms for a week and the stitches remained for another week. In addition, he was instructed not to play for a few months. ("But after four weeks, I had to touch a fretboard," he admits.) Five months after the surgery, Thorpe estimated his guitar technique was about 60 percent of his former abilities.

LESLIE COBER

"Sometimes my hands get too stiff—they want to clamp into fists—which prevents me from playing every once in awhile," explains Thorpe. "But the pain is manageable now. Before the surgery, it hit like an electrical shock and the aching wouldn't go away. Now, it's really only the little things that bother me, like twisting off a bottle cap."

In recent years, an alternative method of surgery has gained popularity. *Endoscopy* performs the same basic procedure as open surgery, but with less impact on the arm. Endoscopy employs a minuscule lens to view under the skin, making it possible to target the problem and allow tiny incisions (in the wrist and palm) to cut the transverse ligament.

"This technique has proven more beneficial than conventional surgery because it is much easier to perform. In addition, it leaves only minimal scarring and the patient can resume playing their musical instrument in a relatively short period of time," says Charles Resnick, an orthopedic surgeon in Los Angeles. Resnick prescribes endoscopy to nearly all of his patients. He claims it has the same success rate as open surgery, but allows patients to start using their arm the evening after the operation.

Surgery, however, is only one of several treatments. Saxophonist Cynthia Mullis began experiencing a constant ache in her hands five years ago, after she'd also taken up the flute. After years of discomfort, Mullis visited a highly reputable hand surgeon "who cost a lot of money and basically just told me to stop playing and get surgery." Then, she discovered low-cost acupuncture treatment at the Haight-Ashbury Free Medical Clinic, in San Francisco.

PHOTO WILLIAM HAMES

Geoff Thorpe (second from left) of the San Francisco-based heavy metal band Vicious Rumors, opted for open surgery to cure Carpal Tunnel Syndrome.

"They asked me all kinds of general questions about my body and health that seemed unrelated to my wrist problem, says Mullis. "But after four months of weekly treatments, the pain was no longer constant; it just flared up once in a while. Even then, the treatment caused the pain to centralize in my wrists, instead of throughout my arms."

Today, Mullis is an active musician. She plays in an all women's sax quintet called Five Winged Bird, as well as an avant-garde jazz band called Planet Good. When she experiences an occasional flare-up, she simply visits the clinic for more acupuncture.

Acupuncturist Nancy Rakela, based in Berkeley, California, sees many patients with CTS. Her main treatment involves the use of needles that are hooked up to an electrical stimulator to enhance the healing process. She also gives patients preventative advice, herbs, and vitamins to nourish the tendons. Additional acupuncture points are addressed to improve the patient's overall well-being. The average treatment varies between six to ten weekly visits.

San Francisco orthopedic surgeon Dr. Leonard Gordon approaches CTS from a different angle. Gordon attempts to stop the cumulative trauma from occurring. He prescribes rest, anti-inflammatory medicine (both oral and injections), and splints. When possible, he has the musician and his or her music teacher come to his office to work on posture.

All doctors agree a vital aspect of handling CTS is acting immediately upon noticing pain, stiffness, or tingling. Too often you hear the tragic story of the musician who waited a few years until the pain became unbearable and faced surgery as the only option. Surgery isn't always successful, and severe CTS can be a recurring disability.

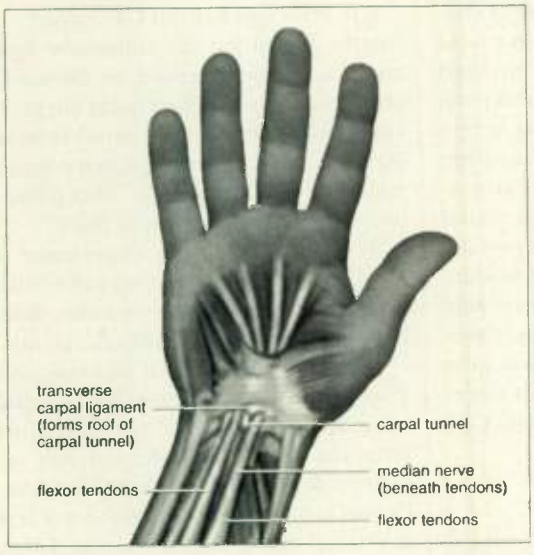

FIG. 1: When the median nerve is compressed at the wrist by the swollen lubricating lining of the flexor tendons, sharp pain, numbness, and/or tingling results. Continuing damage affects the ability of the hand and fingers to grasp objects.

PREVENTION

It's not particularly difficult to prevent CTS; you just have to learn to listen to your body. Now that you know how CTS occurs, you can limit activities that threaten those all-important tendons and nerves in your wrist.

"I suggest that musicians think of themselves as athletes," says Rakela, who emphasizes prevention in her consultations. "And like athletes, they need to warm up and warm down. Do stretching exercises before you rehearse or perform, and start playing slowly. Don't jump into your routine at full speed."

Other preventative measures include resting your hands periodically during play; exercising to condition and strengthen the hand and arm muscles;

minimizing repetition of any particular move; and consulting a doctor to find the best position to hold and play your instrument.

Keyboard players, for example, should keep their wrists straight to prevent strain. Guitar players should avoid gripping the neck with just the thumb and index finger; it puts stress on the wrist. Instead, use the whole hand and all the fingers to grasp the instrument. Guitarist Geoff Thorpe recalls, "I have a violent, aggressive style of playing. I'm always squeezing the guitar; treating it like a weapon." If you're a similar animal, watch for signs of CTS.

Another factor is physical repetition. Try to vary your position when you perform an activity, whether it's playing the guitar or typing documents on a word processor. Also, do not suddenly increase your rehearsal time or twist your wrist and fingers into positions that they aren't used to. And believe it or not, reasonable weight loss and diet adjustments can alleviate CTS because water retention adds to muscle and tendon stress.

KEEPING YOUR HEAD UP

If left untreated, serious CTS can lead to crippling pain and permanent damage, to the point where some musicians may never play again. Too many musicians neglect the early signs of CTS and hope it will go away. Don't be stupid. Keeping alert to the early warning signs and getting early treatment substantially improves your chances for recovery. The worst thing you can do is play in pain because you fear discovering the truth about your condition.

Thorpe's CTS brought out the best in his band members and his community. The guitarist faced huge medical costs—CTS treatment can cost more than $15,000—and, like many musicians, he didn't have health insurance. But his bandmates bailed him out: They gathered a variety of San Francisco Bay Area performers to donate their talents for two successful benefit concerts. And Thorpe hasn't remained idle, moping about his temporary disability. The recovering guitarist used his "down time" to contribute musical arrangements and vocals on the upcoming Vicious Rumors album.

Former **EM** *assistant editor* **Anne-Marie Praetzel** *is using her respite from deadlines to explore the lush flora of Guatemala.*

Reviews

Digidesign Session 8
Integrated Digital Studio

By Larry "the O" Oppenheimer

The leader in Mac-based, random-access recording invades the PC market.

Digidesign developed the first successful, computer-based, digital-audio editing program, *Sound Designer*, and a pioneering computer-based recording/editing system, Sound Tools. Session 8, Digidesign's *Windows*-based, 8-track, hard-disk recording/mixing/editing system, is a bid to again break new ground.

Session 8 is significant in several ways. First, and most noticeably, it is Digidesign's first effort on the IBM PC platform. (A Macintosh version is expected to be released by late 1993.) Second, it is intended to be a studio-in-a-box, with all of the basics integrated into one system. Third, it represents the culmination of first-generation, PC-based digital-recording systems in terms of user interface, functionality, and sound quality.

Digidesign Session 8's Edit screen. Waveform overviews have not yet been computed for the drum bounce on tracks 3 and 4. The gray blocks on tracks 7 and 8 are Silence regions.

OVERVIEW

The Session 8 package contains two plug-in cards, an external audio interface box with cable, and software. It requires at least a 25 MHz 80486SX PC-compatible with 4 MB of RAM, 2 MB of available disk space, two open slots for the cards, and *Windows* 3.1. An enormous SCSI hard disk with an access time no greater than 19 milliseconds is required to store eight tracks of audio. (Digidesign offers a list of recommended drives.) You also need a backup system of some sort to store your work (and free up the system for additional projects). Don't forget these when evaluating a Session 8 system, because they will add $2,000 or more to the total cost.

Session 8 uses non-destructive editing, meaning that edits do not alter the original recording. Non-destructive systems can burn disk space quickly: A 6-minute tune recorded on Session 8 took up nearly 500 MB, including basics, overdubs, and bounces. (I did not delete source tracks after a bounce.) Fortunately, the Session 8 software incorporates a function for archiving to standard audio DAT recorders in real time, which worked well.

One of the plug-in cards contains a Motorola 56001 DSP chip and performs the recording, processing, and SCSI management. The other plug-in card is the interface between the audio interface box, the computer, and the DSP card.

AUDIO INTERFACE

The audio interface is a 3U rack-mount box that teems with inputs. On the front panel, it offers four XLR mic and four ¼-inch Instrument/Line inputs, each with a level pot. On the rear panel are the ten ¼-inch, line-level inputs (five stereo pairs) of a 10 × 2 analog submixer, controlled by front-panel level pots and a master level pot; six effects returns; a 2-track tape return for playback from a mixdown deck; and an S/PDIF digital input. The Session 8's effects returns let you hear effects or other instruments during recording, without recording them to disk.

The audio interface also incorporates the system's eight 64× oversampling Delta Sigma analog-to-digital and eight 256×, 1-bit digital-to-analog converters, isolated from the noisy environment of the computer. In a wise design move, Digidesign did not hardwire the converters to the main inputs and outputs of the interface, allowing you instead to choose various combinations of inputs and outputs to run through them at different stages of the recording and

mixing process.

The interface's front panel also has signal-present and clip LEDs for the eight A/D channels, as well as indicators for the monitor and headphone outputs. By integrating the mixer and recorder into one box, Digidesign eliminated much of the signal degradation that can crop up from long cable runs, low-quality cables, dirty patch connections, crossed audio and AC lines, ground loops, and so forth.

The front-panel mic and Instrument/Line inputs are mutually exclusive, that is, an input can be either mic or line. The mic preamps sounded better than those found on most inexpensive mixers, but I still would use a high-quality outboard mic pre for critical tracks. The nominal input level of the four front-panel Instrument/Line inputs is 0 dBu, making them lower sensitivity than those rear-panel inputs described as "line level" (-10 dBm). These inputs were designed for use with a guitar signal processor, and their impedance is too low to connect an instrument pickup directly to them (although the Route window shows a guitar icon for them), so you need a preamp for your guitar before feeding it to the Session 8.

Outputs include four effects sends, stereo cue, main mix, control-room monitor, S/PDIF, and the 2-track tape sends. In addition, there are four TRS inserts, two stereo headphone jacks (on the front panel), two BNC connectors for clock sync in and out (intended for use with Digidesign's SMPTE Slave Driver), and the 50-pin connector that goes to the computer I/O card.

The XL version of Session 8 ($5,995) is aimed at professional users who primarily need a recording and editing environment. The XL audio interface features balanced XLR inputs and outputs, an AES/EBU interface in addition to S/PDIF, and higher quality A/D converters. It does not include the analog mixer, however.

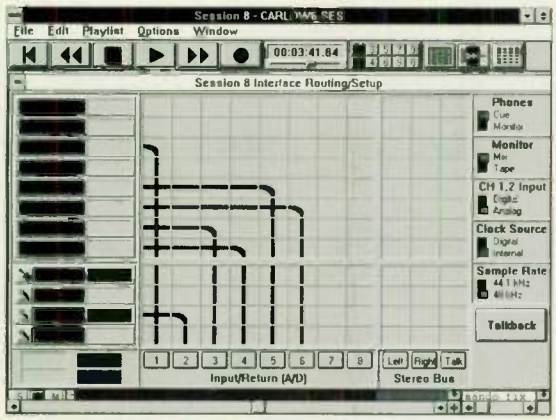

FIG. 1: The Route screen. Note the insert points in the "wells" for Mic/Line 1 and Mic/Line 3 inputs.

THE SOFTWARE

Installing the Session 8 software is relatively painless; unfortunately, dealing with *Windows* is not. The strength of DOS and *Windows*—the ability to get in and tinker with the workings of the system—can be a Pandora's box for the average end user, who is forced

to deal with a morass of IRQs, DMA channels, I/O addresses, and configuration and .INI files. Thus, my greatest difficulties with Session 8 came not from Digidesign's hardware or software, but from dealing with DOS and *Windows*. Once I was up and running, though, I found the system quick and easy to get around.

The Session 8 software focuses on three main screens: Route, Mix, and Edit. (The XL version does not include the Route screen.) The Route screen (see **Fig. 1**) is a virtual patch bay that lets you connect, with a mouse-click, any of the inputs to any of the eight A/D channels. It also has five onscreen switches for selecting the sample rate, the digital inputs for channels 1 and 2, the clock source, and the sources for the monitor outputs and headphones.

An insert point can be assigned to an input by simply dragging it from a "well" to a box next to the input. This makes it easy to put compression, gating, or outboard equalization on an input before recording. You have to do all your processing on individual instruments before you record, though, because the insert points can only be used on inputs, not on tracks during playback. As a result, you can't insert processing during bounces and mixdown, which is unfortunate.

Most systems force you to spend a lot of time shuffling plugs at the rear panel, so reconfiguring the Session 8 without moving a single patch cable was downright thrilling. It also made the system quick and easy to use. Another big plus was the ability to navigate the program while recording, without having to pause or stop.

RECORDING

Once you create your routing scheme, recording is simply a matter of clicking the channel Record Enable buttons, checking and adjusting the levels, and clicking the Record and Play buttons. Disk-based systems always take time to prepare disk space for recording, but Session 8 is the fastest system I have tried, needing only two or three seconds to set up.

After recording a take, you hit Play to hear it and Record to do a retake, with no mode changes or setup required. Punch-ins merely require setting markers in the Edit window and designating them as punch points. Pre- and post-roll are adjusted by simply drag-

FIG. 2: The Mix screen, with channel 1 record-enabled. Note EQ assigned to channels 2 and 8. The groups are color-coded.

ging in the Edit window over the area you wish to hear. Soundfiles are stored as .WAV files, the standard *Windows* format for digital audio files, so it's easy to access them from any *Windows* sound program. Unfortunately, Digidesign doesn't provide a conversion to a format compatible with any of their Mac-based systems.

THE MIX WINDOW

The Mix window (see **Fig. 2**) presents Session 8's onboard virtual mixer. I used Session 8 exclusively in Internal mix mode, where all mixing functions are performed within the system. External mix mode essentially turns Session 8 into an 8-in, 8-out recording/editing environment, in case you want to plug the system into an existing studio setup. In this mode, the effects sends and returns and the cue mix go away, leaving only the eight channel faders, each of which can be assigned to one of four stereo output pairs. (Incidentally, the information on output assignments is not in the manual.)

The onscreen mixer provides eight main channels and eight input/return modules, each of which has a fader, a panpot, four post-fader effects-send pots, a 16-segment level indicator, and a box for accepting EQ. The channels also include a record-enable button, channel-input select (not to be confused with the A/D input select in the Route window), and a separate cue-mix fader, which is the only pre-fader send. The layout is completed with stereo master faders, stereo cue faders, and effects-send master pots.

The EQ is assigned by dragging one of the six EQ icons from its "well" near the top of the screen to a box on the channel fader. Double-clicking the icon reveals a graphic EQ-curve display (see **Fig. 3**) and parameter controls for boost/cut, frequency, response curve (selectable between high shelf, low shelf, narrow band, and wide band), and gain adjust. You select from a predefined set of values; the parameters are not continuously variable. Up to four EQ modules can be stacked onto a single channel. The onboard EQ sounds smooth, but with only six modules, it is necessary to do more equalizing on recording, so you probably will want to insert an external equalizer.

The four fader groups can contain any of the input/return faders, as well as the channels. Grouping is as easy as dragging from one of the Group icons to the fader you wish to include, and clicking. This process is a toggle, so unassigning is achieved by the same procedure. Adjusting the group level or relative levels within the group is an easy task.

A similar approach applies to bouncing. There are Bounce From and Bounce To icons, and tracks are assigned or unassigned by dragging from the icon to the track's fader and clicking. The greatest advantage of bouncing on Session 8 is that its non-destructive nature yields freedom to experiment quickly and safely. No degradation occurs from bouncing because the entire process is in the digital domain.

On the downside, there is no master level control for the bounce, so you have to make individual adjustments on each source track until you reach a suitable composite level. In addition, the completed bounce cannot be heard until all the tracks involved have been unassigned from bounce mode. Although unassigning everything is achieved with a single click, each attempt at a bounce requires reassigning everything from scratch.

Most of Session 8's mixer functions can be automated through MIDI, using an external hardware controller (such as Digidesign's new $995 RI Remote Controller) and a concurrently running *Windows* MIDI sequencer. Alternatively, the Session 8 mixer can transmit MIDI messages to a sequencer as its onscreen controls are moved with the mouse. Default assignments of MIDI controllers

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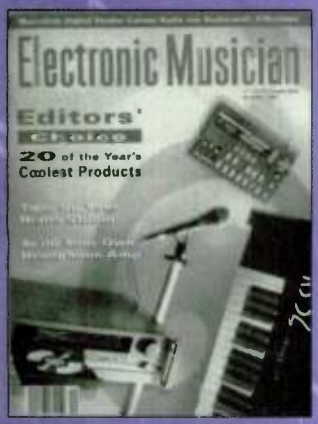

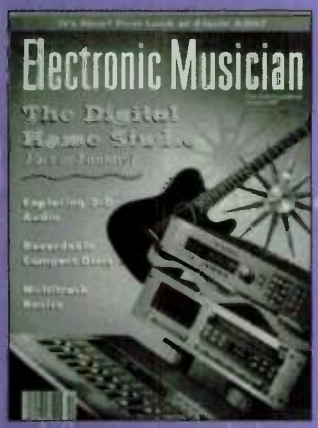

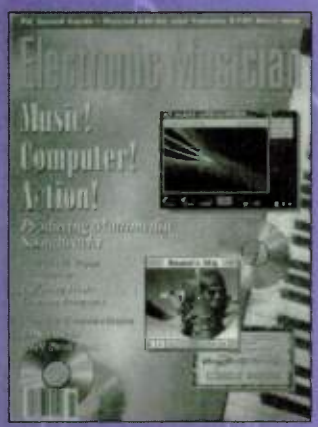

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B30906

to mixer functions are provided, but the Learn button makes customizing assignments a snap. The automation works well, although there are occasional glitches and a small amount of delay between the time messages are sent from the sequencer and Session 8's response. It is possible these problems did not stem from Session 8, but from the pre-release sound card/MIDI interface I used, or from some *Windows* problem.

FIG. 3: The EQ window opens when an EQ module is double-clicked. The parameter values can be selected from a preset list but are not continuously variable.

Because playback of tracks on disk uses no A/D channels, the latter can be used to digitize the effects returns and submixer on mixdown to bring in reverbs or MIDI synths. The ten submixer inputs take only two A/D channels, so you can combine up to sixteen inputs with the eight disk tracks for 24-channel mixdown.

THE EDIT SCREEN

The Edit screen (shown on p. 94) is best understood after examining how Session 8 deals with audio. A recording is stored as a Soundfile. Some, or all, of a Soundfile may be designated as a Region. Each Region is actually a set of pointers to locations in a Soundfile and uses up only a few bytes; thus, many Regions containing the same or different material can be created from a single Soundfile, consuming a negligible amount of disk space.

Regions are assembled into Playlists, with each track having its own Playlist. Manipulating Regions is where Session 8 really begins to shine. Regions are objects, so they can be selected individually, or in groups, and moved around within or between tracks by dragging. Resizing Regions (i.e., adjusting the portion of a Soundfile contained in the Region) is also accomplished by dragging. A waveform display can be generated for each Region, and the user can determine when the lengthy calculations required will be performed, which is a considerate touch. Once calculated, waveform displays are stored in a file, so they need not be recalculated unless the audio in the Soundfile changes. Regions can also be stacked on top of each other in a track. What you hear will be what you see: The portion of a Region hidden by another Region stacked on top will not be heard.

This is where non-destructive editing comes into play. For example, you can record several takes of a guitar solo "on top" of each other, then audition each take or combine bits and pieces of them. Each combination takes only seconds to construct. The unedited original takes are always available at a moment's notice. The elegance and speed of this technique cannot be described in a few words; it must be experienced.

One nice touch is the special Silence Region, which is always available and, like any other Region, is simply dragged from the list to wherever you need it and sized as desired. I took a mandolin track containing rhythm and lead parts and used a Silence Region to cover the lead part while I bounced the rhythm part down with other rhythm tracks. I then deleted the Silence Region and resized the mandolin Region to leave only the lead part for the final mixdown.

Session 8's Grid mode forces a dragged Region's start or end point to snap to the stated reference, which can be any of the eight tracks, or to a Beat marker or one of its subdivisions. Beat markers are created by defining the musical location of a particular point in a Playlist. Session 8 uses the Beat markers to calculate tempo and musical locations, yielding a sort of tempo map that can be used for the grid. A point within a Region can be defined as a Sync Point, which will then be used in place of its start or end when snapping to the grid. Although the grid system is powerful and fairly flexible, it is too bad that a Sync Point cannot be set as the grid reference; that is, you can't designate Sync Points in two Regions and snap one to the other.

Session 8's facility for performing crossfades is simple and flexible. First, set the length of the crossfade by dragging over an area. Then, choose one of the seven fade curves for the fade-in and one for the fade-out. The crossfade is computed and stored in a file. Session 8 seemed to get confused when I opened my 48 kHz Session (a Session stores Routing, Mix, and system configurations, as well as the Playlists), telling me as it tried to open each crossfade file that the crossfade was stored at 44.1 kHz and so was incompatible. I told it that I understood and not to worry, and it opened the Session and played everything just fine. A minor bug, to be sure.

Digidesign intends to enhance Session 8 over time. The first announced improvement is a link to the Alesis ADAT that will allow data to be moved between the two systems in the digital domain, with automatic machine control. This combination promises to be a very powerful system.

EVALUATION

The key to understanding Session 8 is to see the impossibility of being all

Product Summary

PRODUCT :
Session 8 Integrated Digital Studio
PRICE:
Session 8 $3,995
Session 8XL $5,995
SYSTEM REQUIREMENTS:
25 MHz 80486SX or better PC-compatible; 4 MB of RAM; two card slots; *Windows* 3.1; large SCSI hard drive w/19 ms or better access time; backup system
MANUFACTURER:
Digidesign
1360 Willow Rd., Suite 101
Menlo Park, CA 94025
tel. (415) 688-0600
fax (415) 327-0777

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ● ●
EASE OF USE	● ● ● ●
SOUND QUALITY	● ● ● ● ◖
VALUE	● ● ● ● ◖

things to all people and making a $3,995 price point. Session 8 lacks signal processing beyond EQ; there's no compression, pitch shifting, time compression/expansion, or even reverse playback. It has only six EQ modules for eight channels and all the effects returns. Of course, these are features one usually expects on high-priced systems. On balance, I think Digidesign has done a superb job of choosing which tradeoffs to make and which are unacceptable. The Session 8 XL may sound better, but the review unit was, to my ears, high enough quality for album work.

Although there are features I would have liked to see, such as making the inserts available for disk tracks, I found Session 8 to be a reasonably powerful package, especially for the price. Bear in mind, however, that the total system price (including computer, hard disk, and backup) will be about $8,000.

I found Session 8 to be a reliable and solid performer, and encountered no nasty bugs. I did come across several minor annoyances, however, such as the inability to check available disk space or delete Soundfiles from within the program.

An important question is whether to buy a Session 8 (or other disk-based system) or a modular, digital tape recorder, such as the Alesis ADAT or Tascam DA-88. Both approaches have their strong points, and the best of all worlds is probably to have one of each, but most people will only be able to afford one or the other. Tape is far cheaper and offers greater portability. Hard-disk systems, however, are random access, providing superior editing opportunities, and prices for the drives continue to drop. The host computer in computer-based systems adds even more capabilities, such as viewing and editing the audio waveform, sophisticated non-real-time signal processing, internal digital mixing, and concurrent operation with other useful programs.

▼

The onboard EQ sounds smooth, but with only six modules, you probably will want to insert an external equalizer.

People making music in their home or project studios who need digital editing will love Session 8. Professional music-recording and post-production facilities will find it somewhat limited and lacking in many features they need. Clearly, it is the former group at which this product is aimed. And Digidesign's aim with Session 8 is absolutely true to the mark.

Larry the O *writes, performs, engineers, produces, and makes the best cafe mocha in the San Francisco Bay Area.*

MOTU Digital Performer 1.4

By Jeff Burger

At long last, Performer adds digital audio.

Mark of the Unicorn's *Performer* has the distinction of being the longest-lasting professional Mac sequencer on the market. Rather ignominiously, the company's *Digital Performer* has the distinction of being one of the longest-awaited Macintosh sequencers on the market. When the company first announced *Digital Performer*, veteran users and newcomers alike looked forward to the day when this venerable sequencer would consummate nuptials with digital audio tracks, running in parallel. Unfortunately, that day took nearly two years to arrive.

In the meantime, Opcode's *Studio Vision* and Steinberg's *Cubase Audio* have gained valuable ground. With the introduction of *Digital Performer* 1.4 however, MOTU is finally ready for the challenge.

PERFORMER BASICS

Digital Performer (*DP*) is built solidly on the foundation of *Performer* 4.2 and incorporates all the features found in that version of the program, including notation editing and printing and support for MOTU's *UniSyn* universal editor/librarian. As with previous incarnations, *Digital Performer* is copy-protected.

Performer's distinctive interface is implemented as a series of windows that the user can display and arrange as desired (see **Fig. 1**). In addition to a unique graphic treatment, each window has its own mini pull-down menu that accesses related functions. Context-sensitive help is available for most functions; it's invoked by pressing a combination of keys and clicking on the screen area in question.

SEQUENCING

The program offers many configuration options, including support for popular interfaces (particularly MOTU's MIDI Time Piece and MTP II) and the

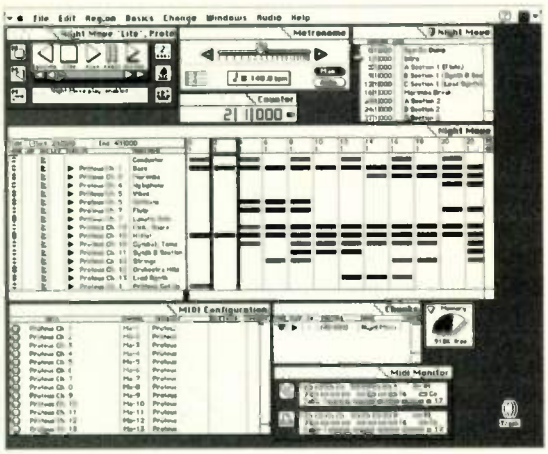

FIG. 1: Each of *Digital Performer*'s main functions appear in separate windows that can be displayed and arranged as needed.

ability to define Devices and Instruments in your MIDI setup. A Device refers to a single piece of MIDI equipment (including NuBus cards such as SampleCell) on a single channel. An Instrument is a group of Devices, a sort of layered, multichannel, multi-instrument superpatch.

DP's master functions can be accessed via separate windows for Controls, Metronome, and Counter, or in a combined version called Consolidated Controls (see **Fig. 2**). The Consolidated Controls window also displays icons that open the product's numerous editing windows. Mac and MIDI key equivalents for most of *DP*'s functions can be defined and edited by the user.

The Metronome window is used to manually specify tempo (down to a hundredth of a beat per minute) and meter, including all values from sixteenth note to whole note, complete with dotted values. The related Conductor track features are so powerful that you can even record a passage free-form, then go back in and tell the software where the measure lines should be.

Basic sequencing work is done in the Tracks window, which contains an unlimited list of tracks that can be named, added, deleted, rearranged, and so forth. A comprehensive list of options for filtering different types of data on input is provided.

Displayed on the left side of the Track window are MIDI activity lights for each channel; also provided here is a loop indicator. Multiple nested loops can be established in one or more tracks, with settings for start time, end time, and number of repetitions or infinite loop. This feature can be used in conjunction with Overdub Record mode for drum machine-style programming.

The right side of the Tracks window shows a grid representing a user-specified amount of time ranging from 30 ticks to sixteen measures. Black bars in the grid blocks represent the presence of dense track data, while gray blocks represent low-density data. (The density threshold can be set by the user.) This display presents a fast mechanism for viewing, selecting, cutting, and pasting data in segments.

EDITING

Digital Performer's MIDI editing functions and options are extensive. Double-clicking on a track name produces the associated Event window, which provides a scrollable, editable listing of each event in the track, identified by start time, type, Velocity, and duration (see **Fig. 3**). The View Filter offers radio buttons for every type of data imaginable, including specified controllers. This is handy in isolating data types from a long list of events; for example, if you're just editing notes, you may want to filter out a sea of controller events. A simple toggle allows note events selected with the mouse to be triggered on the associated devices, another handy feature for locating

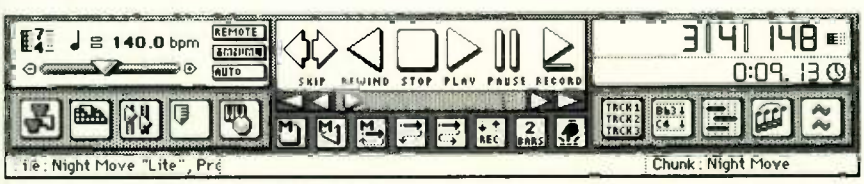

FIG. 2: The Consolidated Controls window unites the main features of the Controls, Counter, and Metronome windows and provides icons that open other main windows.

events. Unfortunately, non-note data is not transmitted in this mode, so your patch changes and the like won't be triggered.

Track information can also be viewed in other ways. The Graphic Editing window presents notes on a scrolling piano roll and plots controller data underneath in a graph (see **Fig. 3**). The display also shows the timing and Velocity details of events under the mouse pointer. On the down side, all notes selected in this window are fired at a Velocity of 64, giving no indication of related volume, not to mention potentially firing the wrong sample in a Velocity cross-switching instrument.

The Notation window offers similar features, displaying events in standard musical notation on a grand staff. A note can be entered, for example, by clicking at the start point, dragging to the right to specify duration, and releasing. Similarly, Command-clicking an existing note produces an editable gray bar that represents duration.

Automated transcription is a fine art at which *Performer* does not excel. The stems of all notes on the treble and bass clefs uniformly point up and down respectively, regardless of vertical position, and the flags and beams interpreted from note values are, kindly put, novel. Printing options aren't much more sophisticated. If you need notation beyond printing out rough parts, you should export the files into a dedicated notation package.

In addition to the click-and-drag editing available in the Edit, Graphic Editing, and Notation windows, areas selected in these windows and the Tracks window can be edited with functions found in the Edit menu and the Region menu. Edit filters also allow operations to affect only certain types of data.

The Regions menu offers more complex functions. Quantization can be performed during or after recording; both alternatives have options so extensive and subtle that they take a while to master. The same can be said for the options in the Humanize function, which provide controlled randomization of note placement, durations, Velocities, pitches, and tempo. Between these two commands, *DP* offers almost anything you could want in terms of "feel" control. A similar degree of control is offered over Velocity and duration in related menu functions.

Transposition extends well beyond

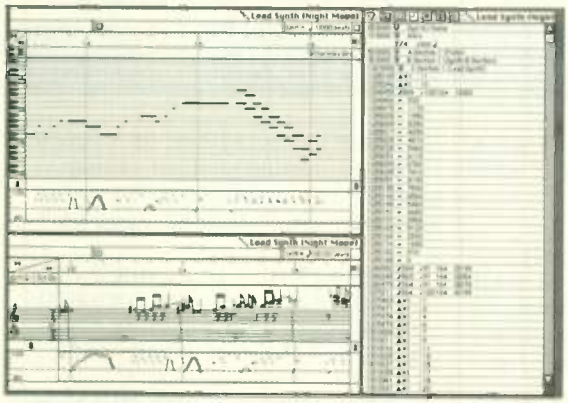

FIG. 3: *Digital Performer* allows events to be viewed and edited in Event List (numeric), Graphic Editing (piano roll), and Notation Editing (standard notation) windows.

simple key and octave changes, including mode changes, harmonization, and custom note-remapping for applications such as changing drum machines or drum kits. Tempo can be scaled with a variety of parameters, which is handy for global alteration of an overall tempo map, or randomization for feel. Time can also be scaled in a selected region, stretching or compressing both the space between notes and their durations. Features such as pitch inversion, custom scales, and reverse time show the program's ability to aid in the composition process. And the list goes on.

The latest versions of *Performer* and *Digital Performer* allow most editing operations to be performed while the sequencer is playing back. This can be handy in auditioning changes, though it took me a while to break the habit of reaching for the Stop button.

SONGS

Song building is accomplished with an interesting method referred to as "Chunking." The Chunks window is designed to contain a list of Chunks, or song segments. Chunks can be loaded from disk in the form of previously stored sequences or songs, or created anew from existing sequences in memory. Double-clicking on the name of a Chunk brings up a full Tracks window associated with that Chunk.

Songs can also be added to the Chunks window. Songs are then structured by opening a Song window and dragging Chunks into it. While this approach might seem a bit convoluted compared to more traditional song-mode designs, there is a distinct benefit in that the Chunks can be arranged both horizontally and vertically on a grid. This allows combinations of entire sequences to be stacked like mega-tracks and gives you the ability to manipulate multiple tracks, such as all the instruments in a brass section, as a group.

DIGITAL AUDIO

Digital Performer adds digital audio through the use of Digidesign Sound Accelerator I and II, Audiomedia I and II, or Pro Tools cards, and the Yamaha CBX-D5. MOTU claims the implementation is open-ended to support future products from a variety of manufacturers. Currently supported file formats include *Sound Designer*, *Sound Designer II*, and AIFF. The more interesting news is that MOTU has written their own drivers that allow *DP* to play back up to four virtual audio tracks on Audiomedia II or Sound Accelerator II boards, internally mixed down to stereo outputs. At the moment, other digital audio sequencers only support two tracks.

The basic digital-audio recording process is straightforward. The program offers peaking meters that can be toggled to monitor input or output; patch-through for monitoring the audio input; and strangely isolated input-level controls for Audiomedia cards. Audio tracks assume rows in the Tracks window, just like MIDI tracks, and are subject to the same transport and track controls (see Fig. 4) Each audio input channel is routed to a separate track and recorded as a mono *Sound Designer II* file; stereo recording is therefore accommodated using two mono soundfiles (although stereo soundfiles can be imported). Multi-Record mode allows two audio channels and an unlimited number of MIDI tracks

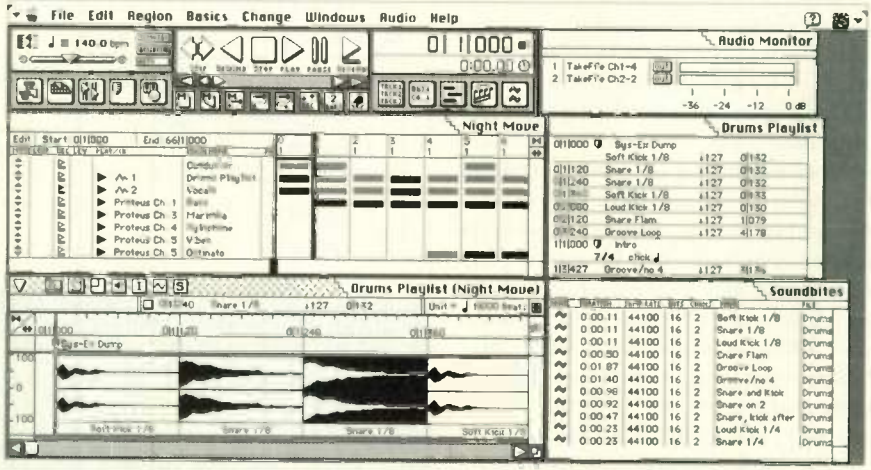

FIG. 4: Audio tracks take their place next to MIDI tracks in the main Tracks window. Other windows provide for monitoring input/output levels, arranging Soundbites, and editing them numerically or visually.

to be recorded simultaneously. The audio-playback channel is specified in a manner that is similar to MIDI channel assignment.

A new soundfile is created each time Record is engaged. While this means that takes are non-destructive and can be revisited if desired, it can also quickly clutter the hard disk with questionable or unwanted takes, as Undo doesn't work after canceling a bad take. Punch-ins are also non-destructive, leading to more files.

MOTU uses the term "Soundbites" to refer to pointers identifying portions of soundfiles. (Soundfiles are what actually reside on disk.) Soundbites make it easier to work with portions of files and are a cornerstone of non-destructive editing. Soundbites can be imported from regions specified in *Sound Designer II*, and entire *SDII* playlists can also be imported as a single audio track (although crossfades are not transferred).

Soundbites can also be defined in *Digital Performer*'s Audio Graphic Editing window, a fairly simple editor that allows standard selection of waveform regions with the mouse. In addition to the obligatory Cut, Copy, and Paste, the program offers several other commands that facilitate Soundbite creation. The Split command makes a Soundbite from a selected region without disturbing the original, which is handy for breaking a chorus out of a longer take in order to vamp out, for example. The Trim command cleans up files by removing unselected areas, and the Compact feature permanently removes areas of a soundfile not referenced by Soundbites, conserving disk space.

The Strip Silence command is perhaps the most powerful Soundbite-editing function. It automatically removes silence from a soundfile and separates the isolated segments into a series of separate Soundbites. This makes it easy to convert the take of an entire passage into phrases that are more easily managed. There are several options for Strip Silence. To begin with, you set a threshold; signals below this level are considered silent. Occasionally, unwanted audio (e.g., mic-handling noise) could exceed the threshold; the Attack/Release parameter sets the minimum time a signal can exceed the threshold and still be considered audio silence. Finally, a toggle restricts the endpoints to zero-crossing amplitudes, which helps eliminate pops.

The Audio Graphic Editing window also allows Soundbites to be dragged to new start times, using the mouse, and quantized for triggering percussive samples. Unlike the competition, however, *DP* cannot quantize to markers positioned within the soundfile. That could be a potential problem if you're trying to align an audio passage based on an event other than the first one. In general, the internal editor is limited to manipulating Soundbite boundaries; features such as normalize, amplitude increase/decrease, pitch conversion, sample-rate conversion, and special effects are not provided. A path can be set, however, to open the waveform in another audio editor, such as *Sound Designer II*, complete with any markers that have been defined. Functions are available to reload Soundbite boundaries after editing regions in *SDII*, or to replace Soundbites altogether with new files.

All currently defined and loaded Soundbites are listed in a dedicated Soundbite window, where they can be managed, renamed, and auditioned. Modified Soundbites are then integrated into the overall composition by placing them into an audio track, using the track's Event List window. Soundbites are given editable Velocity values that dictate the overall playback volume. Special audio volume and pan events can also be inserted in order to control those parameters at specific times. The Create Continuous Control command can be used to generate smooth fade and pan transitions.

Digital audio can also be manipulated in the Tracks window just like, and along with, MIDI data. The distinction is that you're editing the events that trigger the soundbites, not the digital audio itself. The only exception is that one or more Soundbites from a selected region can be mixed into a new soundfile, including the results of any volume and pan events, providing the basic equivalent of bouncing tracks in a multitrack recorder.

Digital Performer supports sync-to-tape in the same basic manner as the MIDI-only version and allows you to work with either MIDI Time Code, or MOTU's Direct Time Lock. (The digital audio doesn't function when synching to simple MIDI Clock, however.) In situations where there are fluctuations in tape speed, the digital audio slows down and speeds up, just as audio on tape would.

CONCLUSIONS

Have we covered it all? No way! *Digital Performer*'s feature list is just short of ridiculous. Subtle indications of MOTU's experience abound. Event chasing, for example, will search backward to trigger previous patch changes and current audio tracks, if you start after the head of a tune. The Console window lets you create onscreen sliders and buttons and assign them to control just about anything you want for mixing, patch editing, and so on.

Digital Performer is an extremely powerful tool for those who need a hybrid sequencing and digital-audio system. The product's history has produced a vast number of advanced features that take awhile to master. In some ways, *DP* is like an Erector set out of which you can build almost anything. However, the product's evolutionary path has produced an interface that brings Frankenstein's monster to mind. The 900-page owner's manual falls in this category and deserves a rewrite to make it more manageable.

Studio Vision and *Cubase Audio* users probably won't be able to justify changing horses unless they need immediate gratification on four tracks of audio. (If you are interested in switching, MOTU has an aggressive $295 competitive upgrade offer for users of *Vision/Studio Vision, Cubase/Cubase Score/Cubase Audio, Master Tracks Pro, Notator, Cakewalk Pro,* and *Sequencer Plus.*) Diehard *Performer* users will welcome the addition of digital audio. All in all, anyone with the desire for integration of power sequencing with digital audio will find *Digital Performer* 1.4 a stable, professional choice.

Jeff Burger *has been using* Performer *since it was knee-high to a Mac Plus (and manly synths still had knobs). His book* The Desktop Multimedia Bible *is published by Addison-Wesley and is available through Mix Bookshelf.*

Product Summary

PRODUCT:
Digital Performer 1.4
sequencing/digital audio software
PRICE:
$895
REQUIREMENTS:
Mac II or higher; Digidesign Audiomedia I or II, Sound Tools I or II, Pro Tools, or Yamaha CBX-D5; System 6.0.7 or later
MANUFACTURER:
Mark of the Unicorn
1280 Massachusetts Ave.
Cambridge, MA 02138
tel. (617) 576-2760
fax (617) 576-3609

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ● ●
EASE OF USE	● ● ● ●
DOCUMENTATION	● ● ●
VALUE	● ● ● ●

Opcode Musicshop 1.0 (Mac)

By Geary Yelton

Sequencing with notation for the entry-level electronic musician.

Veteran electronic musicians have long demanded more integration between notation and sequencing software. In response, most of the top developers have added varying degrees of scoring capability to their sequencers, while increasing the sequencing abilities of their notation software. Beginning electronic musicians are, by definition, more comfortable with music notation than with piano-roll editing and event lists, so it is a given that many new entry-level programs also will be hybrids.

Opcode has entered the fray with *Musicshop,* an entry-level, 16-track sequencer for the Macintosh that offers considerably more than one generally expects from entry-level programs. Like many of the other hybrids, Musicshop's outstanding virtue is that for a relatively paltry $149, it offers solid sequencing features while displaying and printing sequences in traditional music notation.

An update of Opcode's *EZVision, Musicshop* is not a music-transcription program in the manner of Coda's *MusicProse* and Passport's *Encore.* It can only print notes and rests on staves with a title at the top, two small text blocks below the title, and page numbers (see

Fig. 1); you can't enter lyrics, dynamic markings, chord symbols, and so on. Though notes can be manually placed on a staff, there's no palette of music symbols, not even rests.

Opcode states that the minimum configuration for *Musicshop* is a Mac Plus with 2 MB of RAM. Don't believe it. When I ran the program on a 68000-based SE, it was excruciatingly slow. There was always a delay between giving a command, such as Stop or Record, and its execution. Scrolling takes forever. Don't consider *Musicshop* unless you have at least a Classic II. (Fortunately, Opcode is working on an upgrade that will speed up the program, especially screen redraws, by a factor of ten.)

GETTING STARTED

The heart of the program is the Edit window. Though the application defaults to Notation view, by clicking on the View Toggle button, the display changes to the graphical piano-roll view (see Fig. 2).

MIDI channels and ports are assigned and Tracks named in the Track Setup window. Multiport interfaces, such as Opcode's Studio 4 or 5 and MOTU's MIDI Time Piece, are not supported, but if you have an interface connected to each serial port, you can use any sixteen of the 32 MIDI channels.

In the convenient Program and Note Names window, you can name each device, program, and MIDI note (useful for percussion). (The program defaults to General MIDI program names and drum note names at start-up.) The device name becomes the name of the track assigned to its channel. Program names can be typed in manually, or if you have Opcode's librarian program, *Galaxy*, you can subscribe to its bank or bundle names. Name lists can be saved and opened as separate files.

Surprisingly, Musicshop does not support Opcode's *Open Music System* (*OMS*). Presumably, Opcode expects that entry-level users won't be concerned about its advanced capabilities (though *OMS* support is promised in a future upgrade). The program does support Apple's *MIDI Manager*, which allows it to share the serial ports and timing capabilities with other MIDI applications. *Musicshop* can only synchronize to MIDI Clocks and Song Position Pointer; SMPTE and MTC are not directly supported.

RECORDING

The transport controls are found in the Edit window (see Fig. 3), along with the counter, tempo field, cursor-selection buttons, quantization tools, and zoom controls. A status bar displays, depending on its mode, either the sequence name, length, meter, and key; the selected note; or the location of the cursor.

Almost all kinds of MIDI data can be recorded and edited, including System Exclusive. Because there's no means to filter MIDI commands, all data that can be recorded is recorded. If you select Replace in the Setups menu, previously recorded MIDI data is erased as you record a track. You can also select Overdub, which layers new data on top of the old, or Punch, which replaces data beginning and ending at points you specify. You can hear any number of measures play before the punch-in point, or begin recording when you play a note. A countoff can be requested, which plays an audible metronome for one or more measures before recording begins.

Musicshop provides loop recording, and you also can loop tracks during playback. While you're in Loop Record mode, you can change record tracks without stopping, an extremely useful feature. Each of the sixteen tracks can have a different loop length, which offers some interesting possibilities.

Both real-time and step-time recording are supported. When recording in step time, note duration can equal any percentage of the step value or equal rests can be placed between each note. In step recording, you can choose whether to record Velocity. It's also possible (though tedious) to enter notes with the mouse and computer keyboard.

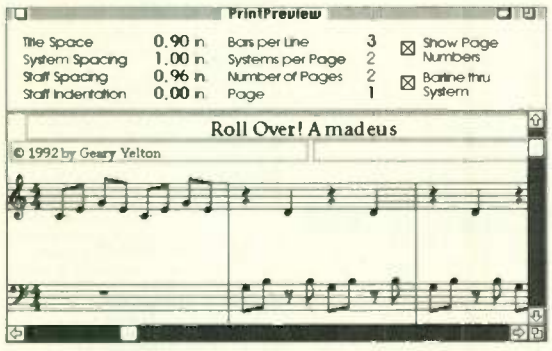

FIG. 1: *Musicshop* prints notes and rests on staves with a title at the top, two small text blocks below the title, and page numbers. However, it doesn't support lyrics, dynamic markings, or chord symbols, and there's no palette of music symbols.

You can literally paint notes on the piano-roll grid by clicking at the desired time and pitch and dragging to the intended duration. Alternatively, in both notation and piano-roll view, you can click the mouse to insert notes, using the Macintosh's numeric keys to change rhythmic value. This technique is trickier than it sounds, though; you have to watch the status bar to ensure, for example, that you don't enter a B♭ instead of a B♮. And if you place a quarter note a half-beat late, instead of right on a quarter-note beat, an eighth-note rest will be inserted.

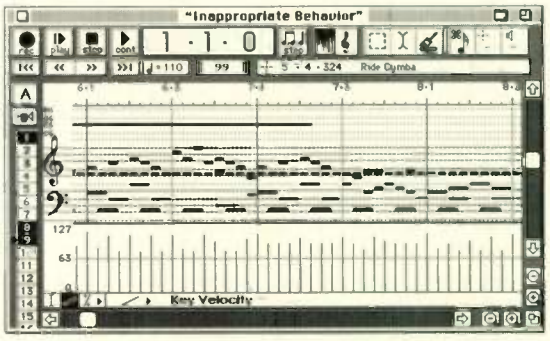

FIG. 2: The graphical piano-roll view in *Musicshop*'s Edit window. By clicking on the View Toggle button, the display switches between notation and the piano-roll editor, but you cannot view both at the same time.

Though you can display as many tracks as you can fit onscreen, multiple tracks can't be recorded simultaneously. This is acceptable for an entry-level sequencer, but don't expect to record live MIDI jams with your friends, or enter 2-handed split parts assigned to different channels. If you intend to dump songs in real time from a hardware sequencer to *Musicshop*, you have to do it one track at a time.

NOTE EDITING

One big advantage that MIDI sequencing has over tape recording is that it's easy to fix mistakes. In either the piano-roll window, or Notation view, notes can be transposed by dragging them up or down on the grid or staff. You can hear the notes when you scrub them in this manner, which is unusual for a program in this price range. You can change a note's location in time by grabbing its left side and dragging it where you want. To shorten or lengthen a note's duration, grab its right side. A range of pitches within an entire track can be selected by dragging to the left of the musical staff or piano-roll grid. When you select an individual note, its location, pitch, and Velocity appear in the status bar only at that moment. Most of the time the cursor location is shown there, so you can't alter note information by typing in the status bar.

Oddly, *Musicshop* doesn't let you use a MIDI controller for editing. You can't select a note and then change its pitch by playing a new pitch on your MIDI controller, nor can you select a note and transpose it or change its duration with a menu command. However, in the Edit menu it is possible to change a note's location with the Move Events command and to insert and delete time.

There are five ways to quantize your music. One type changes the recorded data, adjusting each note's start point; another quantizes only what you hear as it plays back. Notation Display Resolution changes the way music appears in Notation view but doesn't affect sequence playback or its appearance in piano-roll view. This is a really valuable feature that all such programs should emulate. Cursor Quantize limits cursor movement to specific increments, which makes it easier to position notes accurately with the mouse. The fifth kind of quantization changes durations as well as the start points of recorded notes.

A strip chart can be shown below the note display for editing non-note MIDI data, including tempo. Only one type of data is shown at a time. The chart supports Velocity, Channel (but not Poly) Aftertouch, Program Changes, Pitch Bend, SysEx packets, and all controller messages. Edit tools include a pencil for drawing in changes by hand and a variable tool for scaling values, adding an amount, limiting to minimum or maximum values, thinning data, or making notes more legato or staccato. There are also five pop-up edit curves that affect whether you can draw changes in straight lines, parabolic curves, freehand, and so on.

ARRANGING AND MIXING

Individual sequences are arranged into songs in the Arrangement window. Up to 25 sequences can be saved in a single *Musicshop* file, one for each letter from A through Y. As with other Opcode sequencers, a sequence is selected by typing its letter on the Mac keyboard. The Arrangement window is called up by typing the letter Z, or by selecting it from a pop-up menu.

Similarly, a sequence is placed in the Arrangement window by typing its letter. For instance, if you want sequence A to play twice, followed by sequences B and C, just type "A A B C" in the Arrangement window. Each sequence is graphically represented by a block that indicates its length. A ruler shows the measure number at the beginning of each sequence, and the status bar displays the length and title of the currently selected sequence.

The Mixer window provides a fader for each track and contains the mute and solo buttons and pan controls. You can overdub mixer data on previously recorded tracks, and because the strip chart can display Volume changes, it's possible to edit Volume as if it were recorded on a separate track.

EASE OF USE

Overall, *Musicshop* is easy enough for beginners to use. A reference card showing the Edit window and all the

Product Summary

PRODUCT:
Musicshop 1.0

PRICE:
$149.95

REQUIREMENTS:
Macintosh Plus or better (68030 or better recommended), including PowerBook; 2 MB of RAM; System 6.x or later; *MIDI Manager*-compatible

MANUFACTURER:
Opcode Systems
3950 Fabian Way, Suite 100
Palo Alto, CA 94303
tel. (415) 856-3333
fax (415) 856-3332

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ●
EASE OF USE	● ● ●
DOCUMENTATION	● ● ● ●
VALUE	● ● ● ◖

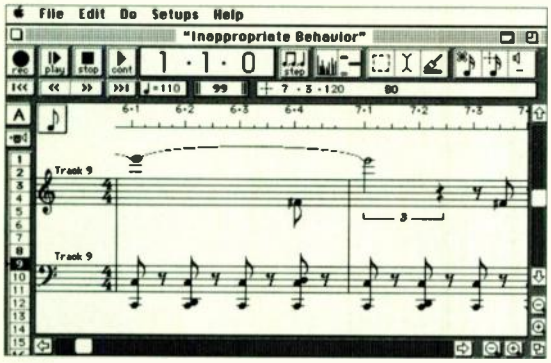

FIG. 3: The Notation view in *Musicshop's* Edit window. The Edit window also contains the transport controls, the counter, tempo field, cursor-selection buttons, quantization tools, and zoom controls. A status bar displays, depending on its mode, either the sequence name, length, meter, and key; the selected note; or the location of the cursor.

menus accompanies a well-written, well-organized, and indexed manual. A tutorial manual runs you through basic recording and editing, with many pages devoted to explaining MIDI. The online, context-sensitive help provides answers much more quickly than leafing through the manual and is faster than help systems that require you to select a topic from a table of contents.

On the other hand, the *Musicshop* user interface isn't perfect. Maneuvering among several windows to set up MIDI channels, track names, and so on isn't as convenient as doing it all in the window where you record, and some users may have difficulty the first time they boot up the program.

Recording, mixing, and arranging songs are straightforward enough. But editing notes with precision in the piano-roll screen is a clumsy process, because the values of the selected notes aren't displayed in the status bar. Even if you quantize, it's difficult to place notes at the exact locations you want them.

What you see in Notation view depends on the Notation Display Resolution, so, as with many other hybrid sequencers, notation is a compromise between precision and legibility. The trouble is that with resolution set to an eighth note, for example, sixteenth notes and smaller aren't displayed. If it's set to a sixteenth note, a quarter note that isn't held for its full duration may be shown as an eighth note tied to a sixteenth. This could make it impossible to print out an accurate score unless you change the recorded part. It may be necessary to create one file for playback and another for printing.

CONCLUSIONS

Musicshop is intended for users whose sequencing needs are modest. If sixteen tracks are enough for your MIDI setup, it's a good choice for the money. Perhaps the ideal *Musicshop* user is a student. The program goes a long way toward teaching the basics of sequencing and makes it possible to print out simple scores and graphic examples of musical phrases. If a score needs dynamic markings, lyrics, and the like, you can always do it the old-fashioned way and draw them with a pen after it's printed.

If you already use *EZVision*, and you want to be able to edit and print your sequences in standard music notation, *Musicshop* is well worth the $50 upgrade fee. If you're shopping for your first sequencing program, and you can't afford, or don't need, something more powerful, give *Musicshop* a try.

Geary Yelton *is an artist in the Creative Services Group of Ernst & Young in Atlanta, Georgia.*

Yamaha QY20 Music Sequencer

By Scott Wilkinson

One sequencer/sound-module combo to go, please.

When the QY10 appeared over two years ago, it caused quite a stir. This unique little gem (reviewed in the May 1991 **EM**) offered a battery-powered sequencer and multitimbral sound module in a unit no bigger than a video cassette, all for $399. Of course, it wasn't without its limitations, particularly its minuscule display; small note capacity; chiclet-sized, 1-octave "keyboard"; and less-than-intuitive user interface. Nevertheless, it was the only choice for electronic musicians on the run.

Mobile musicians now have two choices, as Yamaha has introduced its second generation of music machines-to-go. The QY20 resembles its predecessor in size and concept, but that's where the similarity ends. This puppy is an improvement in just about every respect, albeit with a reasonable increase in price. What changes hath Yamaha wrought? I'm glad you asked.

FIRST GLANCE

The most obvious improvement is the large, graphic LCD display, measuring 128 × 64 pixels. Four "soft" buttons perform various functions, as indicated in the display. Most of these labels pop up when you hit the Menu button, while the Mode button toggles through the three operating modes (described shortly). The cursor-control cluster consists of four buttons oriented at the compass points. Increment/decrement buttons perform data-entry and confirmation duties, and standard transport controls operate the sequencer. This arrangement is clean, uncluttered, and intuitive.

The "keyboard" still resembles black and white chiclets, but at least it has two octaves instead of one and is polyphonic instead of monophonic. As with the QY10, the keys serve several functions. The Octave Up and Down buttons are used primarily to transpose the mini keyboard by octaves to cover an 8-octave range. Unfortunately, there is no indication of the octave setting in any of the standard screens. You can see the setting by holding Mode and Menu simultaneously, which also displays the drum sounds played by each key from the currently selected drum set. However, the Octave Up and Down buttons are inactive while this screen is displayed.

The various input and output jacks are found around the edges of the unit. These include MIDI In and Out and two stereo audio outputs on ⅛-inch mini-phone jacks, labeled Line and Phones. The two audio outputs respond to a single volume control. The power switch and LCD contrast control are also found on the edge.

The QY20 is powered by six AA batteries (not included), which should provide at least six hours of operation. Unfortunately, there is no automatic power-down after some period of inactivity; I wasted a set of batteries before I realized this. You can also power the unit with an optional AC adapter.

SEQ AND YE SHALL FIND

The sequencer offers a resolution of 96

ppqn and can hold up to twenty songs and 28,000 notes (in addition to a limited, but unstated, amount of controller data) in battery-backed RAM. The only external storage is via SysEx bulk dump. As with the QY10, there are four normal "linear" tracks and four "accompaniment" tracks, called Chord1, Chord2, Bass, and Drums. Data can be input from the mini keyboard, an external controller, or another sequencer, and all recorded data can be sent, in real time, through the MIDI Out. Unfortunately, the sequencer does not save or read Standard MIDI Files.

▼

Unfortunately, there is no automatic power-down after some period of inactivity; I wasted a set of batteries before I realized this.

The internal sound module is 28-note polyphonic and 16-part multitimbral with dynamic voice allocation. There are 100 preset Advanced Wave Memory (AWM, i.e., sampled), pitched voices in ROM and another 100 drum sounds in eight drum kits. The sounds cannot be edited, and the unit does not have an effects processor, although many of the voices were sampled with ambience of one sort or another.

By and large, the preset sounds are disappointing. Many have a slight buzz that persists even after the primary sound has faded away, and some have obvious and/or static loops. These problems are sometimes hidden in the context of an entire arrangement. There are a number of good sounds, however, including most of the drums.

A LA MODE

The QY20 is organized into three primary modes: Voice, Pattern, and Song. Voice mode controls the multitimbral sound module. Voices are assigned to sequencer tracks in this mode; track 1 responds to messages on MIDI channel 1, track 2 responds on channel 2, and

so on; track 8, the drum track, responds on channel 10.

A General MIDI mode responds to all sixteen channels, but you can't see any information about the eight channels not shown in the display. Technically, the QY20 isn't a GM module because Yamaha included only 100 GM sounds, excluding some of the sound effects such as the bird tweet and helicopter. They should have included the 28 extra programs for true GM compatibility.

The Voice-mode display is way cool. An 8-channel mixer appears, with track labels and assigned voice numbers and mute, pan, and fader controls. Although the manipulation of these controls from the QY20's front panel cannot be recorded in a sequence, MIDI Control Changes 7 and 10 (Volume and Pan, respectively) can be recorded from an external source. These messages even cause the onscreen controls to move in response.

As the name implies, patterns are recorded in Pattern mode. These patterns are one to eight measures long and consist of drum, bass, and up to two chord parts. There are 100 preset patterns that represent most popular styles including various types of dance, ballad, rock, pop, rhythm and blues, jazz, Latin, and world. You can also record up to 100 of your own patterns.

Patterns are assembled into songs in Song mode. Each preset pattern includes six different, but related, versions: Intro, Normal, Variation, Fill1 and Fill2 (transitions between the Normal and Variation versions), and Ending. Using these versions, you can construct an entire song that remains musically interesting. Using the Normal version during the verse and the Variation during the chorus works well for songs with a verse-chorus structure. You also record lead and other parts in Song mode.

To establish the harmonic progression, you apply different chords to the patterns and versions within a song. This can be done from the mini keyboard, which is labeled with the twelve note names and 25 different chord types. You can even specify an independent bass note for any chord (e.g., Bm7/E). Alternatively, you can activate the ABC (Auto Bass Chord) mode and play a 3-, 4-, or 5-note chord on the mini keyboard or an external keyboard, which the QY20 analyzes and applies to the pattern. In essence, the patterns provide a backup band that responds to

NOVATION MM10 AND MM10-X

As soon as the QY10 made its debut, there was a pressing need for a fully portable, but full-sized, keyboard to go with it. Jumping to fill this need, Novation Electronic Music Systems introduced the MM10 ($219.95). This portable keyboard controller is powered by six AA batteries (said to provide 40 hours of operation), or an optional AC adapter. Its case even includes a special receptacle that holds a QY10 in the proper performance orientation. (It also holds a QY20 with an ADP-1 adapter.)

The keyboard includes 25 full-size, unweighted, Velocity-sensitive keys, as well as pitch-bend and mod wheels. A MIDI Out jack is accompanied by an AC adapter input; a DC power output (to power the QY if you use an AC adapter to power the keyboard); one stereo, 1/8-inch, mini-phone line input; and two stereo, 1/8-inch, mini-phone audio outputs for headphones or an external sound system.

The keyboard's audio outputs are powered by a 1-watt amplifier, but unfortunately, they are very noisy. I recommend using the QY20's audio outputs instead. According to the distributor, the audio output of the QY10 is so low, it requires amplification to be heard in most mobile environments, which is why they put an amp in the MM10. It may be noisy, but it's better than not hearing the music at all.

The controls are simple, offering the ability to change the MIDI channel and transpose by octave and semitone. You can also send Program Change messages, although the procedure is somewhat awkward; I was never sure what Program Change number it was sending. The 1-character LED display is a bit cryptic, but I got used to it.

Novation recently announced a new product, the MM10-X ($239.95). Similar to the original MM10 in size and function, the new keyboard includes a sustain-pedal input, and the mod wheel has been replaced by a programmable wheel that can send Modulation, Aftertouch, Volume, and Pan messages. In addition, the MM10-X sports an LCD display that provides simultaneous readouts of MIDI channel, octave, Program Change, transposition, controller functions, and battery condition. The battery life has been extended to 100 hours with standard batteries, or 250 hours with alkalines. There are no audio inputs or outputs on the MM10-X, as they are not needed with the QY20.

These products are essential for truly portable sequencing with the QY10 and QY20. Without them, lead lines and other parts are virtually impossible to enter in real time, and they make the ABC function a viable alternative for real-time chord entry. If you need to sequence on planes, trains, or automobiles, this is the only ticket in town. Distributed by Music Industries Corp.; tel. (800) 431-6699 or (516) 352-4110; fax (516) 352-0754.

The MM10 provides 25 full-size, velocity-sensitive keys in a battery-powered package designed to accompany the QY10 and QY20.

your chord changes. Chords can occur on every beat, whereas patterns are at least one measure long and always begin on the downbeat of a measure.

There are two relatively complete sets of editing functions for patterns and two similar sets for songs. One set, called "Jobs," affects sections from one measure up to an entire track, pattern, or song. Pattern Jobs affect one or all of the accompaniment tracks and include functions such as copy, quantize (half notes to 32nd notes, with intermediate triplet values), and transpose, as well as scale and offset Velocity and gate time (percentage of note duration).

The QY20 includes an 8-track sequencer, multitimbral sound module, and a well-designed user interface with 128 x 64 LCD display, 2-octave keyboard, and cursor-control cluster.

Song Jobs affect the linear track, and some can also affect the Chord track in which the sequence of chords is stored, but they do not affect the accompaniment tracks. Most of these Jobs can be applied to any range of measures within a track. Among other things, they let you mix (bounce) tracks, copy data from one track to another, quantize, transpose, shift data forward or backward by clock pulses, remove a specified type of event, and modify Velocity and gate time.

The Create Measure Song Job inserts a specified number of blank measures, with an independent time signature, into all linear tracks and the Chord track. Delete Measure removes the specified number of measures and closes the gap in the tracks. These Jobs do not affect the accompaniment tracks, which are pattern-oriented, rather than linear. Unfortunately, the manual does not make this clear, nor does it explain how to make the accompaniment tracks match the linear tracks if you insert or remove measures from them.

The other set of editing functions for patterns and songs starts with an

event list for each track. These functions let you change, insert, and delete individual events in each track.

USING THE QY20

I sequenced several songs in a variety of styles using some preset and custom patterns. Hitting the version keys at the right time is a bit tricky at first, but the versions change slowly enough to manage, particularly if you reduce the tempo during recording. If you start as the manual suggests, however, the patterns play the same chord over and over, which gets old fast. I found it better to enter the chords in step time first, and apply them to the patterns as you assemble them in real time.

Entering chords in real time is not as easy as assembling patterns; I had to slow the tempo way down. Entering chords from an external keyboard, using the ABC mode, is much easier (assuming you have the harmonic and keyboard chops). This can also be done from the mini keyboard, but I wouldn't recommend it.

You can enter repeats and tempo changes only in step time. Any section can be repeated up to 99 times, and repeated sections can be nested up to ten deep. Sudden and gradual tempo changes are easy to enter. The manual says tempo changes can take up to 99 measures, but it's actually 99 beats.

Most of the preset patterns are far better and more musically interesting than the "boom-chick" backgrounds you hear wafting from the organ store in your local mall. In general, the various versions are great for knocking out a quick background part. However,

Product Summary

PRODUCT:
QY20 Music Sequencer
PRICE:
$599
MANUFACTURER:
Yamaha Corp. of America
6600 Orangethorpe Ave.
Buena Park, CA 90620
tel. (714) 522-9011
fax (714) 739-2680

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ● ●
EASE OF USE	● ● ● ●
SOUND QUALITY	● ●
VALUE	● ● ● ◖

some of the Fill transitions are better than others, and a few of the Variations are poorly matched with their Normal counterparts. In addition, some of the Endings are rather abrupt. All in all, though, most people should find at least a few preset patterns that work well with their music.

If not, you can always record your own patterns, although they won't have the six versions. Each of the four accompaniment tracks in a user pattern can be recorded from scratch, in real time or step time, or you can copy tracks from one pattern (even the presets) to any user pattern. Time signatures can range from 1/16 to 16/16, 1/8 to 16/8, and 1/4 to 8/4, and user patterns can be one to eight measures long. With user patterns, you can bypass the Chord function, recording and assembling patterns with total harmonic freedom, as you would in any loop-based sequencer.

Once the accompaniment parts are recorded, you can add your own lead and other parts on tracks 1 through 4. This works as expected, although an external keyboard is essential (see sidebar, "Novation MM10 and MM10-X").

CONCLUSIONS

There's no doubt the QY20 represents a significant improvement over the QY10. With more sounds, patterns, drum kits, and chord types, a much greater sequencer capacity, and a vastly improved user interface, the QY20 proves the old adage that good things can come in small packages.

This device is well-suited to quickly creating accompaniments for live performance and practicing, and its value as a portable compositional and arranging scratchpad is high. The preset patterns are helpful for someone who wants to sequence, but doesn't know how to write a reggae bass line or other stylistically accurate backup parts. However, due to the relatively poor quality of the sounds, I would not use it as a multitimbral sound module in a serious environment.

If the third-generation QY30 (or whatever it's called) includes truly great sounds and the ability to transfer Standard MIDI Files over MIDI without significantly increasing the price, Yamaha will have a monster product. In the meantime, the QY20 offers quite a lot to roving musicians for whom inspiration strikes at 30,000 feet.

Sonic Solutions Sonic Quattro (Mac)

By Al Eaton

High-end random-access audio recording for the mid-level studio.

Sonic Solutions has been making high-end digital audio workstations (DAWs) for several years, but their Macintosh-based systems have been exclusively for the elite. Sonic's best-known product, the NoNoise noise-reduction system, enables audio engineers to become miracle workers, salvaging seemingly hopeless master tapes to produce clear, clean recordings. But the project-studio owner could only dream of acquiring the most basic Sonic Solutions workstation—until now. The introduction of SonicStation II and Sonic Quattro heralds a new day in affordable DAWs.

The SonicStation II records analog or digital audio on two input channels, and it offers real-time playback of twelve internally mixed sound files from two analog or digital outputs. The Quattro is an enhanced version of the SonicStation II. With four channels of digital I/O instead of two in the base configuration, it can be expanded to 24 inputs and outputs. In addition, it offers additional background dumping, loading, and archiving functions. Both systems operate at sampling rates of 44.1 and 48 kHz with 16-bit to 24-bit resolution. They also work with the NoNoise system, although NoNoise is still quite expensive ($19,995).

I tested a Sonic Quattro with version 2.0.3 software. Most of my work involved producing rap, R&B, and Chamoru music for CD releases. I used a wide variety of program material, including solo vocal, group vocal, narrative vocal, bass guitar, acoustic guitar, electric guitar, drums, and a full rhythm section, with and without vocals. Within 30 minutes of unpacking the system, I was up and running. The software installer prompts you to insert each disk in the correct order, making the installation procedure a simple matter that takes just a few minutes.

SYSTEM REQUIREMENTS

The Sonic system requires a Macintosh II, Centris, or Quadra with at least 8 MB of RAM (12 MB with System 7), two NuBus expansion slots, an extended keyboard, a color monitor, a large external hard drive, and Macintosh System 6.0.5 or later. When running under System 7, virtual memory must be turned off.

Because the Sonic card performs all processing, any Macintosh II will work. However, a fast machine is highly recommended; otherwise, redrawing digital waveforms can take quite a bit of time. I tested the Quattro using a Mac IIfx with 20 MB of RAM, an Apple 13-inch color monitor with a standard video card, and System 7.

THE HARDWARE

The primary hardware includes the SSP-3 signal-processing NuBus card and I/O NuBus connector card. The SSP-3 is the heart of the system. It contains four high-speed, Motorola 56001 DSP chips; a 24-bit × 4 MB D-RAM buffer; fiber-optic input and output connectors for four channels of digital audio; an 8-pin, mini-DIN port for reading and generating SMPTE time code; a high-performance SCSI bus; and two high-speed serial ports that connect to the I/O card.

The I/O NuBus card's only function is to bring the SSP-3's SCSI and serial ports to the rear panel of the Mac. If you have only a few NuBus slots, you can use Sonic's custom cable.

Another essential piece of hardware is a large, external hard-disk drive. Sonic offers several models, including the SS-405 1.2 GB drive, SS-407 1.6 GB drive, and SS-411 2.4 GB drive. The SS-405 1.2 GB drive stores 164 track-minutes of 16-bit, 44.1 kHz audio (84 minutes of stereo). The company also offers a 1 GB magneto-optical drive. Although any SCSI drive with an access time of 16 ms or less will work, Sonic Solutions guarantees at least twelve tracks of real-time playback only with their drives; full compatibility is not assured with drives of the same model from the same manufacturer.

According to Sonic's representative, the company carefully qualifies each drive for their system. In addition, hard-drive manufacturers sometimes make minor firmware changes that may cause problems when used with the workstation. The Sonic folks feel that if you only need eight channels, you can probably use a standard drive, but you must be sure you are really getting a sufficient sustained—not short-term burst—transfer rate. (Good luck getting this information.) For the record, Sonic Solutions states that their drive is required. I would be happier if they could guarantee 8-channel compatibility with any drive that truly meets the recommended specs.

Sound files can be stored on as many as six SCSI hard drives per SSP card, and more drives can be added to the system at any time, without shutting down. Although sound files can't be spread across drives, you can edit transparently among files on different drives.

Sonic's optional half-rack SS-611 Optical Converter box performs simultaneous, bidirectional conversion between the optical digital I/O on the Quattro's SSP-3 card and the box's AES/EBU-S/PDIF I/O. All Sonic Solution digital connections use an optical path, so this is Sonic's way to access the world of devices with XLR and RCA connectors.

Another option is the SS-610, a stereo, analog-to-digital and digital-to-analog converter box that uses 16-bit, 64× oversampling, Delta-Sigma converters. It operates at nominal analog levels of +4 dBm or -20 dBV and includes an internal crystal oscillator for recording at either 44.1 or 48 kHz. The SS-610 can accept an external clock source, so multiple units can be slaved to a single clock for multitrack applications. This half-rack unit operates on the previously mentioned optical-transmission scheme.

In addition to its multitrack, random-access recording abilities, the Sonic system can be used for compact-disc premastering and production. The optional *TrackMaker* software ($895) and Sonic Solutions/Sony CD-200 CD printer ($7,995) produce Red Book-standard CDs (using write-once optical media) and premasters (PMCD format) for commercial CD production. (For more on the technology of CD production, see "Personal CD Recorders" in the October 1992 **EM**.)

RECORDING

After opening the application and looking at the menus, it was immediately apparent that this is an intense and non-intuitive program. The majority of the menus are doorways to other submenus. For musicians who are technologically shy, this could be a vast undertaking. The manufacturer also uses some product-specific terminology, which doesn't help the situation. However, the manual is complete, well-organized, and includes an index (as well as a few typographical errors).

Fortunately, Sonic also includes CE Software's *QuicKeys 2* macro-making software with preprogrammed macros, which lets you trigger most of the menu commands from key equivalents on the Macintosh keyboard. With so many menus and submenus, these macros really help you get around. The on-screen key-equivalent template is a thoughtful touch.

The Mixing Desk window (see **Fig. 1**) is the first to appear after launching the application. This virtual mixer has four Audition Channel input strips in the left-hand section of the screen. There's more than meets the eye, however, because each of the four virtual Audition Channels can play up to three sound files from the Edit Decision List (EDL). These sound files share the filter (EQ), pan, mute/solo, and level settings of their mixer channel. Thus, the system can play up to twelve sound files with four sets of channel controls. When additional inputs are added to the system, the mixer expands accordingly. On the output side, the mixer

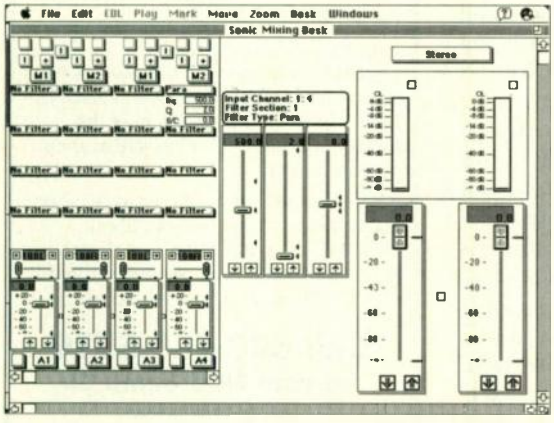

FIG. 1: The Mixing Desk window has four Audition Channel input strips in the left section of the screen; each strip offers level, pan, channel mute and solo, as well as parametric, highpass, and lowpass EQ. The output section includes a pair of level meters and master faders.

includes a pair of level meters and master faders.

Level and panning moves can be fully automated. In addition, each channel has one band of fully parametric EQ, a highpass shelving filter, and a lowpass shelving filter. The filters can be ganged to simultaneously EQ two or more channels as a group. The digital EQ sounds excellent; it's quite musical, unlike the EQ on some DAWs in this price range.

Recording multiple sound files for album sequencing couldn't be easier. The flow of digital audio signals is specified in the Audio Preference I/O window (see **Fig. 2**). After opening the Record Sound File window, which also opens the Transport Panel window, simply name the file, hit Record, and then Play.

The Transport Panel resembles the familiar tape-deck transport controls (Fast Forward, Rewind, Play, Stop, and

Product Summary

PRODUCT:
SonicStation II and Quattro
PRICE:
Sonic Quattro 4-channel $6,995
SonicStation II 2-channel $4,995
SS-610 A/D-D/A converter $995
SS-611 optical converter $575
SS-405 1.2 GB Sound Disk $2,395
Total Quattro System (less computer) $10,960
MINIMUM REQUIREMENTS:
Macintosh II or better; 8 MB RAM (12 MB with System 7); two NuBus slots; extended keyboard; color monitor; hard drive; System 6.0.5 or later
MANUFACTURER:
Sonic Solutions
1891 East Francisco Blvd.
San Rafael, CA 94901
tel. (415) 485-4800
fax (415) 485-4877

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ●
EASE OF USE	● ●
SOUND QUALITY	● ● ● ● ●
VALUE	● ● ● ◖

Record), so its operation is easy to understand. This is a "floating" window that remains active even as other windows are opened and closed, so the transport controls are always accessible unless you close it.

This panel also includes a current-location counter and three cue-point memory buttons. The cue points are set in one of three ways: hitting the space bar as a file is playing in order to grab locations "on the fly," typing or dragging the desired time values into the Cue Point window, or pasting location numbers that were cut or copied from another window. Although the inclusion of cue points is great, there should be more than three, especially for video and film work.

After recording and updating the disk file, a new file is automatically created, ready for naming. This feature is handy if you are recording multiple songs from DAT to compile for CD mastering. Even file-naming is optional; sound files are named automatically in sequence for each recording (i.e., Recordings: Take 0001, 0002, 0003, etc.).

All parameters in the Default Record window can be user-specified, so most of the hard-disk housekeeping can be automated. All input signals can be monitored from the output, even while playing back files from the EDL.

The SonicStation SND folder on the Mac desktop includes individual folders for each stereo sound file on the system's SCSI drives. These folders don't contain the actual sound files, only data about them. When a stereo sound file is opened, it appears as two mono files. These mono Source files are linked; they can be manipulated separately or as a stereo pair.

EDITING

After recording, it's time to open the Edit List. Audio data is strung together to create an EDL that defines the arrangement, including cuts and crossfades. The list contains and displays up to 64 sound files, but no more than twelve files can play at a time.

You can view the EDL as a series of waveforms, as written text, in a bar display, or in any combination thereof (see Fig. 3). The software displays up to sixteen tracks at a time on a large monitor; with my 13-inch display, I spent a lot of time scrolling. I would have appreciated a Mark and Jump feature to get from one place to another.

Editing preferences can be changed for each EDL to cover a wide range of recording environments. For example, you can select the recording sample rate and bit resolution (for use with optional 20-bit converters), and you can display time as SMPTE time code or feet and frames.

The ability to edit a sound file while recording to, or dumping from, a hard disk in the background is a particularly powerful feature. Edits can be performed on a separate sound file, or an already-recorded section of the file being recorded. All edits are non-destructive, with multilevel Undo and Redo.

Although the Sonic system lets you delete silence from the beginning and end of files in the EDL Display Panel, the version I reviewed does not offer a way to remove these unused portions from the hard disk. Since disk space is critically important, I would like to see a feature that reclaims the disk space occupied by deleted segments. According to the manufacturer, version 2.1, which should be out by the time you read this, lets you purge any unused portions of sound files that have been cut within an EDL.

When the EDL is complete, you're ready to assign the audio files to the Audition Channels of the mixer for processing and playback.

TO MIDI OR NOT TO MIDI

The Quattro has a minimal but usable MIDI implementation. You can use the

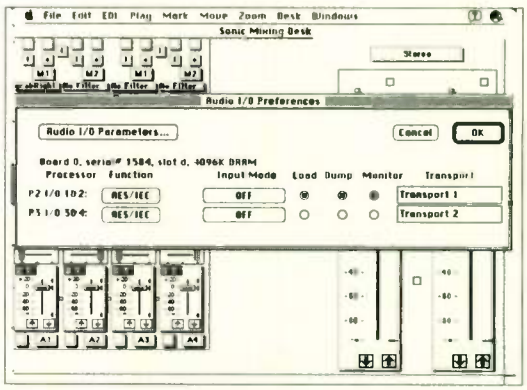

FIG. 2: When recording sound files for album sequencing, the flow of digital audio signals is directed in the Audio Preference I/O window.

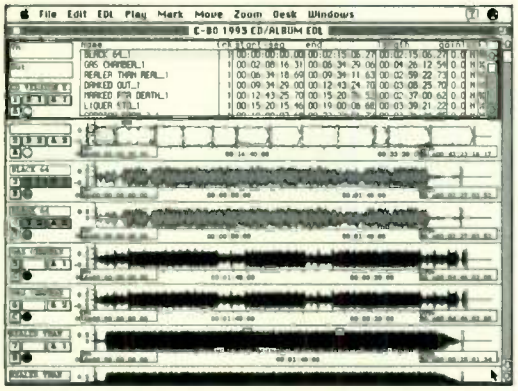

FIG. 3: You create arrangements in an Edit Decision List, which contains up to 64 sound files. The EDL displays data as a series of waveforms, written text, and/or a bar display.

JLCooper CS-1 and CS-10 to control the transport functions, specify edit points, and change the viewing screen with MIDI messages. (Other MIDI boxes that send continuous controller messages, such as the Peavey PC 1600, will probably work, as well.) However, the system only responds to messages received on MIDI channel 16. For MIDI applications, the system uses Opcode's *Open Music System* (*OMS*) or Apple's *MIDI Manager;* the latter can be slow and cumbersome, but it works most of the time.

The Quattro can transmit MIDI Time Code (MTC) messages to synchronize a sequencer, but it cannot read MTC. As a result, the sequencer must be a slave to the Sonic system, as it would with time code from an analog deck. This is fine for some applications, but not others. For example, you can't edit the MIDI sequence while controlling the digital audio; you have to go back and forth between the two applications every time you want to modify the sequence.

At the very least, Sonic should implement full MTC support. Ideally, the Sonic system should be completely integrated with a sequencer in the same way that Digidesign's Pro Tools, Sound Tools, and Audiomedia integrate with Opcode's *Studio Vision,* Mark of the Unicorn's *Digital Performer,* and Steinberg's *Cubase Audio.*

AUDIO QUALITY

The Sonic system's sound quality is equal to the best I've heard. As mentioned earlier, the EQ is excellent, and I experienced no aliasing or other digital garbage. The internal bus uses 24-bit processing, which represents the high end for current technology. In addition, the system works with third-party (e.g., Lexicon) 20-bit A/D converters, which should raise the system to absolutely top-notch audio specs.

I used the analog converter on a few mixes in which I sent the same source material to a Panasonic 3700 DAT. The sound of the two units was a bit different. The Quattro was warmer-sounding and had less edge than the DAT, but it's hard to say which was better. It's a matter of personal taste.

DON'T BUG ME

The first software version I received caused repeated crashes, but after upgrading, I had very few problems. There is one small, intermittent bug that doesn't seem to interfere with the workings of the system. The color of the windows keeps changing when going from function to function, which is somewhat disconcerting.

In an era when applications of all kinds are relatively stable, I wonder why this bug is still hanging around. In light of some initial computer crashes and the color-changing problem, it's reasonable to wonder if there are other problems I didn't find in the limited time I had with the system.

CONCLUSION

After learning the basics, I only used the Quattro in real-world situations on my clients' sessions (with the clients' consent, of course). Therefore, some features were not tested. For example, I didn't use Time Twist, a time expansion/compression algorithm that does not change the pitch of the audio as it changes the length. I also had no opportunity to test the Loop Generator/Loop and Fill algorithm, which makes it possible to repeat sections of audio up to an infinite number of times. This feature is a good way to create a long background ambience out of a shorter piece of audio. However, locking different pieces of music to the tempo of a sequencer would be difficult, given the MIDI limitations.

The Sonic DAW stands out as a powerful multitrack editor rather than a multitrack recorder. The ability to edit "on the fly" is particularly valuable. Of course, you can add more inputs and outputs by

installing more hardware, but that costs $5,495 for each 4-channel expansion. The basic system is fine for sophisticated post-production applications, such as overdubbing and editing sound effects and dialog on a stereo music bed.

On the other hand, if you are looking for an all-in-one sequencing/digital-audio package, you would do better to consider one of the systems that specialize in MIDI integration. If the Sonic system could open and play Standard MIDI Files in sync while performing its digital-audio duties, it would be a much more attractive package to the MIDI musician. If it also chased MTC and offered more complete support for Opcode's *OMS*, it would be a stronger musician's package than Digidesign's Pro Tools. Nevertheless, if you can live with your sequencer chasing the audio, but not the other way around—and after all, we've been syncing to tape all along anyway—the MIDI features are adequate.

Sonic's system is potent and concentrated. Sonic offers an open-ended, modular system with no-holds-barred audio quality. The upgrade path is costly, but comparable to other high-end systems. If your priorities are top-grade sound quality, multitrack audio-editing muscle, and room for future growth, the Sonic Quattro is the state of the art.

Al Eaton *is a producer/engineer and owner of One Little Indian Productions in the San Francisco Bay Area. He loves to utilize every electronic gadget and studio gizmotron he can get his hands on.*

Sennheiser ProForce Microphones

By Michael Molenda

These dynamic mics are a force on stage and in the studio.

In a valiant effort to mold me into a socially acceptable human being, my mother always stressed that first impressions are lasting. I'm not revealing this personal tidbit to elicit sympathy for mom's failure—after all, I became a musician—but to warn you about Sennheiser's new ProForce microphones. The glass-fiber housing and plastic windscreen of these models makes them look more like toy "Mr. Microphones" than rugged, professional stage mics. But don't be fooled by appearances; these are marvelous instruments.

Sennheiser's ProForce series of dynamic microphones includes the MD 511 cardioid and the MD 515 supercardioid (shown).

The ProForce series includes five models of dynamic microphones. The MD 511 ($149) and MD 515 ($199) are almost identical, except that the MD 511 is a cardioid and the MD 515 is a supercardioid with additional handling-noise elimination. (Sennheiser attributes the added sound insulation to their Synthetic Calibrated Spring.) Both mics deliver a frequency response of 50 Hz to 18 kHz. Sennheiser also offers two models with a noiseless on/off switch, the MD 512 and MD 516. Unless you require an on/off switch, I'd bail on this feature because it'll cost you an additional $20. The MD 527 ($299), an all-metal supercardioid, was not tested.

Although I couldn't help laughing when I unveiled the ProForce mics at a band rehearsal, the cheap-looking housing is actually an incredibly tough, glass-fiber composite. I say "incredibly tough" with confidence; my initial skepticism caused me to drop the mics on a cement floor, toss them against the sheetrock walls of the rehearsal studio, and bounce them off various other surfaces. They didn't even flinch. No cracks, no internal injuries, and no scratches. And unlike wire-mesh types, the plastic windscreen used on the ProForce line resists blows without becoming deformed. The windscreen also removes for easy cleaning via a bayonet mount.

SOUND CHECK

It's a good thing that the ProForce mics can take a punch, because I realized too late that doing the torture test *before* the sound quality test wasn't a great idea. (Duh!) I sang through the MD 515 in a crammed rehearsal room and was able to get more than enough volume before feedback crept in. The off-axis rejection is excellent. But even more impressive was the mic's smooth, well-articulated sound.

My voice has an obnoxious upper register that could break every window on the TransAmerica Pyramid. The presence peak—a slight midrange boost designed to enhance vocal intelligibility—of most mics usually forces sound-reinforcement engineers to compress my voice at least -10 dB at a 10:1 ratio and diminish the high midrange frequencies. However, the MD 515 delivered a nice, warm timbre, *without* the additional processing, even during full-out, rock 'n' roll screams. I was so impressed that I brought the mic into the studio to record some live scratch vocals during a rhythm track session. Again, the sound was clear and smooth.

In addition, when necessity forced me to stand in front of the mixing console and sing and engineer simultane-

Product Summary

PRODUCT:
ProForce dynamic microphones
PRICE:
MD 511 ($149)
MD 512 ($169)
MD 515 ($199)
MD 516 ($219)
MANUFACTURER:
Sennheiser Electronics Corp.
6 Vista Dr.
PO Box 987
Old Lyme, CT 06371
tel. (203) 434-9190
fax (203) 434-1759

EM METERS	RATING PRODUCTS FROM 1 TO 5
SOUND QUALITY	● ● ● ● ●
VALUE	● ● ● ●

ously, the supercardioid pattern prevented signal bleed from the monitor speakers from compromising the vocal track. I wouldn't hesitate to employ the MD 515, or the cardioid pattern MD 511, for recording master-quality vocals, provided the singer's timbre called for a dynamic mic.

I also used the MD 511 and MD 515 to record a guitar amp and a snare drum. Although the sound was clear, I missed a certain aggressive quality. In the studio, I wouldn't choose a MD 511 or MD 515 over a Shure SM57 for tracking these instruments. In live situations, it would be a toss-up. And speaking of live situations, even though the MD 515 boasts added sound insulation, I found both models exhibited very low handling noise.

▼ The MD 515 delivered a nice, warm timbre without additional processing, even during full-out, rock 'n' roll screams.

CONCLUSION

Sorry, mom, but some first impressions *are* deceiving. The ProForce line may look a bit cheesy, but they deliver the goods. For vocals, the MD 511 and MD 515 sound incredible; some vocalists could record masters with these mics. This means that home recordists with limited budgets can upgrade the quality of their vocal mic collection for under $200. The ProForce series offers a bountiful high quality/low price ratio. And that's the impression that should stick.

He knows you couldn't care less, but **EM** *managing editor* **Michael Molenda** *is giddy that his new wave band, Ascot Jacket, is charting on several college radio stations.*

PG Music PowerTracks 1.0 (PC)

By Bob Lindstrom

Solid sequencing for an unbelievable price.

Cheap and good. Those two words might go together in your imagination, but it's rare when they actually team up in the software marketplace. So you can understand why the rational response to a $29 MIDI sequencer is skepticism. How is it possible? What doesn't it do? What's the catch?

Well, rare as it is, *PowerTracks*, from PG Music, is the authentic item: a real, 48-track, MIDI sequencer at an unreal price. This is no stripped-down, hyped-up, bargain-basement impersonator. *PowerTracks* is a hard-working, lean, little MIDI performer. It lacks some bells and whistles and has a few problems, but it does a lot more than you would expect for the price.

OVERVIEW

PowerTracks is actually two products. On one 3.5-inch floppy disk are a *Windows* version (v. 1.06 reviewed) with a mouse-driven, graphical interface; and a separate DOS version (v. 1.17 reviewed), also with mouse support. The *Windows* version requires *Windows* 3.1, 2 MB of RAM, an 80286-based or better PC, and a MIDI interface or sound card. The DOS version requires an XT or better with 512 KB of RAM, DOS 2.0 or better, and a MIDI interface or sound card.

The spartan, 72-page manual focuses on the *Windows* version of *PowerTracks*, and because that version has more features, you probably will, too. However, if you don't do *Windows*, DOS documentation is located in a text file on the disk. For $29, PG Music assumes you can print your own DOS manual.

LOOKS LIKE THE BIG GUYS

If you're familiar with the *Windows* versions of premium sequencers such as *Cakewalk* and *Master Tracks Pro*, you'll notice several similarities in *PowerTracks'* multiple-window interface. A scrolling Tracks screen provides access to all 48 tracks and parameters such as MIDI channel, Program Change, Bank Select, and Volume.

A Bars screen shows each measure as white or shaded blocks to indicate the presence of MIDI data and is especially convenient for mouse-driven, click-and-drag editing. Meter and Tempo Map screens allow you to type in measure- and beat-specific changes. You even get a real-time mixer; a SysEx librarian with device-specific support for synths from Yamaha, Roland, Korg, and other manufacturers; and a Comments screen for attaching notes to your data files. A lineup of icons across the bottom of the *PowerTracks* screen provides instant access to each of these windows.

Above the main display area is a standard set of "tape transport" controls, along with displays that show current playback location, elapsed time, key and meter settings, and the beginning and end points of the current editing block. Also included are buttons for track solo, All Notes Off, and punch in/out. Scroll bars adjust tempo and shuttle forward and backward through the score.

Just above the transport, a standard *Windows* menu bar provides access to a full set of features, including cut, paste, copy, and erase (with a data filter to select MIDI events within customized parameters); MIDI and sync setup; step editing; percentage quantize (also with an adjustable data filter); transpose; and much more.

Below the transport, a virtual keyboard's keys light up during playback to indicate the note events in the currently selected track. If you are a guitarist, you can take advantage of *PowerTracks'* distinctive Guitar window, in which lighted fret positions indicate note events (see Fig. 1). The authenticity of the display is uneven due to the huge variety of possible guitar fingerings, but you can customize the display's "strings" for use with alternative guitar tunings.

RECORDING

Recording in *PowerTracks* is elementary and elegant. In the Tracks window, you select a track with mouse or cursor keys. Highlight the status block and press Return to set the track to Play/Record. You can push "W" to rewind the transport and hit "R" to activate recording, or mouse-click the appropriate transport buttons for those commands. If you set up an audible MIDI metronome, you'll hear the number of count-off measures. After recording, you're prompted to keep or discard the take.

PowerTracks is as efficient a MIDI recording environment as you're likely to find. Using a combination of keyboard and mouse controls, I hopped swiftly from track to track, looping tracks, removing empty measures, and punching in corrections.

I found track-looping particularly handy. You activate looping by mouse-clicking the loop box in the Tracks window. Because my keyboard is a few feet from my PC, I always have beats hanging over into the next measure before I can reach the computer keyboard to stop recording. *PowerTracks* automatically ignores those empty beats and sets the loop from the end of the last measure that contains MIDI data, not from the point where recording stopped.

EDITING AND MORE

PowerTracks' shortcomings become apparent during editing. You can graphically cut-and-paste measures in the Bars window, or you can press F2 to tweak MIDI data in an Event List display built from all the currently selected tracks. However, there is no piano-roll display to fine-tune your inspirations or eliminate mistakes. This omission complicates editing. You can watch the keyboard or guitar displays to identify note events, and if you're an event-list expert, you can easily get down to the individual numbers. But

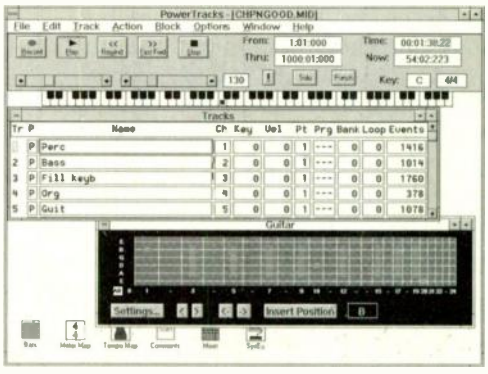

FIG. 1: *PowerTracks* for *Windows* boasts a full-fledged graphical interface, including a Tracks window for MIDI recording and editing, a keyboard whose keys light up to indicate note events, and a Guitar window that displays note events on a fingerboard.

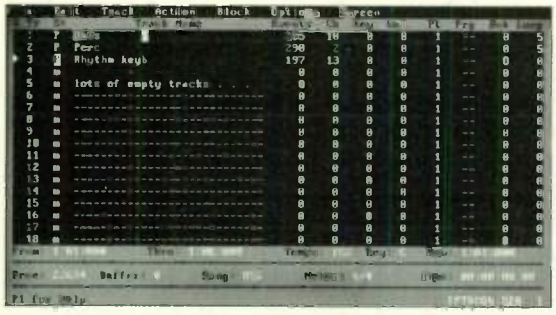

FIG. 2: ***PowerTracks*** **for DOS provides most of the functions of the** ***Windows*** **version, including the Tracks window, but does it in a text-based, mouse-driven screen display.**

without a graphical editor, I had to rely more than usual on punch in/out corrections.

The *Windows* sequencer includes several other important features. Especially noteworthy are MIDI Time Code and SMPTE support, variable clock resolution up to 480 ppqn, Standard MIDI File load/save, and a solid Undo feature.

The DOS version of *PowerTracks* (see Fig. 2) shares much of the feature set of the *Windows* version. Some omissions are obviously related to the limitations of the DOS display, such as the graphic Guitar window. (As partial compensation for the text-based DOS screen, the user can customize the program's color scheme.) Most of the other features are intact, including the pull-down menus; context-sensitive help; multiple-track event-list editing; Bars display; percentage quantization, with data filter; and SMPTE/MTC sync. One significant difference is that clock resolution goes only to 240 ppqn in the DOS version. *PowerTracks*' data files are compatible with both versions.

ACTS LIKE A LITTLE GUY

On the whole, I consider *PowerTracks* a reliable program. But like all software, it has its quirks, particularly in the *Windows* version. I experienced occasional crashes, for example. On one occasion, the program locked while I was inserting a Program Change message in the Event List editor. On four or five occasions, the program locked while playing back and recording sequences. None of these lock-ups were recoverable from within *Windows;* I had to reset the computer and lose all unsaved data. Once, I received a fatal error while loading the program.

I don't experience random lock-ups with my other *Windows*-based MIDI sequencers, so I must assume the problem is not hardware- or system-related, and *PowerTracks* has a few bugs. Ordinarily, program crashes would make me shy away. However, they were few, infrequent, and—at this price—forgivable. Still, I hope PG Music addresses them ASAP.

One of the "big guy" features in *PowerTracks* is Program Change support for General MIDI devices and the Roland MT-32 synth. In the Tracks screen, you can click on the Program box, and *PowerTracks* will display a list of ROM patch names for whichever device you've set as the default. If you aren't using an MT-32 or GM device, you can enter generic Program Change numbers.

The drawback is that the program supports patch lists for only one device type at a time, so you cannot have an MT-32 or MPU-401 device on one track and a named, General MIDI synth patch on another.

Among the other flaws: You cannot set the metronome for count-in only; it's either on or off for the duration. In the Tracks window, the left/right scroll bar won't scroll fully to the left by clicking the arrows; you must drag the scroll box. The SysEx librarian accepted 8 KB dumps but could not handle a 36 KB bank dump from my Roland D-550 synth. Finally, when running in *Windows* resolutions greater than 640 × 480 pixels, I could not use click-and-drag to select edit blocks in the Bars windows, even though a 640 × 480 Bars window worked perfectly.

A PRETTY NICE GUY

While an update may be in order to correct some problems in the *Windows* version, *PowerTracks* still represents an astonishing value. If you're a newcomer to MIDI or *Windows* and want an inexpensive, yet capable sequencer, *PowerTracks* is an excellent choice. MIDI beginners will also be grateful for the context-sensitive help displays. While the help is sometimes less than comprehensive, it usually provides enough information to resolve my questions and get me back to work without cracking the manual.

Although the DOS version works well and is more stable overall, the *Windows* version is where it's at. *PowerTracks* multitasks skillfully in *Windows*, maintaining a solid clock even while you go to other applications. It is fully compatible with the multimedia features of *Windows* 3.1, whether you use the *MIDI Mapper*, or directly access the MCI drivers. It worked equally well with my MPU-401-compatible MIDI port and a Sound Blaster 16 ASP card with a Wave Blaster.

There are few surprises in *PowerTracks*, and that in itself is a surprise. At this price, I expected to frequently bump my head against a feature wall. In fact, for standard MIDI recording and sequencing, I found the program's simplicity refreshing. *PowerTracks* is well-suited to the needs of the budget-minded musician and is a cost-effective choice for the multimedia developer who occasionally needs a MIDI sequencer but doesn't have the desire or moolah for a full-featured, premium MIDI package.

Bob Lindstrom *is a composer, freelance author, and orchestral conductor. He also is a former editor-in-chief of* Computer Shopper *and* A+ *magazines.*

Product Summary

PRODUCT:
PowerTracks
PRICE:
$29
REQUIREMENTS:
Windows version 1.06: 80286-based or better PC; 2 MB of RAM; *Windows* 3.1; MIDI interface or sound card
DOS version 1.17: XT-compatible or better PC; 512 KB of RAM; DOS 2.0 or better; MIDI interface or sound card
MANUFACTURER:
PG Music
111-266 Elmwood Ave.
Buffalo, NY 14222
tel. (800) 268-6272
or (416) 528-2368
fax (416) 628-2541

EM METERS	RATING PRODUCTS FROM 1 TO 5
FEATURES	● ● ●
EASE OF USE	● ● ● ●
DOCUMENTATION	● ● ●
VALUE	● ● ● ● ●

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PRO FILE

Synthetic Metal

Faith No More samples success.

By Steffan Chirazi

Faith No More's break out stardom is an important rock 'n' roll tale. The success of their third album, *The Real Thing* (2.5 million sales in the U.S. alone), proved that you don't need a uniform, pigeon-holed sound to be a massive commercial hit. And their sound is anything but uniform.

Although classified as heavy metal, Faith No More's music is an unconscious and carefree fusion of rock, metal, pop, and rap. *Angel Dust*, their latest album, sports a range of genre-busting cuts, from the thick metalesque rage of "Jizzlober" to the pop strains of "A Small Victory." By using unusual and "found" sample sources, keyboardist Roddy Bottum provides the unifying ingredient for this musical gumbo.

Bottum emerged scar-free from the era of stodgy, Rick Wakeman-style, 1970's keyboard pomp. Instead, he chose to combine his early classical piano training with an astute use of samples and modern technology.

"I never liked any of the cheesy stuff like Moog synthesizers; they always sounded stupid," Bottum recalls. "Kraftwerk was one of my first real influences. I tend to get really turned on by what I'm currently listening to. Recently that's meant a lot of techno stuff. I like the idea of taking a sound and looping it, then using that as a sound source and letting accidents happen. The strange, almost arbitrary noises that result are very important to what I do. I find that the best stuff often comes from messing around.

"These days I've been using computers a lot," he continues. "Software programs such as Opcode's *Studio Vision* allow me to sequence up to 99 tracks and incorporate digital audio. I also have an E-mu Emax II keyboard [with hard disk] and a bunch of sounds on CD-ROM."

On *Angel Dust*, Bottum threw in a bunch of everyday, forgettable noises and turned them into beautifully textured pieces. "The break in 'A Small Victory' is very typical of what I do," he says. "I like to use odd sound sources, rather than programmed sounds such as strings and pianos. On that particular song, I used a cash register, a bell, a siren, and other environmental sounds. I recorded most of the sounds onto DAT, just while wandering out and about, and then I loaded them into the Emax."

Bottum suggests that sampling may have to become a more sinister and clandestine affair as lawyers and their clients come out shooting in increasing numbers. "Sampling is certainly getting dangerous," he cautions. "For another song on *Angel Dust*, 'Crack Hitler,' we sampled the voice of a woman who's pretty famous in Brazil. She announces flights for Varig Airlines. We all really liked the voice, so we taped her, used the voice, and now she's suing us for using her voice without permission."

Does the threat of legal action impose creative restrictions on musicians who sample?

"You just have to be really careful when it comes to copyrights and sound," says Bottum. "The alternative is to become sneakier as far as disguising the sounds you use. But ultimately, if I'm forced to bang a few pots and pans and record those as a sound source, that would be fine; with continuous looping, anything can happen."

Steffan Chirazi *and his son, Zak, often savor the spoils of rock journalism over a latte at the infamous Farley's cafe in San Francisco.*

Faith No More (Bottum, sitting, third from left)

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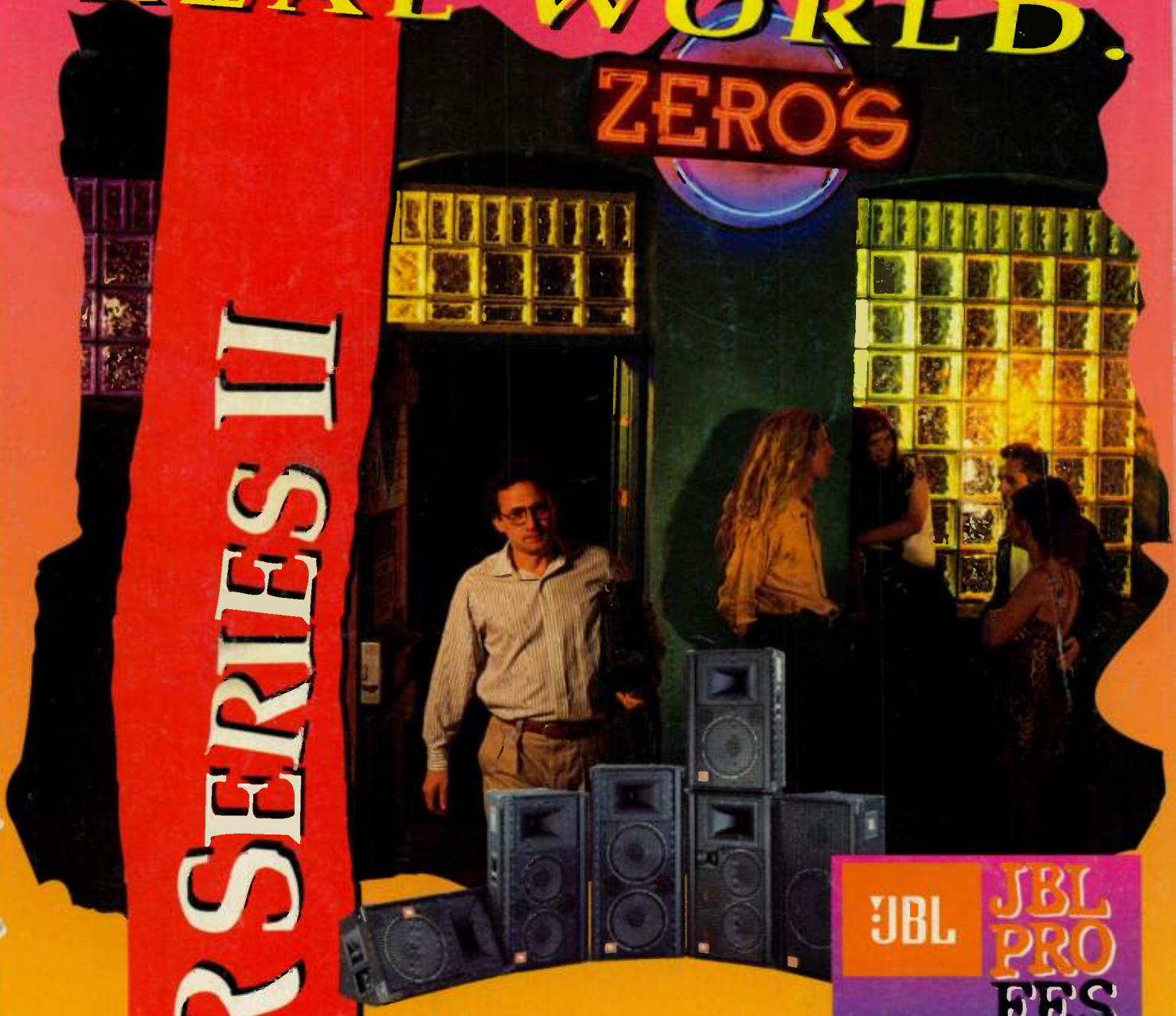

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