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INTRODUCTION

Making Music with Technology

Digital audio was once the exclusive domain of those with deep pockets or access to a university or multimillion-dollar recording studio. Times have changed. Today, digital recording and music production are within reach of anyone who can afford a modest computer. And traditional recording is just the beginning: computers are tools for composition, sound creation, and performance, and a means of connecting music and sound to visuals and other media. Sophisticated studios are still valuable places, and professional expertise is irreplaceable. But the amateur in a home studio can produce professional-sounding results too. The production studio doesn't even have to be at "home." People really do make music in coach-class airplane seats and improvise with laptops onstage.

Digital audio tools have become, in essence, a new musical instrument in their own right—or perhaps more accurately, an ensemble of instruments. But while the technology has brought the ability to make amazing music within easy reach, getting the best out of the technology is not guaranteed to be easy. Like learning how to play any musical instrument, learning how to use digital audio technology requires assimilating a lot of knowledge and skills.

The new forms of computer-based music making put new demands on musicians. It's no longer enough to master a single instrument (be it a grand piano or an electric guitar) and leave the rest of the recording process up to other experts. Musicians today need to know how to get the numerous elements of digital audio technology to work together smoothly. Today, you need to be an instrumentalist, composer, conductor, recording engineer, producer, and computer specialist all at once.

This book brings together the information you'll need to master the new skills involved in digital audio production. Although there is a nearly infinite

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range of musical styles, tastes, and musicians, there are basic needs that all of us have and basic information that we all need at our fingertips.

We need to understand how sound itself works, so we can manipulate audio effectively once it's in the computer. We want to be able to create new sounds and shape existing ones. We need to be able to record performances on acoustic and electric instruments, voice, and the many real-world sounds around us, and we want that recording to resemble the way we hear those sounds before they reach the microphone. We want to share our music, whether through printed scores, CDs, DVDs, online distribution, as soundtracks for video and motion pictures, or in live performance. To make this happen, we need to get past the learning curve of gear, figure out which equipment and software to buy, learn how to plug it in, decide which cable to put where, and learn how to keep everything working.

The first step is often just to pierce the fog of unfamiliar terminology.

"But what does an 'expander' do?"

A student had looked up the name of an audio effect in the manual for a software product he was trying to learn. There would certainly have been room for a full explanation in the manual, since it was a phone book-sized tome. Instead, the author had provided a circular answer that would make sense only to someone who already knew the answer. It said something like "the Brand X digital expansion module provides high-quality expansion of an audio input."

So what does "expansion" mean?

If you've gotten this far, you probably already know *why* you want to learn more about digital audio. Now that this book is in your hands, it's simply a matter of getting started. All of us have been in the same spot as the student I quoted above: all of us are beginners at something, even if we're expert at something else. What we need is a place to start.

WHAT'S IN THIS BOOK

This book is a comprehensive reference for creating music with digital audio technology, centering on the computer. It's a practical guide to the diverse skills you'll need to produce a wide variety of music and sound. You can use it as you would a reference book, particularly if you're a more advanced user, but it's also designed so that if you read it in order you'll develop a solid foundation that you'll be able to build on more easily.

The first four chapters cover the underlying fundamentals of sound plus choosing and configuring gear:

- **Chapter 1** explains how sound works, how we hear, and how sound is translated into digital form. Understanding these fundamentals will help demystify many of the terms and concepts used in audio tools, and will help you get the results you want.
- **Chapter 2** surveys the landscape of available hardware and software gear, explains what each tool does, and shows how to choose the studio setup that's right for you.
- **Chapter 3** focuses on how to configure and optimize your computer and equipment for the best audio performance.
- **Chapter 4** explains how to connect your hardware, from the many potentially confusing cable types and labels to various patching setups.

The next five chapters cover various production techniques. Depending on your interest, you may want to read some or all of them:

- **Chapter 5** is an overview of how software tools can produce a finished song, focusing on two entry-level tutorials, one for the Mac and one for Windows. It explains the use of loops in song production, particularly for backing tracks and live groove-based performances.
- **Chapter 6** explains various microphone types and how they're used to capture sound, including where they're positioned when recording many of the commonly used musical instruments.
- **Chapter 7** explores the different kinds of audio processing and effects. You'll learn what effects are and how to best use them in production.
- **Chapter 8** is an introduction to MIDI and explains how it can be used to capture performances and control software.
- **Chapter 9** covers how to create and edit original sounds on digital instruments, making your computer or hardware synthesizer into an expressive musical instrument.

The final four chapters bring together the earlier topics, showing you how to produce a finished result, whether it's a recorded track for CD or other distribution, a notated score, a video, or a concert performance:

- **Chapter 10** looks at how the raw materials of an audio project can be shaped into a finished recorded track, how to store that track in different file formats, and how to distribute your finished content on CDs, DVDs, and online.

- **Chapter 11** covers how to create, edit, and share a notated score.
- **Chapter 12** explains how to work with video and motion, including how to match sound to image and how to manage and edit time information and digital video formats.
- **Chapter 13** explores the techniques needed to make a computer a performance instrument, whether it's for simple backing tracks or for more elaborate interactive setups that include synchronized visuals.

WHO THIS BOOK IS FOR

This book is written primarily for musicians. The scope of what that word means has expanded: the word "musician" rightfully applies to recording engineers and producers, to composers and arrangers, and to DJs and electronic performers. If you're using computers and other technology to produce music or any other type of sound, this book is written for you.

Topics like acoustics, MIDI, audio processing, synthesis, mixing, mastering, notation, video scoring, and electronic performance have each been the subject of numerous individual books. But the reality is that a wide group of people need to use many or all of these techniques in combination. Products like Apple Logic Pro, Digidesign Pro Tools, Cakewalk SONAR, and others provide resources for handling all of these tasks in a single package. So clearly, there's some overlap in these techniques and among the people who use them.

Because each topic could fill a whole book, it would not have been practical for us to cover every detail. Instead, this book provides an overview in each area, starting with the basics. In these pages you'll find the terminology and concepts that software and hardware manuals may frustratingly assume you already know, as well as some practical advice on how to apply specific production techniques to your music. If you're new to the field, this will be more than enough to get you started doing hands-on work with your tools of choice. If you've been working with the technology for a while, *Real World Digital Audio* will help ease the learning curve as you add more advanced tools to your studio and delve into more specialized books on the subject. You'll find references to some of the seminal works scattered throughout the text.

The "industrial strength techniques" tagline of the *Real World* series challenged us to cover power-user techniques, but we're especially interested

in the needs of beginners. The person who has years of recording experience might know absolutely nothing about sound design for synthesizers. So although this book is densely packed, we've made every effort to explain each topic in detail rather than assume what you know.

Real World Digital Audio focuses primarily on the computer, not as the exclusive device for accomplishing every task, but as a hub that you'll sometimes use with other equipment. For an increasing majority of musicians and engineers alike, that's the reality of modern audio production. This doesn't mean some of the techniques discussed in this book can't be applied if you're working with the hardware counterparts of some of the software tools mentioned. New audio hardware often resembles or even incorporates computer software. Ultimately, even as specifics change, many of the underlying concepts remain. But where appropriate, our illustrations do focus on computers and software.

How to Use This Book

If you're not picking up at page one and reading straight through to the end, you'll find that this book is designed with features to help navigate the breadth of topics covered.

Essentials

You'll find an Essentials box at the beginning of each chapter that introduces the key terms and concepts in that chapter. If you find some of the topics overwhelming, check out the "Where to Start" note at the bottom of the Essentials box for a sense of what "step one" is.

DVD and Hands-on Examples

Hands-on tutorials and tips in each chapter guide you and suggest when to put some of the concepts to practical use with the software demos and content included on the bundled DVD. For an overview of what's on the DVD, see the Appendix.

Of course, if you have your own tool of choice, you'll still find instructions and examples that apply to you. You'll also find additional cross-platform content on the DVD, including royalty-free audio loops and samples that you can use with other applications.

On the Web

Because digital audio continues to evolve daily, you can check www.realworlddigitalaudio.com for updates to the book, links to current information and news, and other online resources and extras. The Web site also includes a series of *Pro Files*, which are interviews with leading musicians and technologists about digital audio.

Use in a Classroom

Trial software and saving files: With the exception of SoundSchool and the open-source program Audacity, the demo applications on the disc are incapable of saving work, though they can be used for learning purposes.

Although this book isn't an academic book (and there are fine books that are), it is designed to be suitable for an introductory electronic music, computer music, or audio production class, particularly at the high school or undergraduate level. It is biased away from open-ended software like Csound, Reaktor, Max/MSP, and Pure Data, which are often emphasized in academic courses. But the sections on MIDI, synthesis, audio processing, and performance are all relevant to curricula that use those programs.

The modular nature of the chapters means that individual chapters can accompany units on those topics, particularly in the case of recording and audio processing, MIDI and synthesis, notation, or mixing and mastering.

Key symbols

Throughout this book you'll find numerous boxes and margin notes containing extra information. Each item is flagged with a handy symbol that indicates what type of information the item contains. Here are the symbols, and an explanation of what they mean:

The Clarify icon is used when the item provides an in-depth discussion of a concept that is explained briefly in the main text.

The Define icon is used when the item gives a basic definition of an important term or concept.

The DVD icon is used when the item points you to files or tutorial examples on the DVD that accompanies this book.

The Hands-on icon is used when the item provides a procedure that you can try on your computer.

The Tip icon is used when the item gives a suggestion that will save you time or make your workflow more efficient.

The Web icon is used when the item lists or describes on-line resources.

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