Total Recording - David Moulton

Mike Rivers
July 2001, updated slightly April 2011

I met Dave Moulton in the Summer of 1987, where he was an instructor in a National Public Radio music recording workshop. I attended the workshop intending to hang out with some of my engineering buddies and picking up a few tips, but it was Moulton's lectures that put some new ideas into my head.

As a regular contributor to Recording Magazine through the 1990s, Moulton has taught readers quite a bit about music and sound over the years. Now, with the editorial guidance of (then Recording editor) Nick Batzdorf, he's rolled years of working and teaching experience into a book. "Total" it says, and total it is. In 425 densely packed pages, the author presents clear and rigorous treatment of the scientific principles surrounding the job of making recordings. While adequately technical, the fact that we're in this for the sake of the music is constantly reinforced, with nearly every technical discussion tying the subject back to some aspect of music theory, composition, performance, or the emotion that we aim to convey in our recordings.

The Forward section summarizes the book so well that I'll let Dave do it: "Due to the wide range of subject areas that the sound recording discipline engages, including music, acoustic, psychoacoustics, electronics, aesthetics, psychology and business, it makes a very powerful platform for learning and for the integration of disparate subject areas - the profession of sound recording is interdisciplinary with a vengeance. Interestingly, little has been made of this remarkable suitability of the field as a vehicle for learning, and, to date, the educational community has not seriously taken advantage of this feature of the discipline, treating it instead as a vocational specialty. However, there is no reason that you, the reader, can't take advantage of this learning opportunity. You can learn a tremendous amount about a lot of different stuff by learning how to make good sound recordings!"

There's a wealth lot of material here. For the purpose of this review, I set aside one hour each morning and night for reading, and it took me about a month at tht rate to get through the book cover to cover. There's a couple of years worth of college level material packed between the covers, and a marathon reading session is like going to Summer school. I'd recommend a more leisurely pace. The order in which subjects are presented is fairly logical, however considerable overlap, repetition, and referral to other sections makes it possible to flip the book open to almost any page, start reading, and learn something useful.

It's All About The Music

Total Recording opens with a discussion of the elements of music, and of the roles we play and the hats we wear in the process of turning a musical concept into a finished recording. There's a thorough grounding in the physics of sound, which branches off into discussions of how musical instruments work, how we perceive pitch, timbre, and loudness, and how our ear and brain puts it all together. With this background, it's easier to understand how and why some of the tricks that we use in mixing (covered much further along in the book) work. Moulton looks at the recording engineer as being an artist rather than a scientist, with the loudspeaker as his instrument. He equates the process of multitrack recording, in many respects, with that of a musical arranger.

If you don't start with good music, (and he strongly emphasizes the importance of lyrics) you can't make a good recording. The musical terms that we throw around in the studio - timbre, dynamics, phrasing, rhythm, groove and "the pocket" are explained in relation to how they make the listener react. While I'd imagine a 60 year old college professor to be heavily steeped in classical music and write about the beauty of age old literature, fine acoustic instruments, and great performance halls, Moulton is pretty hip, and Total Recording leans heavily toward pop music production. One piece of evidence is that MIDI is introduced fairly early on as a tool for understanding how all the elements of a musical performance are assembled - sneaky in a way, as many of us associate MIDI-fied music as being lifeless.

Theoretically Speaking

The section entitled "About Sound And Audio" covers a lot of ground as well as a lot of pages. Throughout, theory behind the electronics used to reproduce music is related back to music theory and the way we hear. Our perception of loudness morphs into a discussion of gain and gain structure, which affects distortion, which in turn affects how our emotions react to the music. In discussing acoustics, the concept of reflections and reverberation is used to explain the sense of warmth imparted to music performed in an appropriate environment, as well as how phase cancellation caused by reflections results in changes in musical timbre.

I've never delved deeply into human physiology, so I found Moulton's detailed explanation of how our hearing mechanism works particularly fascinating. Did you know that there's a part of our auditory chain which improves our hearing's resolution at low levels that works very much like dithering in a digital audio system? This is great bedtime reading - not likely to be immediately applicable to what you do in the studio tomorrow, but which may influence your thinking the next time you turn a knob.

There's such a wide range of subjects discussed in the Studio Hardware and Software section that I'd blow my 2500 word allowance (this review was originally written for Recording Magazine) simply by listing them. He introduces the concept of a transfer function, using it to explain filters (equalizers) and dynamics processors (compressors, limiters, and expanders), which he then ties into how changing overtone relationships and altering attack and decay affects musical timbre. Artificial reverberation is related back to the study of acoustics and how it affects our perception of musical performance space. The principle of precedence in hearing - how the difference in arrival time of a sound at each of our two ears affects where we perceive its location in space - is used to explain how adding delay can be used to create the auditory illusion of spaciousness. Microphones and loudspeakers and their interaction with the room, the source, and the listener are discussed in great detail.

I had a minor quibble with the order in which studio tools and devices were presented, but this is just a personal preference. I've always considered the console as the heart of a recording system, so I'd start the discussion of the control room equipment with the mixing console, then build around it with processors and effect devices. Perhaps, since by the time this book was written, studio are being built without a console at all, he doesn't discuss consoles until about two thirds of the way through the section. This is a reasonable approach for the reader who's working in a console-less studio, but a traditionalist like me got fidgety waiting to read his explanation of all the gozintas, gozoutas, and controls. I've found that people who understand signal flow through a console have less trouble relating to routing setups in computer-based DAWs.

Production and Studio Operation

While, for the most part, earlier sections of the book relate physics to the music, this section relates studio tools and techniques to the music. It's the section that you'll probably turn back to most often. While it's not a cookbook - you won't find the right settings to compress a washtub bass or EQ a nose flute - Moulton provides the spectrum and amplitude envelope of various instruments as examples to explain how they can be modified (and why) by the available studio tools.

He introduces microphone directional characteristics by examining how they relate to the radiation pattern of various instruments, and how proper mic placement can be effective in managing room acoustics. Various stereo mic techniques are are given a brief but comprehensive look. Some pictures would have been useful here since some of the placement descriptions are difficult to visualize with only text. There's a detailed section on delay, echo, and reverberation that's well worth understanding.

Many useful techniques and tips are sprinkled throughout the nearly 100 page section on production and studio operation. While you may not want to take it all in one gulp, there's nothing in this section that should be skipped. There's something here to be learned by just about anyone. I found his recommendation of listening to A-minus-B (left channel minus right channel) particularly interesting. While I've done this before, it's been to detect stereo blunders, but Moulton presents it as a useful way of looking into the spatial and timbral content of a mix. Since most of my recording work has been with jazz, classical, and folk music, his discussion of the pop music mixing process gave me a real appreciation of what it's like on "the other side". Now I better understand why a modern multitrack mix often takes dozens of hours to perfect.

While not taking the reader on a purely direct path from mic to CD, nearly every element of studio practice is addressed, from mic selection and placement, through gain management, monitoring, signal processing, and mixing. Moulton also emphasizes the benefit of maintaining detailed documentation throughout the process and provides several examples of forms he uses to keep track of his projects.

Up To Date

Things change fast in this business. While the techniques and principles described are applicable to any size project, Moulton's introductory remarks suggest that the project studio is one with limited track count, appropriate for pre-production. In the ten years since this book was published, 24-track recording projects done entirely on the kitchen table has brought us expectations of producing a commercial-grade CD at home.

It appears that this book project began around 1997, before 24-bit digital recording was common practice, so the 96 dB recording range (the theoretical limit for 16-bit resolution) frequently mentioned in the book, while still valid for today's most common delivery medium, the CD, appears a bit dated. Moulton, however acknowledges and presents a convincing case for sampling rates above 48 kHz. In discussing digital interfacing, he mentions AES/EBU and S/PDIF, but not IEC-958, and describes the ubiquitous fiber optic lightpipe only as an ADAT interface.

Proper use of terms is a personal crusade of mine, so I was a bit ruffled at the author's rather casual dismissal of dBm as the common unit of audio voltage when it's really power ("m" is for milliwatts). If a teacher can't teach us to use the correct terminology, who can? I guess Moulton's just being practical, accepting that this improper usage (like "phase" when we mean "polarity" - a differentiation which, bless his heart, he makes strongly) will simply never go away. In spite of this gaffe, in 2011 I find more people correctly using dBu when talking about

voltages. His discussion on specifications, however, helps to bring marketing claims into perspective, and will aid the reader in keeping himself up to date.

Quirks and Quibbles

Throughout my reading, I had the underlying feeling that I was listening to a classroom lecture and following along with the professor's notes. Don't take this as an implication that it's dry and boring (which, as a lecturer, Moulton is anything but), but rather, that I frequently wanted to dig little deeper into what I had just read – raise my hand and ask a question. Almost always, my question got answered later, but often not until another section, often far removed from where I was currently reading. A casual reader taking the book in small doses may forget about an underlying principle by the time an important application is presented.

Total Recording is all about music and what we hear, and the package includes a CD of listening examples. This could, and should, really enhance the text, but somehow I never felt compelled to play the CD to illustrate what I had just read. I know that if I was in his class, after lecturing for a while, he's say "here, listen to this" and there it would be, but in the text, Moulton never suggests places where taking a break for a listening session (and pointing to the appropriate CD track) is appropriate.

When I realized that I had finished reading the book without cracking the CD envelope, I turned to the track listing, then found that I had to hunt for the relevant sections of the book to remind me of what I was hearing. The CD is a good plug for Moulton's Golden Ears course which teaches critical listening skills. Many of the CD tracks are presented as A-B-C-D examples rather than A-B, A-C, A-D, so you really need to thoroughly understand what you've heard in Example A before you understand the difference presented in Examples C or D. On my copy, Track 25 is actually a duplicate of Track 24, and the contents listed for Track 25 is missing. I presume this will be corrected in future productions.

There's so much interrelated material in the book that I found the lack of cross-references somewhat annoying. It's peppered with "go back to the section on (this or that)" statements without a pointer to a page number or title, making a quick refresher awkward. You'll probably remember that you read something about that, but not where, and with the overlapping content, you may not turn back to the section to which he was referring. Also, very few of the illustrations are numbered and are referenced in the text only by description or position. There's little confusion as to which illustration applies to what text, but as one who has written and edited technical manuals, I consider the lack of figure numbers a significant omission. There's a detailed index and table of contents which helped point me to relevant sections when I knew what to look for, but with

a twelve page Table of Contents, navigation is a bit cumbersome. I ran across a few typos and a couple of minor errors, but nothing worth correcting here.

Lastly, I hate the way the book is bound. It has a hard notebook-like cover with multiple steel rings to bind the pages. It's cool in that it lays flat, but the combination of thin paper and the friction from a large number of binding rings makes opening and closing the book a two handed, three step chore. (The Department of Advertising Copy may misquote me as "This is a book you absolutely can't close!"). If you don't handle it with care, you'll risk tearing the pages. This is a book that will be valuable for many years, and after just a month, I found it getting pretty disheveled. I would have much preferred more conventional binding. Fortunately, the newer printing uses heavier paper.

In Summary

There's a wealth of information here, all of it worth reading. When explaining things that I've known about for a long time, I've found that I've adopted some of Moulton's language. When reading questions posted on various on-line forums, I've thought "gosh, I read about that in Total Recording". This is a strong indicator as to the depth and breadth of the book since people will ask just about anything in an audio-related forum. Understand, though, that this is not the Total Recording Cookbook. While no trade secrets are revealed, you'll get a thorough appreciation for the many phases of work that go into a music recording. The details are in the theory and the strengths are in the book's completeness and clarity. I've always embraced the principle of "Teach a man to fish and he'll always be able to eat", and this is what Moulton's Total Recording is all about. This book isn't an instant cure for what ails your recordings, but it's a great investment in your future as a recordist.

I'll leave you with a quote from the book which sounds very dated in 2011, but it's something that I still strongly believe myself:

"So what are the real advantages and disadvantages of digital audio? How does the additional complexity and expense of a parallel system that does the same things that we can do in analog give us enough benefit to offset the additional cost and complexity? We gain something in terms of low noise and frequency response stability. But, especially given the claims by many that analog is superior, are these benefits worth it? I personally believe that the real benefits to us lie in the realm of production and production cost, and that the disadvantage lie in the fragility and variability of the systems."

Times and attitudes change, but the fundamentals are forever.