ROUTLEDGE

MUSIC AS A CHARIOT

THE EVOLUTIONARY ORIGINS OF THEATRE IN TIME, SOUND, AND MUSIC

RICHARD K. THOMAS

Music as a Chariot

Music as a Chariot offers a multidisciplinary perspective whose primary proposition is that theatre is a *type* of music. Understanding how music enables the theatre experience helps to shape our entire approach to the performing arts.

Beginning with a discussion on the origin and nature of time, the author takes us on an evolutionary journey to discover how music, language and mimesis co-evolved, eventually coming together to produce the complex way we experience theatre.

The book integrates the evolutionary neuroscience of the human brain into this journey, offering practical implications and applications for the auditory expression of this concept—namely the fundamental techniques artists use to create sound scores for theatre.

With contributions from directors, playwrights, actors and designers, *Music as a Chariot* explores the use of music to carry ideas into the human soul—a concept that extends beyond the theatrical to include film, video gaming, dance, or anywhere art is manipulated in time.

Richard K. Thomas is Professor of Visual and Performing Arts at Purdue University with over 100 credits as a composer, sound designer, author, playmaker, and educator. He is a Fellow of USITT, and winner of the 2018 Distinguished Achievement Award in Sound Design and Technology.

Music as a Chariot

The Evolutionary Origins of Theatre in Time, Sound, and Music

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Routledge
Taylor & Francis Group
NEW YORK AND LONDON

First published 2018
by Routledge
711 Third Avenue, New York, NY 10017

and by Routledge
2 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

Routledge is an imprint of the Taylor & Francis Group, an informa business

Library of Congress Cataloging-in-Publication Data
Names: Thomas, Richard K., 1953– author.
Title: Music as a chariot : the evolutionary origins of theatre in time, sound, and music / Richard K. Thomas.
Description: New York : Routledge, 2018. | Includes bibliographical references.
Identifiers: LCCN 2017038214 | ISBN 9781138295469 (hardback) | ISBN 9781138295773 (pbk.) | ISBN 1315145634 (ebook)
Subjects: LCSH: Music in the theater. | Theaters—Sound effects. | Music—Philosophy and aesthetics.
Classification: LCC MT960 .T48 2018 | DDC 781.5/5—dc23
LC record available at https://lccn.loc.gov/2017038214

ISBN: 978-1-138-29546-9 (hbk)
ISBN: 978-1-138-29577-3 (pbk)
ISBN: 978-1-315-14563-1 (ebk)

Typeset in Sabon
by Apex CoVantage, LLC

Dedicated to all my students
Who helped me build the class upon which this book is based.
Who challenged me when I was wrong,
And forgave me when I was right.
Who laughed with me at the endless insanity of the human condition,
And sat with me in "silent wonder" for a moment at the beauty
of our predicament.
But most of all, who became the lifelong friends and colleagues
I'll cherish and admire
For the rest of my days.

CONTENTS

FOREWORD

In the summer of 1988, I had just completed an undergrad degree in electrical and computer engineering at Purdue University that also included a fair amount of classwork in acoustics and music theory. I was set to start grad school in the fall, also at Purdue, to study acoustics in the School of Mechanical Engineering. But, as the summer progressed, I began to question my plans and bounced between a fascination with acoustics and engineering and a deeper desire to explore the more creative aspects of music and audio.

Tension between the analytical and the expressive, between things engineered and things created, was not entirely new to me. An influential and prescient teacher in my senior year of high school summed it up in a note on my final essay of the year: "You will always wrestle with a tug of war between the analytical and the creative."

With summer passing and grad school approaching, I was running out of time if I was going to change course. Fortunately, I found a path forward with the help of two tremendously supportive and generous people: Stuart Bolton, my professor for acoustics and noise control, and Helen Brown, my professor for music theory and composition.

To this day, I am grateful that they supported me to expand my outlook beyond traditional engineering, which, among other things, included introducing me to Rick Thomas, a professor in Purdue's Theatre Department. Rick encouraged me to enter his graduate sound design program and helped me through a compressed application process. That fall, I was accepted into the M.F.A. program in the Theatre Department at Purdue.

One of my first interactions with Rick reflects what I came to appreciate about him as a teacher and an artist, and also reflects one of the core ideas in this book. Rick said, "You know a lot about engineering, but we need to teach you about the human condition."

These were inspiring words, but putting them in practice at the start of the school year was more terror than inspiration thanks to Rick, who had decided that "learning about the human condition" was best achieved by putting me—an uptight engineer—in the first-year undergraduate acting program. "Fish out of water" doesn't begin to describe how out of place I was among actors, but fortunately my peers and professors both had an abundance of empathy and goodwill. The craft and principles that I learned with them for creating and performing art as part of a team have served me over three decades of work in technology and entertainment.

During grad school, I had the privilege to help Rick teach sound design classes, which both drew upon and built on his evolving ideas about the nature of music in theatre. The curriculum for these classes was my first exposure to the fundamental connection that Rick saw between the visual and the auditory. The idea that size in the visual world could be thought of as volume in the auditory world, that lines and shapes in physical objects could correspond to melodies and harmonies in music, that the texture and color of a surface could be thought of as the timbre and tone of an instrument—these were foundational to me.

After completing my M.F.A., my career took a direction away from the theatre, and I began working on and designing video games. It turns out that putting on a play and making a video game have more in common than one might think. Both video games and theatre seek to immerse the audience in a fabricated moment in space and time and take them on an emotional journey. Both involve working as part of a diverse and collaborative team, and both depend on harnessing technology to tell a story and captivate the viewer.

Rick would lead his students through a process of deconstruction followed by synthesis: a process of getting to the root and core of something and then exploring how its pieces could be manipulated to make something new. I believe that process is echoed in his approach to this book. We can better understand how music incites emotions and creates mood if we start with a model of how our brains process sound waves. We can better understand the role of music in any art form if we go back through time and trace the connections between music, language, stories and performance.

Today, the Theatre Department at Purdue is housed in a wonderful collection of purposeful and modern facilities. During my tenure, things were more improvised and cramped, and Rick was gracious enough to share his office with his graduate assistants. A file cabinet in the corner of that office housed Rick's growing collection of notes and papers, many of which were my first exposure to his thinking about the connection between artist and audience and how we each uniquely experience music and theatre.

Rick continues to be a mentor and friend, and I know that he has put a career's worth of thinking and experience into writing this book, which should speak well to sound designers, composers, musicians, directors, actors, engineers, and anyone who has ever sat in the audience of a live performance.

Matt Booty
June 2017

Matt Booty is a corporate vice president at Microsoft, where he works in the Xbox division and leads the Minecraft video game franchise.

ACKNOWLEDGMENTS

I've been putting off writing these acknowledgments for pretty much the whole time I've been writing this book. When it takes your entire life to write a book, you leave behind an incredibly long trail of people to whom you are deeply indebted. I don't want to leave anyone out, but this section too, must have a finite length. Regrettably, I will not be able to mention everyone to whom I am deeply indebted. Instead, I'll try to make sure I cover everyone in groups, and just hope no one is too offended that I didn't have space to name them personally.

First, let me thank the people who specifically helped my make this book: Al Pounders for his lovely cover art; Matt Booty for his awesome foreword; Carnegie Mellon sound design professor, Joe Pino; and my dear lifelong friend and collaborator, Carrie Newcomer, for their endless patience and endurance in reading this book in its formative stages and providing so many helpful comments and suggestions along the way. Thanks also to my Honors 499 class who helped me test this version of the book in spring 2017, and to the Honors College for funding the project. These were brilliant students never afraid to tell me when they thought I was off my rocker, or really needed to explain something better, and I think the book is much better for that. Many thanks to Robert Meitus, who helped me navigate all the legal hurdles that one has to leap to get a book published. I also need to acknowledge the many specialists in their own respective fields, who actually made most of the discoveries revealed in this book. Hopefully, I have gotten their conclusions right. Finally, thanks to the good people at Routledge, who've shown incredible faith in my work and ability to bring this project to fruition.

Let me also thank my colleagues.

First, thanks to the many mentors who have helped me shape my theatre aesthetic over these many years, especially Van Phillips, Jim O'Connor, Dale Miller, Joel Fink, Dick Forsythe, Caryl Matthews, Abe Jacob and especially my dear friend Maurie Mogridge, who, after 40 years of "Tuesdays with Maurie" lunches, still provides wonderful insights and inspiration.

This book is partly autobiographical, but doesn't overtly reflect what I've learned and the great companionship I've shared with so many composers and sound designers, engineers and technicians over the years. They've influenced this book more than they will ever know. I met these wonderful people through

the many theatres and universities in which I've worked and visited, and some extraordinary organizations: The United States Institute for Theatre Technology (USITT), not just the Sound Commission, but especially the believers in the organization whose primary discipline was not sound, but understood its importance nevertheless. They empowered my career and our field by believing that sound design and music composition was an important art form. I am indebted to the International Organization of Scenographers, Theatre Architects and Technicians (OISTAT) and the amazing friends and family I've found and cherish there from all over the world; my friends and colleagues in the National Theatre Conference (NTC) who have allowed me to pontificate and explore the function of sound and music in theatre beyond the confines of design and technology; and the newly founded Theatrical Sound Designers and Composers Association (TSDCA). Another group of colleagues that has been indispensable to both my own personal development and the field of sound design for the theatre are the many manufacturers and other professional organizations who have assisted my work, become great friends, and with whom I have had the great privilege to collaborate over these many years.

Let me take time to thank Purdue University, which actively embraces its role as a Research One institution, and has supported my research *and* creative endeavor for over 40 years. From top to bottom, I could not have found a more wonderful place to spend my career. The Dean's Office, particularly our current Dean David Reingold and Associate Deans Joel Ebarb and Melissa Remis, made this book possible through two sabbaticals and subvention funds for image acquisition, for when a picture really could say a thousand words. The head of our Patti and Rusty Rueff School of Visual and Performing Arts and Harry Bulow, who has unfailingly supported my work even when it seemed destined to fly off the deep end. I've had the tremendous pleasure of working with many great faculty and staff from departments, schools and colleges all over campus in deep and meaningful ways: my many friends and colleagues in the Music and Dance Divisions and the Art and Design Department; my long-standing collaborations with Hall of Music Productions and Steve Hall; WBAA, Film and Visual Studies, the Electrical and Computer Engineering and Multidisciplinary Engineering programs in the College of Engineering; the Purdue Polytechnic Institute, especially the Department of Electrical and Computer Engineering Technology. But especially, I want to thank my second family, the faculty and staff of Purdue University Theatre. Like any family, we love, fight and challenge each other on a daily basis, but I wouldn't trade them for the world. My deep appreciation to our staff, who routinely go so far out of their way to accommodate my seemingly harebrained ideas. This incredible group of colleagues has helped to make me a better artist and person. They are a family like no other, and I cherish the time we've spent together.

I'm blessed to have so many friends, and I want to thank all of them, but especially the ones who held my hand through the last two years of this arduous book-making process: Carrie Newcomer and Robert Meitus, Maurie Mogridge, Al Pounders and Loren Olson, my dear friends Larry and Rita Smeyak, and my concert buddies, Alex Chorosevic and John Hermes. And, as long as I'm mentioning my friends, I must thank the roommates I've had over the many years, who taught me valuable life lessons, and became a lifelong friend thereafter.

Finally, I am deeply indebted to my family whom I love so dearly. In their own way, they've helped make possible the production of this book: Buz and Judy, Tom and Bonnie, Jay and Tammy, TJ and Leah. Finally, I must never forget my mom and dad, Harry and Lillian, who sacrificed everything to build one of the most wonderful families in the world.

CHAPTER 1

WHY THIS BOOK?

> *Of the nature of the soul . . . let me speak briefly, and in a figure. And let the figure be composite—a pair of winged horses and a charioteer. Now the winged horses and the charioteers of the gods are all of them noble and of noble descent, but those of other races are mixed; the human charioteer drives his in a pair; and one of them is noble and of noble breed, and the other is ignoble and of ignoble breed; and the driving of them of necessity gives a great deal of trouble to him . . . the soul which has seen most of truth shall come to the birth as a philosopher, or artist, or some musical and loving nature.*
>
> —Plato, *Phaedrus*

> *Know thou the self as occupier of the chariot, but the body as the chariot itself; but know thou the intellect (buddhi) as charioteer, and also the mind (manas) as rein. The senses (indriya) they call the steeds, the objects of sense the resorts (gocara) for them; him that is yoked (yukta) with self, senses, and mind, the wise call by the name enjoyer.*
>
> *—The Katha-Upanishad*

Introduction: An Ear-Opening Experience

I was a junior in high school in 1969, a nerd at a time when nerds could not have been less fashionable. Every day brought another embarrassment and humiliation. But I had found music early in my life, and music, it would turn out, would be my salvation.

One day, after a particularly traumatic experience—which, curiously I can't even recall now—I came home, and went up to my bedroom to sulk. I can't ever remember being so despondent and overwhelmed. I pulled out a new record that I had just bought a couple of days ago. It was a new band I had recently encountered, Pink Floyd. I put on side three of *Ummagumma*, an experimental departure from their earlier albums.

I lay down on my bed as the grand and pompous first movement of *Sysyphus* started. Somehow it was exactly what I was feeling: angry, oppressed, overwhelmed. The second movement, a piano solo, calmed me down quite a bit, and was much more reflective, although quite melancholy, which was now how I was feeling. The third movement led me into a world that was funky but unpredictable, a bit scary and chaotic, again very much like my life. It built to a huge climax, and then released into this quiet, reflective but deeply unsettling world.

By this point I was only semi-conscious, but somehow deeply connected to the music, my moods changing with the album tracks.

A crashing, raging sound momentarily shook me from my reverie followed by an eerie dissonant and slowly building section before the monolithic oppressive chords made their final climactic re-entrance. It left me in a very calm place, immersed in a world of birds singing and insects buzzing around, and eventually a very simple, peaceful acoustic guitar seemed to take away all my pain. This gave way to the final movement on that spinning bit of vinyl, *Several Species of Small Furry Animals Gathered Together in a Cave and Grooving with a Pict*. The piece is among the most whimsical in popular music. It left me . . . happy.

As I awoke from this experience, I was astounded. How was it that less than a half an hour ago I had lay down on my bed overwhelmed by despair and hopelessness? And now I was . . . happy!? Nothing in my world had changed, except that I had listened to music. How was it possible that music could possibly have that kind of influence on me?

A little over three years later, I was going into my junior year at Michigan State University, when I landed a job as an assistant director with one of our faculty members, Peter Landry, at the Calumet Summer Theatre, in one of the most northern points in Michigan. We were mounting a production of Emlyn Williams's classic psychological thriller, *Night Must Fall*.

The rehearsal process was uneventful until about two weeks before we opened. Peter received news that his father had passed away. He told me that he would need to leave for about a week for the funeral, and I would have to take over directing the play. Picture this: I'm barely a junior, and all the people in the company are either grads or the senior star actors at Michigan State. And I'm going to "direct" them! Now, I'm an opportunist as much as anybody else, so I was like "yeah, sure I'll do that, no problem."

Then Peter said, "Oh, and while I'm gone could you find some sound effects? Door creaks and thunders, things like that." This is a murder mystery, right? It's about a gardener who comes to visit this really, really old lady in a wheelchair, and it's one of those creepy, spooky, great summer stock entertainment kind of shows. So, he left, and I started to put together some sound effects from these Electro Voice sound effects records they had—thunders, door creaks, all the sounds I thought the show might need—and commenced to directing the production. And I directed, and I directed, and I directed, and every day the show just got progressively . . . *worse*. It never got *better*. Every direction I gave made the show *worse*. It kept going down and down and down and down and down . . .

So now I'm really embarrassed, and Peter comes back from his father's funeral about a week later, and the show is as deadly boring as you can possibly imagine. Not at all scary, my creepy sound effects are not doing anything. We all gathered, and Peter pulled out this reel-to-reel tape recorder—in those days it was a Wollensak. He sat down, and said, "well I'll tell you what, let's just run through and see what we've got." We started running through the show, and while Peter was gone, he had put together a soundtrack of film composers such as Bernard Herrmann, classic music from fifties suspense thrillers. And the show went from "I can't bear to watch this" to frightening, chilling and riveting. The tempo and rhythms of the actors magically fell into place; the music *commanded* and *transformed* the acting. I experienced the show like it was my very first time and it totally blew me away.

Suddenly I realized how music could fundamentally transform theatre.

Old School Aesthetics

So began a journey that has lasted my entire life, a combination of discovering how sound and music work in the sound scores I composed, and of sharing those discoveries with students in sound design classes over 40 years.

These are the discoveries I hope to share with you in this book, but before I do, it's important that we understand something about art and artists. We are all unique and different. That is as it should be. Who would want to live in a world in which all of the art followed the same set of rules, in which all of the art somehow turns out the *same*, because we all follow the same rules? Every maker of art and every person who experiences art has a separate and unique *aesthetic*.

Aesthetic. That word can mean a lot of things to a lot of people. It has changed quite a bit from its original use. The origin of the term aesthetic comes from the Greek term *aisthetikos*, which means "perceptible things," or from *aisthesthai*, meaning to "perceive by the senses." However, it was resurrected and appropriated in the mid-eighteenth century to mean what it generally means now, our general sense of beauty and art (Oxforddictionaries.com 2016). But this earlier definition precisely fits our needs in this book. So, we will use the term exclusively in this book in the Greek sense. When we use the term aesthetic in this book we will mean *how we perceive the world through our senses, especially our senses of hearing and sight*. Using the term in this way allows us to immediately bypass value judgments in perceiving art. Quite the contrary, it validates every individual's own valuation of art. If it moved you, then it's a valuable piece of art.

Oh, and by the way, in 2003, *Stylus* editor Ed Howard reported that the general consensus about the *Ummagumma* tracks I had been listening to was that they were "something lower than shit" (Howard 2003). Other people's aesthetic. Go figure.

At the same time, we are very concerned in this book with how we *connect* with each other using music, especially when we use it in the more highly specialized discipline of creating sound scores for theatre. How our audience *perceives* music is critically important in understanding how we connect with one another, even more so when we attach ideas to music like we routinely do in theatre. We will find that using the term "aesthetic" in the Greek sense will be much more helpful in improving our ability to create and understand music composition and sound design for the theatre.

In using the term "aesthetic" in this manner, we go much further than avoiding often less than useful valuations of artworks that undermine and inhibit creativity. If you create music in your art work, this book makes no attempt to evaluate the quality of your art. Instead, this book will hopefully give you a fundamental understanding of the interconnection between composer, performer and audience. To do that, it helps to understand how human beings perceive the world through their senses. But do not confuse that with me trying to convince you to like music that I like, or theatre that I like, or that I think you should compose or design in a certain way. I will show you some fundamental tools we use along the way, and help you understand how we use them and why they work. What you do with them is gloriously your own business. In that sense, my hope is that my aesthetic will *inform* your aesthetic, not that I will convince you that I have attained some ultimate truth that you must blindly adopt as if it were a religion.

When Sound Gets Divorced from Music

As an example, let's consider how I have typically composed sound scores for theatre over the last 40 years. I like to work more like the composer of a musical would work: we compose pretty much the entire score, and the director then stages the entire production allowing the preexisting music which dictates tempo, dynamics, vocal colors and so forth. I've been fortunate to work with an extraordinary director, Joel Fink, together in this manner for many, many productions both in Chicago and at the Colorado Shakespeare Festival, and we've developed an amazingly intuitive relationship where we instinctively know how each other "perceives the outside world through their senses," each other's aesthetic. On any number of productions, Joel has walked in to the first cast read-through with my complete soundtrack, to which he will stage the production. Yes, there are many changes and adaptations we will make along the way to address mistakes I made in the composition, nuances that the actors bring to the performance, and the tremendous conception that Joel develops in the realization of each production. Working in this manner puts a tremendous responsibility on my shoulders to come to a complete and full understanding of exactly how music works in the production. There have been instances where Joel has listened to my initial compositions and said "lovely piece, Rick, but this music is for a different show." But for the most part, the score is largely composed in advance of the rehearsal process.

Composing the score in advance of rehearsals, like a musical, has become a large part of my theatre aesthetic.

But it isn't the only viable aesthetic out there. Most directors will argue for a different aesthetic, and with very valid arguments. While working in this manner has its advantages, as evidenced in the dominance of preexisting scores in musical theatre and opera, working in this manner also has its decided disadvantages. In particular, an existing score tends to undermine the journey of discovery undertaken by the actors. Including music very early in a production tends to dictate the actors' pacing and rhythms—it's very hard to fight against it. Many directors are very leery about introducing sound too early in the rehearsal process, and some prefer not to introduce it until the actors' pacing and rhythms have been clearly set. Scenic artists typically develop the space in which the events of the play unfold. Once this space has been created, directors then learn how to reveal actions that take place in time. Since sound is primarily a time art, it makes sense to orchestrate those actions after the actors' action has been staged. Doing this helps to accommodate the rhythms imposed on the actors' performance imposed by the scenery. This is another very common way of working, especially in smaller theatres with limited budgets. Most films are also created in this manner. The composer receives a relatively complete edit of the movie and then composes the score to support the rhythms and pacing of the actors and the film editor.

Working in this manner places its own challenges on composers and sound designers: their process can't really start until the other processes are complete. In film, this often means very compressed time schedules squeezed between the "rough cut" and the release of the film. In theatre, this often means that the composer/sound designer can't really begin to work on a show until the technical rehearsals—a time-honored tradition made all the more pragmatic by salaries that compel sound artists to restrict their effort to very short time periods. Still, this approach can work amazingly well provided that the amount of

orchestrating required is doable, and, conversely, that the sound team has developed the extraordinary ability to create workable sound quickly and efficiently, often while waiting for lighting designers to perfect their own contributions.

If composing the sound score before the show goes into rehearsal is one approach, and composing the sound score during the technical rehearsals is another, there remains but one more aesthetic in the creation of sound scores: composing the sound score *during* the rehearsal process. It seems that this is, for practical reasons the most common approach, but perhaps the one that is the most fraught with potential problems when the sound score is composed simultaneously, but separately from the rehearsal process. The problems with this approach will require a bit of explanation, but is so important that it serves as one of the underlying themes of this book, so bear with me.

Joe Stockdale is considered by many to be the "father" of Purdue Theatre. He came to Purdue in 1951 and directed productions there until spring of 1976, three months before my tenure at Purdue began. He led the LORT Purdue Professional Theatre and directed 140 shows that included such notable artists as William Saroyan, Academy Award winner Anne Revere and James Earl Jones. His students included such legendary figures of the American stage as Peter Schneider and Tom Moore (Williams 2007). Later in life I had the privilege of discussing some of my then emerging ideas about the function of music in theatre, and Joe graciously offered these thoughts in an email to me:

> At the end of the sixteenth century in a Florentine academy, opera was "invented" as part of the rediscovery of classical theatre. The creation of opera was based on an interpretation of Aristotle's writing about music as a constituent part of tragedy. However, in opera, the libretto [plot's text] was secondary to music because operas were sung throughout and therefore music composition and its relation to character was the natural focus rather than music's relationship to plot described by Aristotle.
>
> Throughout the centuries that followed plot and its relationship to character continued to be the focus in drama except for interludes of musical prominence such as Ben Jonson's court masques (1605–1625), Gay's *The Beggar's Opera* (1727), Rousseau's *Pygmalion* (1770), Diderot's discussion of fitting prose to music, music's popularity in underscoring the text of melodrama, Richard Wagner's thoughts on the unification of the theatrical elements of opera, musical background for early silent films, then TV soap operas, and eventually genuine musicals such as *Show Boat, Oklahoma, South Pacific, Gypsy*, and *West Side Story* and now the triumph of the musical revue on Broadway which pretty much eliminates plot and dialogue.
>
> (Stockdale 2009)

Joe's disdain for the modern Broadway musical aside, there is a very real problem with Joe's snapshot history for me: it only considers instrumental and sung music. It doesn't include music's profound influence in theatre that is neither instrumental nor sung music.

For example, it doesn't include the *prosody* of the actors' dialogue. Prosody is the part of speech that doesn't use signs or symbols like language does; it involves the rhythms with which the actors speak, the stresses and dynamics, the speech melody. It's how we tell a question from an exclamation from a command, even when the words spoken are all exactly the same. Consider the many ways of saying the simple statement "I'm going to the store." It could be filled with the excitement and anticipation of having just won the lottery. It could be filled with frustration and anger, like how I would say it after I discovered for the third time that I was missing a part to repair my leaky faucet. It could simply be filled with indifference because I'm bored and need something to do. Or it could be bursting with the excitement and anticipation of going shopping for that new flat-screen television. It's a form of music that we as orchestrators cannot ignore.

Beyond the music inherent in the actors' speech, there are also inherent rhythms and dynamics of the actors' physical performance. In another art form, we would consider these to be a form of dance. But can we ignore these when we create sound scores for the stage?

The plot of the play also has its own musical structures. Traditionally this structure follows the form inciting event, rising action, climax and resolution. But modern theatre provides us with many alternative forms. In order to draw us into the world of the play we implement very specific rhythms, tempos and dynamics. These musical elements bring together the prosody of the actors' voices, and their physicalizations into a larger musical structure that also includes scene changes, blocking, projections, lighting and more. One of the most common problems I encounter in younger student composers and designers is their inability to conceive how the individual elements of the production combine to form a larger whole, in the same manner that a composer develops a theme in a sonata into an exposition, a development and a recapitulation. These are critically important musical structures.

You may argue that I am defining music unnecessarily too wide. But I will argue in the course of this book that this wide definition of music is justified anthropologically, neurologically, evolutionarily and historically, and one way or another is essential to creating the dramatic experience of the audience. Hopefully by the time you finish reading this book you too will never think of music so narrowly again, that is, solely confined to instrumental and sung sounds that we *hear*.

Let's briefly discuss how the problem of sound scores becoming disconnected from the music of the actors and the play came to manifest itself in theatre. Electronic theatre sound design as we now know it came to the theatre table pretty late. Electronic pioneers started experimenting with sound in the theatre in the 1930s and 1940s. One of the earlier means of cueing recorded sound into a performance relied on a sound operator dropping the needle onto a spinning disc rotating at 78 revolutions per minute. A valuable operator was one who could produce the desired sound in a relatively precise way—"If the dog could bark somewhere around here, that would be great!"[1] As you can imagine, this precluded the ability to perform in a musical manner that had the same precision as, for example, a pianist who could play ahead of the beat, on the beat or off the beat—millisecond differences that have great musical meaning in performance.

However, the musicality of a lot of these sound "effects," as they were probably rightly called, was not so important. Sound was being used iconically; that is, the sound performed was being used as an icon for the real thing to let the

audience know some specific fact about the story (e.g., that a dog had barked). As long as the audience understood that the sound they heard was supposed to *represent* a dog, all was well. And, of course, it was easier to play a recording of a dog than to have a real dog located offstage and convince it to bark on cue. Never mind that the dog barked in the acoustic environment of the backstage area, not the actual acoustic environment of the scene. Ditto for a train. The prominence of dramatic realism in the twentieth century paradoxically empowered this iconic approach to sound over musicality.

By the time I started "designing" sound in the early 1970s, and for quite some time after, everyone referred to sound as "the newest design element," if they were willing to consider it as a design element at all. Because sound was so often considered in its iconic function rather than its musical, a whole process developed for incorporating sound into a production that was modelled after lighting: stage managers calling cues, sound operators located in glass booths, and loudspeakers located where the lights were, creating sounds that emanated outside of the dramatic space. Sound often became a Band-Aid to address other problems: scene and costume changes that went on way too long, instilling mood where none had surfaced in the rehearsals. As I once overheard an artistic director say to a struggling director: "Put some music under it. It will mean *something*." Of course, as my sound design friend Joe Pino put it, "that's the problem. It always means *something*. There's no way that you can prevent that" (Pino 2017).

And, most significantly, there was little to no perceived need to bring in the sound team early in the process to create the music *with* the team. Back in the day, some directors' idea of sound design was that they would provide a list of sound effects, and the sound technician would go to their sound effects library and find several versions of the required sound. The director would then pick out the best one. This was sound design? No wonder people were saying "sound design? There's no such thing as sound design, it will never be an art form." So we played the sound effects back at something resembling the right moment, mostly because the audience needed to know something, for example, that a dog barked—backstage.

By the time theatrical style changed to demanding a more musical theatre, the processes were so firmly in place to *prevent* the musical integration of sound into a production that change would often be an uphill battle. Today the sound team often goes away on its own and develops the sound score that seems appropriate for the script and the director's interpretation. But this approach that divorces the composer and designer from the other "musics" of the production often leads to fragmented, trivial, oversimplistic sound scores that more often distract listeners rather than pull them deeper into the performance. This process often results in the creation of two *musics*, the music that drives the performance itself, and the audible music and sound that attempts to somehow match, dictate, correlate or illustrate that internal music.

Such a process of composing the sound score simultaneously, but separately from the composition of the music of the actors, seems to be rather hit or miss. Ideally, we would compose the sound score simultaneously *within* the rehearsal process. But as I said before, that is pragmatically difficult for a variety of reasons. To overcome what is pragmatically working against us, we need a fundamental understanding of how sound and music work in theatre that could then empower us to utilize their full power to engage and transport audiences into our dramatic worlds. What we need in production is an aesthetic informed by the experience of

music in theatre, that transports the audience into the world of the play. It is my hope to build the foundation for such an understanding in this book.

Who Should Read This Book

Even in the preceding examples, many production teams have achieved extraordinary results using any of the three processes described without the benefit of this book! This is no accident. Music is primal; it's a biological component of human physiology and psychology. Music is so fundamental to our being that we take it for granted that we understand it. Everybody can listen to music and be moved by it. You don't have to have any training whatsoever. That is quite different from language. An intuitive approach also applies to making music. Many of the world's most beloved musicians have no formal training whatsoever. They can't read a note of music; they have no formal training on their instrument. They play from the heart, from deeply ingrained intuition, allowing their emotions to flow through their instrument. Ask them how or why they play notes in a certain way, and they will be at a loss to explain. It just happens.

A similar situation exists with directors and actors and other artists expressing themselves through music. For example, a director may say to an actor, "If you put a beat right there in that line, you'll get the laugh you're looking for," and sure enough, the actor puts the beat there—just a little pause, just a little cadence, a musical thing right there, and there's a laugh. The actor turns to the director, and says "how did you know that?" The director responds, "I don't know," or "I've been doing this for 40 years." But ask the director why, why musically is that right? They can't tell you. It's intuitive. Music is very intuitive. It's one of the arguments about music being biologically and evolutionarily driven. It's really intuitive. All cultures have it. All time periods have it.

For many, this intuition is enough. For the rest of us, there will come a time when we need to effectively communicate, and we will want to have a command over our tools in order to connect with our audience effectively. Nearly everyone can communicate to a certain degree using their native language. However, the best communicators are those that also study their language, who understand and learn the nuance of meaning, syntax, phrasing, efficiency and precision. It is similar with music. In every artist's life, there are hills and valleys; hills of magnificent inspiration that come from who knows where, and valleys where we seemingly don't have a creative idea to offer. We don't need to understand how music works in theatre to get us through the hills, we need to understand how music works to provide a craft that leads us to success in the valleys. In this book, I will argue that the art we need to understand, that will lead us to better craft, lies in understanding music holistically. The more we understand how music works, the more we will understand how theatre works, because theatre is a type of music.

You'll notice that I keep using the term "connection" in describing our work as composers and sound designers for the stage. This implies a distinct bias that I have as a playmaker, that also applies to my target audience: that music is fundamentally not the same as communication, in which *information* is transferred from one entity to another. We'll see that music doesn't usually work that way. Instead we use music to manipulate the audience's perception of time, and in the process, stimulate emotions in them. It's a careful distinction, one that will hopefully become much more necessary as we move forward in this book.

But this process of connecting with an audience still involves transmission, mediating and reception. My objective is to transport the audience to a balanced

blend between a world we as a production team choose, and a world the audience creates in their imaginations. Because of this, I tend to carefully balance how much I leave to chance. There are many fine artists out there who are perfectly content to simply express themselves as artists and let the audience make of it what they will. Pure composers often encounter this problem when they first attempt to write for the stage—it's not enough to be able to express oneself in a moving manner. Expression in theatre is tied to a larger conception, and must support that larger conception in what is experienced by the audience. So, while we will discuss the careful balance we must achieve between what we give the audience as playmakers and what we require the audience to supply themselves, this book is intended for those who want to improve their ability to connect with an audience, their ability to consciously manipulate design elements to affect an audience in a very specific and predetermined way.

Given these caveats, I hope that this book will prove an invaluable source of inspiration for composers and sound designers alike, regardless of whether you have formal training in music. For years, I called my course "Composition for Non-composers," but, in practice, I have found that formally trained composers have found great benefit in it also. Forty years' experience teaching this subject in classes does provide some hope that this material will help you become a better composer and designer. But I've discovered something else along the way: there is tremendous interest in this subject beyond composers and sound designers for theatre and film. Musicians, directors, playwrights and actors have found their way into my class and enriched the dialogue tremendously. Visual artists interested in exploring the element of time in their works have also participated and found value in these discussions. Even those with just an avocational interest in how they are being manipulated when they go to the theatre have found the discussions contained herein intriguing. There's something to be said for the idea that one gains even more enjoyment from experiencing a work of art when one is able to simultaneously analyze the experience one is having. It is the intention of this book to provide some tools to do just that too.

Overview of the Book

In this book, then, we'll attempt to identify the core principles of music that apply not just to instrumental and sung music, but to art in general, and more specifically to theatre, including playwriting, directing, acting, visual design, and, of course, sound design and music composition.

We'll make the argument that theatre is specifically a development of music, a specialized form of music. Our thesis is very simple:

Music = Time Manipulated
Song = Music + Idea
Theatre = Song + Mimesis

We start with time and define that. What is music, then? Music is just time manipulated. We will define music in a very broad way to include the prosodics of speech and visual music such as dance. What is song? Song is simply when you add the communication of ideas to the fundamental connection provided by the music. And then finally, what is theatre? It's when you take a song, and you add imitation to it (or more specifically, mimesis, which we'll explore quite a bit in

later chapters). Instead of singing *about* something, we *become* that something. It's that simple, and we shall see that this is exactly how theatre developed.

The most important principle for which we will be building a case is that theatre is a very specific type of music. You can have music without theatre; you cannot have theatre without music, especially as we define music in its broad sense. Once we understand how music works in its broad sense, how music works in its more traditionally understood aural form will hopefully become much clearer.

To get to the most basic principles we use in creating sound scores for theatre, we'll need to narrow our subject down quite a bit. We will do this by separating culturally acquired characteristics of music and theatre that change significantly from one time period to another and from one culture to another. Such an investigation would be overwhelming, and it would not get us where we want to go. There have been thousands and thousands of volumes written on the historical and cultural forms theatre has taken. We are not interested in supplanting those; we are simply interested in exploring the foundation upon which those forms are built. We want to identify core principles, and to do that we need to identify elements and principles of music and theatre that have not changed for tens of thousands of years. They worked the same way for the Greeks as for cave dwellers. They work the same way for us. Timeless principles are a great place to start when building an aesthetic of music and sound in theatre. If you are going to build a foundation for learning how to use music to connect with an audience in theatre, what better place to start than things you know to be true for everybody? So we will study music as an evolutionary adaptation. Why evolution? Evolutionary changes take place over thousands and millions of years. If a trait applies to our ancestors and also applies to us, we're pretty certain that we've identified a fairly fundamental principle of the human condition that we can learn to manipulate. By identifying those principles, we can assure ourselves that the principles that we discover will apply to all periods of sound and music, and to all cultures, not just white Anglo-Saxon Protestant males in the United States.

As we shall see, music is simply a word we use to describe how we consciously manipulate our perception of time. In order to understand music, then, we will need to understand how time works. We'll start there, at the beginning of time and the universe, looking for clues in the fields of physics and astrophysics. We'll specifically look at the physical differences between sound and light and their relationship to matter. Then we'll trace how we came to be able to perceive time and space, and the specialized evolution of our ears and eyes to do both. We'll investigate how evolution led to important pretheatre activities such as ritual and dreaming and connect those to our understanding of how time and space work. We'll see how rhythm evolved around the same time that primitive man began to walk on two legs and look at the relationship between rhythm and bipedal locomotion.

We'll consider the complementary evolution of music and language, especially in the evolution of the human brain, and in particular, the relationship of music to language in song. This will lead us into discussions about the neurological evidence showing fundamental brain functions that haven't changed in thousands of years. Michael Thaut wrote one of the outstanding books on this subject, *Rhythm, Music and the Brain*, and explains the reason this inquiry is so helpful in this way:

> Music has received an unprecedented research focus in the brain sciences over the previous two decades. This came as a surprise to many artists and scientists alike; it was an unlikely development

> for music, as an aesthetic medium and art form, to become a focus of many serious brain scientists' major research efforts. Furthermore, music received an almost exclusive and privileged position in brain research compared to other artistic fields. No other art form has received anything close to this level of attention.
>
> . . . We now know that by studying the physiology and neurology of brain function in music we can actually obtain a great deal of knowledge about general brain function, in regard to the perception of complex auditory sound stimuli, time and rhythm processing, differential processing of music and language as two aural communication systems, biological substrates of learning versus innate talent in the arts, and processing of higher cognitive functions related to temporality and emotion. Music has become a very useful model for brain research in perception and cognition.
>
> It has become quite clear in recent years that one of the most interesting and provocative suggestions coming out of these efforts in music and brain science is the realization of music as a biologically deeply ingrained function of the human brain. The brain has neural circuitry that is dedicated to music.
>
> (Thaut 2005, vii–viii)

We'll look into the relationship between this neurological evidence and the evolution of art as a human endeavor. We'll connect psychological theories to this evolution, specifically related to the evolution of music, how and why music incites interest in its audience, and the role that memory, a close ally of music, plays in art.

We'll see how music and song contributed to the first great civilizations and how, when combined with mimesis, they begat the art form we now know as theatre. In conclusion, we'll consider the development of one specific strain, the first truly *autonomous* theatre of ancient Greece, as a case study. We'll investigate how Greek theatre developed out of music, and explore their uncanny understanding of how humans perceived both. Aristotle said that tragedy developed from the dithyramb and comedy from the phallic song. What's the importance of this statement? The importance of this statement is that Aristotle specifically suggests that theatre developed out of a musical form. It's not a minor detail. It's a major consideration that supports the major underlying theme of this book—especially when one considers the role that Greek theatre played in the subsequent development of Western civilization.

Ten Questions

1. Define the term "aesthetic" as we will use it in this book.
2. What is the purpose of this book, and what does that have to do with our definition of aesthetic?
3. Describe three ways in which sound designers create sound scores for theatre.
4. What is prosody?
5. Name three forms of music besides instrumental and sung music in plays.

6. What does it mean when we use sound "iconically"?
7. What is the great danger of creating the sound score during but independent of the rehearsal process?
8. State the thesis of the book in its most simple way.
9. What is the most important fundamental principle underlying this book?
10. What types of principles will this book hope to explore, and which types will it hope to avoid?

Things to Share

1. Tell us a story about the first time that music profoundly moved you, that moment when it changed your life. Play us an excerpt of the music, so we can more fundamentally appreciate that moment. When you tell your story, consider when and how you will introduce the music. How will you set up the story in such a way that when you play the music, and we hear the music, we will have something like the same experience you had when you first encountered the music?
2. Tell us about your music aesthetic. How do you perceive music through your senses? Tell us about what kinds of music you like, and see if you can look deep into your life to help us understand why you are attracted to this music. Find a way to help us connect to this music in the same way you do. Then play an amazing example of this music for us to experience.

Note

1 See David Collison's outstanding book for a detailed and delightful history of sound in the theatre: Collison, David. *The Sound of Theatre*. 2008. Eastbourne, UK: Professional Light and Sound Association.

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PART I

THE NATURE OF TIME

CHAPTER 2

LET THERE BE A BIG BANG

Introduction: If a Tree Falls in the Universe . . .

About 13.7 billion years ago, the universe exploded into existence with the Big Bang. As far as we know, there was very little music and theatre at that particular moment. There is quite a bit of controversy about what came before the Big Bang. One line of thought says, "nothing," which is hard to wrap our brains around. But we do call it the "dawn of time." Before the Big Bang, there was no time. There was no matter. Or if there was something, it is irrelevant, because it cannot possibly have any effect on the present moment. This monumental event set into motion everything that came after it, not from a deterministic point of view in which every future moment is inevitable, but from the vantage point that all the rules of the universe, including how sound and music work, proceed from this singularity, this singular moment in time.

Now, the Bible also says in Genesis 1:3, "And God said, let there be light: and there was light." Notwithstanding that the surrounding verses paint a decidedly different picture of creation, the Bible has a good point. The Big Bang must have been quite a spectacular burst of light, but could it have made a sound? In my very first Introduction to Sound Design class in the spring of 1977, I offered two distinct definitions of the word "sound." I got the first out of David Collison's 1976 book, *Stage Sound*. At the time, it was really the only book devoted to sound for the theatre outside of Harold Burris-Meyer's 1959 book, *Sound in the Theatre* (Burris-Meyer 1959). Collison's definition states: "sound is essentially the movement of air in the form of pressure waves radiating from the source at a speed of about 1,130 feet (350 meters) per second" (Collison 1976, 10). The second definition came from Howard Tremaine's *Audio Cyclopedia*: (sound) "is a wave motion propagated in an elastic medium, traveling in both transverse and longitudinal directions, producing an auditory sensation in the ear by the change of pressure at the ear" (Tremaine 1969, 11). Besides the obvious difference in technical specificity between the two definitions, I couldn't help but notice a critically important distinction: one definition insisted that it's not a sound if no one hears it; the other, not so much. A light bulb went off, as I realized that the answer to the age-old question about whether a tree falling in the woods makes a sound if there is no one around to hear it, depends on how you define sound! Even in my first classes, I became aware of how important definitions were in making your case. This may sound like a small thing now, but we will return to the importance of it in Chapter 4 when we define music, and in Chapter 12, as we bring together

many of the ideas of this book into a hopefully consistently argued and well-supported thesis about the origins of theatre in music.

Leaving aside the "if a tree falls in the woods, and no one is around to hear it, does it make a sound?" cocktail party chestnut, we are still left to deal with any definition of sound that describes it as a vibration that propagates through a medium, such as air. While the singularity that produced the Big Bang was infinitely dense, the next moment and all the subsequent moments produced a lot of empty space. And sound doesn't travel in a vacuum. So, it's pretty debatable how big a "bang" there actually was. As a pragmatic reality, while the potential for sound existed throughout the universe since the dawn of time, it would not be until about 9 billion years later when the earth formed that sound would begin to have a practical significance.

Now this might seem like nit-picking, but in actuality it reveals an incredibly significant difference between light and sound that has tremendous implications for this book and for the art we create. Light and sound provide two of the most important stimuli to our senses that help us apprehend the external world. In theatre, they are almost solely responsible for providing the sensory input that informs our aesthetic. If we consider theatre to be an art form in which we seek to divine the great secrets of the universe, then we must accept that we will be doing this primarily through these two senses. Before we can understand how we use these senses in the creation, mediation and experience of theatre, it will help tremendously to first understand a bit more about them and how they reveal our universe to us.

In this chapter, we will investigate the fundamental differences between light and sound and how evolution advanced so that we could perceive them. We will see how light transmits through electromagnetic waves that are perceived by the eye as primarily spatial and secondarily temporal, and how sound transmits through mechanical waves that are perceived by the ear as primarily temporal and secondarily spatial. Understanding these differences is essential to understanding the role that time and music play in theatre. We will investigate that role in later chapters.

The Nature of Light and Sound

When I first started teaching about sound design back in the mid-1970s, there was great pressure to think, and therefore teach, about sound like it was visual design, for example, scenery, costumes and lights. Sound as a design element, when anyone considered it at all, was thought of as "the fourth design element," similar to the other three. My job quickly became to provide lectures on sound design in introductory scenography classes based on this premise.

In one of the beginning scenography classes, taught by my major professor, Van Phillips, and legendary Broadway lighting designer, Lee Watson, we investigated fundamental elements of visual design: line, color, mass, rhythm, space and texture. It wasn't a far leap for me to find strong equivalents of these elements in sound. I liked the process Van and Lee used, and developed my own course based on their class. I've been developing these ideas ever since, and they not only serve as the foundation for this book, but also my workshops and class projects based on this book. I am indebted to them both for planting the seed that would later become my life's work.

Finding a common language to talk about both visual design and sound design seemed surprisingly easy. Much later in life I would discover why. Sound and

light provide our senses with clues to the nature of the universe in the form of waves that emanate from matter in that universe. These waves might come from a distant star, or that molten eruption on our forming earth. Waves are vibrations that transfer energy from one place to another. There are two relevant media that transmit waves: space and mass. Generally speaking, light waves are electromagnetic vibrations that transmit through space, and sound waves are mechanical vibrations that transmit through mass. In order for us to know anything about the universe that surrounds us, we'll have to take in energy that has been transmitted to us through space and mass.

Waves transmitted through space and mass share a great number of similarities. They have wavelengths and frequencies that are determined by the speed with which they travel through the medium. They share properties of *reflection* (the angle of incidence equals the angle of reflection), *diffraction* (the ability to bend around objects), *absorption* (typically turning the energy into heat, like your microwave), *transmission* (going right through an object) and *Doppler shift* (a phenomenon in which the received frequency changes from the source frequency because either the source or the receiver or both are moving). So, from the vantage point that sound and light are both wave transmissions that share similar properties, it makes perfect sense that we would want to consider sound design as similar to our visual design counterpoints, scenery, costumes and lights. I suspect, however, that in my beginning scenography classes and the larger theatre in general, this was more of a marriage of convenience than a matter of scientific inquiry.

But the waves that travel through space and those that travel through mass also have significant differences. In an effort to separate the differences between sound and light, I developed the practice of starting each guest lecture by writing Einstein's famous equation, $E = mc^2$ on the chalkboard. "This is also how theatre works," I would say; "dramatic energy is equal to mass put into motion by '*c*' which is space and time, light and sound." I really knew nothing about Einstein's theories, but for some reason, the equation seemed to fit. Only much later would I realize the significance of this statement, and much of this book will lay out the argument for including this concept in one's aesthetic.

Electromagnetic waves that travel through space, such as light, transmit themselves using the massless photon which streams from the source to the receiver. This type of transmission allows electromagnetic waves to travel at the fastest speeds possible in our universe, 186,300 miles per second.[1] This lack of mass allows photons to oscillate at superfast frequencies—311,000 to 737,000 gigacycles per second for light, with wavelengths of 16–38 millionths of an inch. The tiny wavelengths of a light wave typically reflect in all directions when they encounter an object, which is responsible for making objects visible from many directions simultaneously. But those same tiny wavelengths only travel in a straight line, meaning that the receiver must be pointed at the source of the light in order to perceive the streaming mass of photons. This does have its advantages, however: it allows the receiver to precisely determine the direction of the incoming source of light. Light is very well-suited to reveal the spatial characteristics of mass. Why? Because light involves extremely fast vibrations that can convey a tremendous amount of information about the spatial characteristics of a source, especially direction and shape.

Mechanical waves that travel through mass, such as sound, work quite the opposite of the fast oscillations of light. They are much closer to the sense of touch, which requires direct contact between the source and the receiver. Mechanical

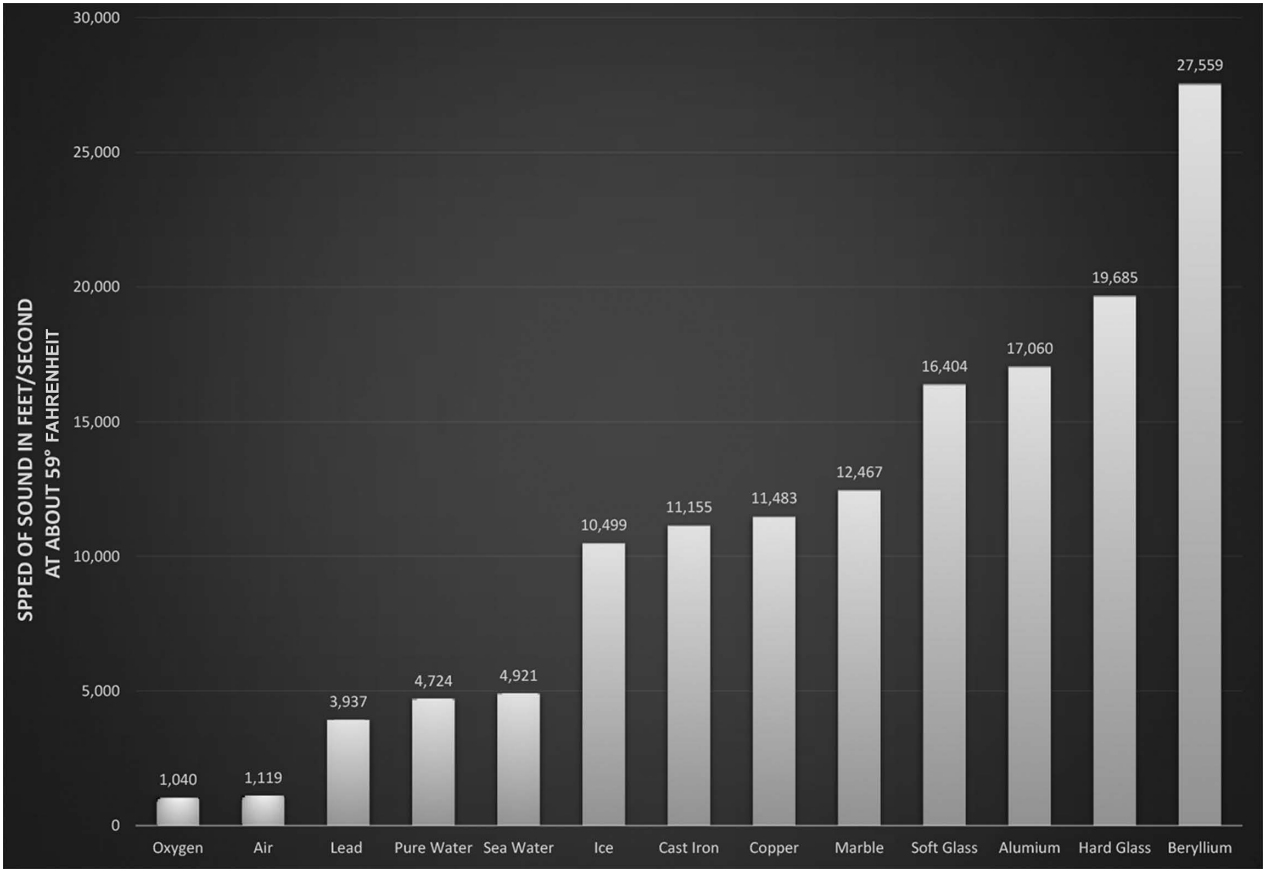

Figure 2.1 The speed of sound traveling through various materials.

Credit: Davis, Don. Carolyn Davis. 1987. *Sound System Engineering*. Indianapolis: Howard W. Sams. 149.

waves generated by the source vibrate the molecules of their neighbors in all directions, and these molecules vibrate their neighbor, and so on, continuing in this fashion until they are absorbed, or the wave has reached the receiver, and, in turn, vibrates the receiver. This type of transmission takes a lot more time to happen than for light. Sound transmits much, much slower than light, about 1,130 feet (344 meters) per second in air.

The types of vibrations that can be transmitted through mass work best at very low frequencies, less than 20,000 vibrations per second for sound, and have wavelengths as long as 50 feet! As frequency increases, the mass medium itself absorbs more and more, often turning the wave into heat before it effectively reaches the receiver. Mechanical waves transmit best at short distances, much closer to the zero-distance requirement for touch.

Sound waves that travel through mass constantly change perceptibly over time. The wavelengths that reflect off of objects do not provide detailed spatial characteristics about the source itself. The mass through which sound transmits also degrades the ability of the sound wave to provide detailed information about the spatial characteristics of the source. Unlike light, sound sources emit waves over a wide spherical area, especially at lower frequencies; the receiver does not need to be oriented in any particular direction in order to receive information from the source. This "omnidirectionality" tends to compromise the receiver's ability to localize to the specific direction of the source, especially at low frequencies. Sound does provide the receiver with amplitude information that varies in time in an analogous manner to the way the source vibrated, but at a later time than the source because the vibrations are traveling at substantially less than the speed of light. Sound waves provide less detailed information regarding the spatial characteristics of the source, but very detailed temporal information.[2] Therefore, sound waves are very well-suited to revealing the temporal properties of mass, that is, how mass vibrates in time.

In this way, electromagnetic vibrations such as light complement the mechanical vibrations such as sound in such a way as to provide a more detailed picture of four primary dimensions of our universe than either one does individually. Potsdam is either 40 kilometers or 30 minutes from Berlin; if you know both, you know more about the journey to Potsdam than if you only know one. Scientists use the speed of light, 186,300 miles per second, to determine the precise length of a meter. They first developed our concepts of time (hours, minutes and seconds of a day) based on the spatial position of the sun in the sky (ibn-Ahmad al-Bīrūnī 1879, 148). We understand then, that light reveals space by defining it relative to time, and sound reveals time by defining it relative to space[3] (Thomas 2010; Landau 2001).

Consider how magnificently light and sound complement each other and how important they have been to our survival. Our 4-billion-year-old earth must have had its share of spectacular storms producing lightning and thunder. While the photons emitted from the lightning flash provided very specific information about the spatial direction of the lightning, the time it took for the sound to travel to the receiver would also provide important information about how imminent the danger was. From an evolutionary vantage point, it would certainly make sense for organisms to develop an ability to perceive both electromagnetic waves that transmit through space and mechanical waves that transmit through mass. Organisms that did this would stand a much better chance of surviving.