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MUSIC AS A VIBRATIONAL PRACTICE

Singing and Listening as Everything and Nothing

The unnamable is the eternally real.
Naming is the origin
of all particular things.
—LAOZI, *Tao Te Ching*

[The scientist's] religious feeling takes the form of a raptured amazement at the harmony of natural law, which reveals an intelligence of such superiority that, in comparison with it, all the systematic thinking and acting of human beings is an utterly insignificant reflection. This feeling is the guiding principle of [the scientist's] life and work.
—ALBERT EINSTEIN, *The World as I See It*

Stendahl [Marie-Henri Beyle] wrote that music was the highest form of art and that all the other forms really wanted to be music. This was of course a Platonic idea, all the other art forms depict something else, music is the only one that is something in itself, it was absolutely incomparable. But I wanted to be closer to reality, by which I meant physical, concrete reality and for me the visual always came first, also when I was writing and reading, it was what was behind letters that interested me. When I was outdoors, walking, like now, what I saw gave me nothing. Snow was snow, trees were trees. It was only when I saw a picture of snow or of trees that they were endowed with meaning. —KARL OVE KNAUSGÅRD, quoted in Mark Sussman, "Fueled by Sentences: The Uncanny Art of Karl Ove Knausgaard"

At the outset of this book, I set out to try to understand how it is that music can both restore and destroy. More specifically, I asked how it is that what we think of as the same music can have radically different effects, at different times, on a single person. The book took as its premise that investigating music

from the sound, signal, and signification (or symbolic) levels cannot fully explain this conundrum. In taking this position I joined a number of scholars who have set out to examine music and musical experience beyond the parameters relied on by music discourse. I have thus far posited that the specific ways we have conceptualized music's building blocks—as species of sound with particular parameters—limits our knowledge of music's ontology, epistemology, and ramifications. When I write that music is connected to sound, I do not necessarily refer to sound as work. Scholars have defined the activity of music, or musicking, with great nuance. However, while much broader practices than those delineated by the work concept are addressed here, an assumption about cultural, performative, or scientific practices involving the "art or science of combining vocal or instrumental sounds," to borrow the definition of music in the third edition of the *Oxford English Dictionary*, is common. Even if we cannot reach unified notions of the "art or science of combining vocal or instrumental sounds" and the practices surrounding that combination, including dance movements (which are soundless, or the sounds they make are not part of their intention), I am not aware of any musical cultures whose concepts of music do not include dealing in some way with notions of sound and silence. By denaturalizing these parameters—indeed, by denaturalizing the notion that music deals in the currency of sound, silence, and chronological time—music can be investigated as nonstatic, not limited to the aural sense and dimension. Instead, we can intentionally investigate music as action, materially transmitted and propagated.

From this fuller view, we have come to the formulation that music is the practice of vibration.[1] Tied to this realization is the understanding that music is neither external nor measurable. From this perspective, we can answer the question that initially motivated the project: since music is always materially and relationally contingent, it is never the same external force that both restores and destroys. Rather, since music is vibration, there are multitudes of material circumstances that contribute to each of its particular articulations, each unrepeatable and hence unique, and each with a potential to affect us that can be revealed only in the particular articulation that takes place within and among each material situation and unique listener.

My initial inability to answer the question arose from my assumption that a single cause was producing different outcomes. An intermaterial vibrational perspective explains how something that, in the figure-of-sound framework, appears to be the same music can lead to very different outcomes for the same person.[2] That is, vibrations that enter my body are transmitted by and through the body at the very point in time that I sense it. More precisely, "it" is not

something external that an internal "I" senses. There is indeed no separation between "it" and "I": each configuration forms a unique node and is best understood when investigated as such. The transmission and vibrational configuration are unique and unrepeatable in any dimension. In other words, since sound cannot exist in a vacuum, a given material circumstance and its articulation comprise as much of what we provisionally understand as the sound as what we may point to as the sound or the music.

Ironically, now that we have understood how the so-called same sound can have both restorative and destructive effects, we can also begin to understand that the very question oozes out of a logic that relies on the figure of sound. Indeed, the question's specific articulation must be reconsidered in light of its answer. In other words, the concept evoked—the same sound—implies fixity and knowability, in the same way as does the question "where does the sound begin and end?" There is no "same" music. There is no externally fixed music that is passed on in an unchanged form into vastly different environments, causing different effects in people. There is only the music that comes about in a particular material-vibrational transmission, and the delineation and meaning we give to that transmission. In this way, the music that restores a particular person is, by definition, not the same music that destroys another.[3]

In other words, it is the figure-of-sound framework's ways of understanding music and vocabulary that reduce two drastically different events to what we conceive of as the same event. It was out of the desire to untangle such assumptions that the motivation to write this book arose. The previous framework constrained us to understand music's effects in the world as symbolically based. Due to this assumption, some of music's outcomes and effects seemed illogical, or were unexplainable within that framework. As we have seen, there were no existing analytical frameworks that could deal fully with the idea that the same music could affect the same person with different outcomes.

If sound and music have been reduced to static nouns, then the practice of vibration is a verb—regenerating its energy through material transmission and transduction within a continuous field. (And it is listeners who delineate this continuous field into nodes according to a priori parameters.) In other words, in applying the intermaterial vibrational framework, we turn our focus away from the effect and force of a stable object and toward the unfolding intermaterial process. This refocusing suggests that we need to reexamine not only assumptions about music, but also the ways in which questions are framed and thus what kind of knowledge is sought in that questioning. Moreover, our realization suggests that this shift moves musical inquiry away from the musical objects we study, and toward an intrinsically human and material realm.

To this end, as a result of examining the details of what happens in the doing, in this chapter I propose that an investigation into music is an investigation into relationships and community. Thus, I explicitly move the discussion about music and its ramifications out of the orbit of the knowable and the potentially meaning making, to the material and always already relational.

The Limits of the Symbolic

In which ways may conceptualizing sound and music through the figure of sound—sound and music as knowable—limit not only our understanding of the musical event and our own contribution to it, but also its range of power? Recall from chapter 3 that defining and naming music as distinct sound is akin to nudging a child into the symbolic realm. In the same way that an infant's thick event is usurped and reduced to sound, music's thick event is naturalized and reduced to sound. And in the same way that the sounds "mama" and "papa" are severed from the infant's thick output—"a pure manifestation of vocal resonance linked to a state of internal displeasure"—music as knowable sound is severed from the thick event of musical experience.[4] Over time, what was manifested as a thick event is slowly stylized into a signifier, overlaid with the signifieds *maternal caretaker* and *paternal caretaker*—or sound and silence.

Considering the symbolic in relation to the operatic voice, Michel Poizat notes that the child's cry is not only responded to, but also "*attribute[d]* meaning" and "*interpret[ed]* . . . as a sign of hunger or thirst or whatever."[5] Similarly, the thick event of musical experience is carried into the symbolic order when knowable sound segments are understood within systems of sounds and music and overlaid with a given sound's contextual functionality (say, the second step in a scale) and cultural and historical meaning (say, a commercial jingle). Poizat poetically describes the process of entering into the symbolic: "This first, pure cry is qualified as mythical or hypothetical because as soon as it is interpreted and elicits a reaction, its original 'purity' is lost forever, as it is now caught up within the system of signification that is already in place with the intervention of the Other."[6]

Similarly, in the same way that we generally believe—and act on our belief—that once the symbolic order has opened up for a child, he or she has moved fully from the presymbolic to the symbolic order, so we generally respond to sounds we can name as music, and thus constrain within the symbolic order, with the presumption that they occupy only that order. By defining and naming a sound within the thick event of music, we bring music into the symbolic and subsequently constrain our relationship with it to the limits of the

symbolic. But music still operates on the nonsymbolic level. In other words, while people may operate within the symbolic order, the presymbolic does not cease to exist. Similarly, while we can meaningfully understand much music within the symbolic order, music continues to influence us within the presymbolic domain.

For example, in his work on reggae sound systems in Jamaica, Julian Henriques addresses the dynamic between music constrained within the symbolic order and its force within the presymbolic order.[7] Henriques takes up the challenge of describing and explaining the force a community of participants in an event creates and acts upon around the vibes that flow between a given sound system, music, and the community. While the forces described are not constrained to the figure of sound and the symbolic, the discourse around them is.

Henriques's strategy is to carefully map the technical aspects of the sound system, and humans as material and cultural agents. He concludes with a notion he terms "*sonic logos*." With this concept, he seeks to capture the "kind of reason that emerges from the relationship between two distinct senses of sound."[8] With the idea of the sonic logos, then, Henriques seeks to encapsulate the "practical activities of soundings," as in "the periodic movement of compression waves through a material medium," with "sociocultural *values*." Henriques contrasts his approach with the way in which, in a sociocultural context, we can "[get] a sense of" something by seeking to "know" as much as possible about it beyond its nonmeasurable qualities.[9] With the sonic logos, Henriques explains, we move to, from, and between the body of sound and its mindfulness—that is, between how the sonic logos might be "'built' from the crew's ways of knowing and skilled techniques to understand[ing] how they 'make sense' of what they do. It thus explores the *relationship*, connection and intertwining of body and mind together."[10]

Henriques's work exemplifies one strategy used in attempts to understand dynamics beyond the symbolic. Sound's affect beyond the symbolic and logos is captured by Emma Dillon's phrase "sense of sound," while the recuperation of vocality through thirteenth-century French manuscripts and Shane Butler's tracing of the writer's hand and voice through written words and the materiality of book and handwriting have also been influential to my thinking on this matter.[11] Furthermore, gravitation toward rationally explaining a fixed and defined musical phenomenon, often dealt with through the application of hermeneutics despite the felt necessity that music reaches beyond its bounds and promise, is encapsulated in Phil Ford's repurposing of Christopher Lehrich's phrase "magical hermeneutics."[12]

It is this tension, so poignantly captured by Ford, that Poizat examines in

his work on opera fandom, the fans themselves, and their desire for operatic voices.[13] For Poizat, coming from a psychoanalytical perspective, the thrill of consuming an operatic voice is found in its "failure of speech and the signifying order."[14] He also refers to this condition as the "pure cry," which exists "outside musical discourse" as "sheer vocal effect."[15] He offers a historiographical speculation in which opera is read as a slow progression from speech-like song, within which "singing grows more and more detached from speech and tends more and more toward the high notes; and culminates in the pure cry." He defines this "pure feeling" that comes from listening to music as not "mere pleasure," but rather as "jouissance."[16]

In a related view, David Schwarz posits that "musical listening subjects are produced when moments in performed music allow access to psychological events that are presymbolic—that is, from that phase in our development *before* our mastery of language."[17] Thus, "music can remind us of phases in our development when we crossed from imaginary to symbolic experience, and that the musical representation of such threshold-crossing produces listening subjects."[18] Indeed, for Schwarz, we "listen to music as an attempt within the symbolic order to hear echoes" "of presymbolic experience we hear into the spaces between symbolic convention and presymbolic sound."[19] However, again we find ourselves pitting the sensible and symbolic against the nonsensical and nonsymbolic.

Poizat, however—like Henriques, Dillon, Butler, and Ford—seeks to avoid this separation by embarking on a discussion of the materiality of the voice. According to Poizat, we are always in search of the "vocal materiality" and the "simple phonic materiality" that we experienced before the voice became symbolic.[20] On the one hand, he argues that it is this "lost object" that the opera fan is trying to regain. But, on the other hand, he also says that it is not truly a loss—in his words, "there is merely a 'loss effect.'"[21] Because the subject has "unconsciously made it the representation of a totally purified trans-verbal state," the presymbolic is understood as lost.[22] But "the elation felt by the fan, listener, and spectator of opera in those rare and fleeting moments when the music lover is irresistibly captivated" is indeed the work of the present presymbolic "vocal materiality" or the "presumed primitive encounter with jouissance."[23] Thus, voice's sound and materiality constitute both the naturalized mode that prevents access to the presymbolic, and the only portal that can offer entry to it.

In her sociological work on music in everyday life and music therapy, Tia DeNora has examined questions about the body's materiality in relation to music and the role of signification in that process.[24] However, rather than

thinking about music and its sonorous link to the body, she suggests that we consider "what music may achieve, silently." More specifically, DeNora posits that while music's "link to the body" is "distinct from music's interpretive processing," the process is not a regression to "a nondialectical understanding of music-as-stimulus."[25] Also addressing the traps that can arise when we follow the trail of bread crumbs scattered by the sound of music and its possible function as sign and signified, Gary Tomlinson has noted: "Humans are symbol-makers too, a feature tightly bound up with language, not so tightly with music. . . . Homo symbolicus cannot help but tangle musicking in webs of symbolic thought and expression, habitually making it a component of behavioral complexes that form such expression. But in fundamental features musicking is neither languagelike nor symbollike."[26] For Tomlinson, studying humans in relation to the symbolic offers clues about music's ancient origins. And even for scholars without similar ambitions, such discussions offer clues regarding the relationship between the symbolic and music making. As Tomlinson notes, music in itself is not primarily symbolic; rather, it is made to serve the symbolic. If we can release that perspective, he continues, we can "plot . . . the counterpoint between musicking and the language and symbolic cognition that coalesced alongside it."[27]

One part of the presymbolic phenomenon that some psychoanalytically oriented scholars address is, for me, most clearly explained by Tomlinson. He concludes "Evolutionary Studies in the Humanities: The Case of Music" by pointing out that part of the problem with understanding music is the limited timescale within which we think about it. If we go far enough back, Tomlinson observes, we can clearly see that humans engaged in "musicking" prior to the appearance of "either language or symbols."[28] Tomlinson's preliminary million-year evolutionary history of hominids shows us that musicking is neither dependent on, nor an evolutionary outcome of, symbol making. What Poizat understood as the "presymbolic," DeNora recognized as "silent practice," and Tomlinson thought of as musicking independent of language or symbols, I describe as the thick event of music and, ultimately, as intermaterial vibrational practices and events.[29] Thus, on some level, while we primarily conceptualize—and, accordingly, have access to these events—on linguistic and cultural planes, we still react perceptually and instinctually to them. If you will, we are affected by the falling of the tree rather than by the sound of the tree-falling event, as indeed our presymbolic and prelinguistic ancestors most likely experienced the phenomenon.

Toward an Organological Inquiry into Intermaterial Vibrational Practice

Some scholars might react to the proposal that we investigate music from an intermaterial vibrational perspective much as I initially reacted to Juliana Snapper's underwater opera. Recall that I first dismissed her work by asking why I should bother with something so unlikely and cumbersome. In the same way, scholars and others might rightly ask why we should insist on viewing music as intermaterial vibration when, on the one hand (even if we agree that the figure-of-sound framework is incomplete), it works well enough and, on the other hand, in the larger scheme of things, why should we bother with the return to vibration? Is this not such a small detail that hardly anyone would notice? Is this particular emphasis not just a minute shift in perspective? Furthermore, will we not, in reality, continue to think about sound in the way we have always thought about it? In other words, what useful outcome could this perspectival shift have? In response to these objections and questions, I argue that even a cursory examination of music itself as vibrational material matter suggests a few points at which our understanding of music departs from how we understand it through the figure of sound and the symbolic.

First, when music is predominantly understood not only through the symbolic but as material and, indeed, intermaterial vibration, we can begin to conceive of it in a class with—instead of separated from—other intermaterial vibrational phenomena. While John Cage famously included so-called silence in his compositional material, thus questioning the nature of sounds allowed in music and the position of intentionality in their production, understanding music on a par with other intermaterial vibrational phenomena questions the division between material modes, including the exclusion of some from our attention. If we understand our bones and flesh as participating in forming the music we experience, are they not as much a part of the music as the so-called musical work? And if music is the fluctuation and transmission of energy, does it not have something in common with other forms of energy fluctuation and transmission?

Second, when we examine music as vibrations, we see that the object of study is not only the vibrations but also, for all practical purposes, the material that vibrates. Expanding our perspective in this way reveals that the vibrations themselves are shadow phenomena and that, in fact, vibration does not exist prior to a specific material realization. In other words, we cannot experience and define the boundaries of a particular vibrational occurrence before

it comes into existence. Indeed, this node does not exist, or is not realized, except at the precise moment when the engaged material vibrates. A familiar image that may offer a useful analogy is the invisibility of the wind, except when it moves a tree branch.

While the musician and philosopher Sun Ra, for example, understood music as the privileged engagement of vibration within a broader cosmology, I came to this place of inquiry through two simple steps.[30] The first was to take seriously what I understood as grave inconsistencies in representations of music's meaning and culture. Taking those inconsistencies and their ramifications—such as why and how the same music could restore and destroy the same person—seriously, I looked into the underlying questions and assumptions. Through doing this, I understood that it was the questions that produced these types of answers. In other words, if the knowledge produced seemed entirely inadequate or irresponsibly incomplete, the second step was to change the questions. So, when I stopped banging my head against the question of the meaning and effect produced by music, my thinking was dislodged enough to enable me to further understand the dynamic of relationality.

In examining the fundamental questions underlying most inquiries about music (which are based on the assumption that music is knowable), I began to understand how theories built on articulated or tacit assumptions about the figure of sound often do not make room for inquiry of and through practice. For example, while the figure of sound promises to explain and systematize the intricacies of music, our dependency on its conceptual framework locks us in perceptually and intellectually, eroding our ability to approach musical phenomena beyond sound. As a consequence, we allow music to be ossified into what initially promised to be merely a useful theoretical framework. The theory of the figure of sound, then, rejects the phenomenon it sets out to investigate, replacing it rather than merely moving us toward partial understanding. As a result, the figure-of-sound theory is woven into the world so strongly that we hardly know when and how we are using it, or when we are not.

Throughout most of this book I have described the way the figure of sound functions, how we can let it go, and what can happen if we do. In the end, we are left with the realization that when we do let the figure of sound go, we become able to interact with music in a way that helps make us better able to answer the question to which the figure of sound purported to lead, but did not: how is it that music does what it does? The punch line is this: the question is not answered theoretically, with reference to the a priori; rather, it is answered practically and with no a priori as a baseline reference. Before we shift to the question behind the question, and before we work through these

issues in practice, we have no way of articulating that underlying question. Without breaking through the foundational position that the figure of sound has come to occupy, which prevents us from comprehending music more fully, this question is inaccessible. I propose that we can understand more about music's many dimensions if we do not limit ourselves to the logic presented by the figure of sound, but instead use the perspective of performance and practice to burrow down into expanding notions of music to the material, vibrational, and energetic arenas.

With *Sensing Sound*, then, I suggest that a return to the study of music as intermaterial vibration can afford a better understanding of the ways in which music does what it does, and the ways in which humans use it as a force for good and bad. I propose that this study of listening, singing, and other music making is akin to an organology of intermaterial vibration. A practice that began in the seventeenth century, organology is the study of musical instruments in regards to aspects ranging from their historical aspects and social function to instrument building (design, material, and construction) and performance.[31] In *Sensing Sound*, I assume that the "instrument" is the field of intermaterial vibration, and I have studied the construction of the vocal instrument in relation to, and as constructed through, performance practice.[32]

Thinking about music beyond that which is sounded is, of course, not new. Renaissance thinkers saw *musica*—that is, the study of music within the liberal arts—as "the science of comparing numbers, which could be manifested in myriad external forms."[33] Considering sound as vibration is also, of course, unoriginal. Galileo Galilei's *Dialogues Concerning Two New Sciences* (1638) offered the first systematic study of vibrating strings, and his explanation of the origin of consonance and dissonance remains generally accepted today.[34] And in 1660 Robert Boyle's classic experiment in which a ticking watch was placed in a partially evacuated glass chamber showed that sound exists only when mediated, or transduced, by matter.[35]

"The words instrument and organ are in Latin and Romance languages intertwined," Bonnie Gordon reminds us. "Organ," she explains, "derives from the Latin organum, which means instrument, and which comes from the Greek word that means musical instrument or organ of the body."[36] The problem of the boundaries between "organs endowed with sense and those without" was considered by many people. For Francis Bacon, Galileo's contemporary, there was no difference between humans and mechanical instruments, but organological studies do separate the human from the nonhuman organ.[37] While there is no consensus that such a division is relevant, the relatively recent material turn can help mend that historical gap and habilitate the study

of music's materiality. Indeed, building on Bill Brown's thinking about things, by putting into perspective notions of what an instrument is and what an organ is, I examine the collective intermaterial vibrations of music, sound, and voice to ask how music "as an inanimate object enables human subjects (individually and collectively) to form and transform themselves."[38] Focused on vibrating technology in the period when it was recently introduced to the public, Shelley Trower's work shares Brown's interest in material cultures. Examining the culture of the Romantic harp; vibratory objects including strings and spiritualist objects; and the introduction of new technology such as the bicycle, railway, sewing machine, and vibrating medical devices, Trower is concerned with material and literary cultures and objects as "vibratory movements of various material objects" and how "vibration is also bound up with different kinds of materiality beyond objects, including the air and ether."[39] In this way, Trower provides a useful model for historical work on vibration and how it has been conceived, harnessed, and used.

I take the position that studying voice, sound, and music from the point of view of materiality generally, and organology specifically, offers access to an otherwise unrecuperable history and process.[40] That is, I assume that investigating the intermaterial vibration of singing and listening can become a music-analytical operation itself. Studying intermaterial vibration as organology puts voice and perception into conversation with Emily Dolan's observation that "in their ubiquity and diversity, instruments might be thought of as boundary objects."[41] Building on the work of Trevor Pinch and Frank Trocco, Dolan quotes Susan Leigh Star's and James Griesemer's work on boundary objects within museum and exhibition contexts. Star and Greisinger explained that an object's "boundary nature" can be understood as "simultaneously concrete and abstract, specific and general, conventionalized and customized. They are often internally heterogeneous."[42] Bringing the discussion back to musical instruments, for example, Dolan notes that the synthesizer's boundary nature is described by Pinch and Trocco. That is, the idea of the "liminal entity" is invoked to convey not only the crossing of boundaries, but also the transformation that takes place through that crossing.[43]

We may consider material and vibration as instruments, while what are more traditionally conceived of as musical instruments may be considered as subclasses of material and vibration. If we use this viewpoint, our conception of the liminal space and arena necessarily shifts. Voice, with its ability to filter out certain frequencies by changing shape, is often used to describe the synthesizing process. Voice also plays multiple roles as an anatomical entity that protects the lungs from food and liquids, as a sound shaper, and as a transmit-

ter of music and words. With its many roles, voice represents a prime example of the physicality of the "boundary object" or "liminal entity."[44]

As noted throughout this book, some of the material that vibrates during a musical experience is the human body. By considering music in this way, we may study the phenomenon of the "boundary object" or "liminal entity" through observing shifts in vibrational patterns. We may also come to terms with the notion that we are one and the same as the vibrations. Rather than viewing music as an external and stable object, signal, or ground for meaning making, it is these various intermaterial vibrational states (thick events) that we transmit and take in, that we interpret and make meaning with, and that we refer to as music. Thinking through intermaterial vibrations, we learn that we are putting ourselves on the line.

However, by pursuing intermaterial vibration within a music-analytical context, I have no illusions that I am adding to the existing technical knowledge about these topics. Because much of current music discourse has moved so far from directly drawing on this knowledge (although the knowledge is already present in related fields), my modest hope is to merely reengage some of the terms. My point is precisely that this book does not offer new insights. Instead, it engages insights arising from the observation that music discourse limits its understanding of music to sound, silence, and the practices that surround them. Recall from the introductory chapter that I position vibration (as in sound), transmission (as in intermaterial flow), and transduction (as in the conversion of wave forms from, say, mechanical to electric) within historical and theoretical discourses. I draw on this rich body of knowledge to distill my proposition that analyzing music, and life in music, from this perspective can tremendously enrich our understanding of how music does what it does.

Intermaterial Vibration and Energy

In the following visual representation created by R. Bruce Lindsay explaining vibration, the severance of sound and music from other broad areas of material vibration, transmission, and energy is telling. As I noted earlier, when we believe that music deals in the figure of sound—the currency of sound and silence—implicit or explicit questions nudge us into identifying its distinct units (types, qualities, and temporal span) and form (From which units is music built? When does the music stop and end?). In figure 5.1 we can see that music is largely conceptualized as constrained by the limitations of musical scales and instruments, with a much smaller overlap with areas such as communication and room and theater acoustics. While some might differ re-

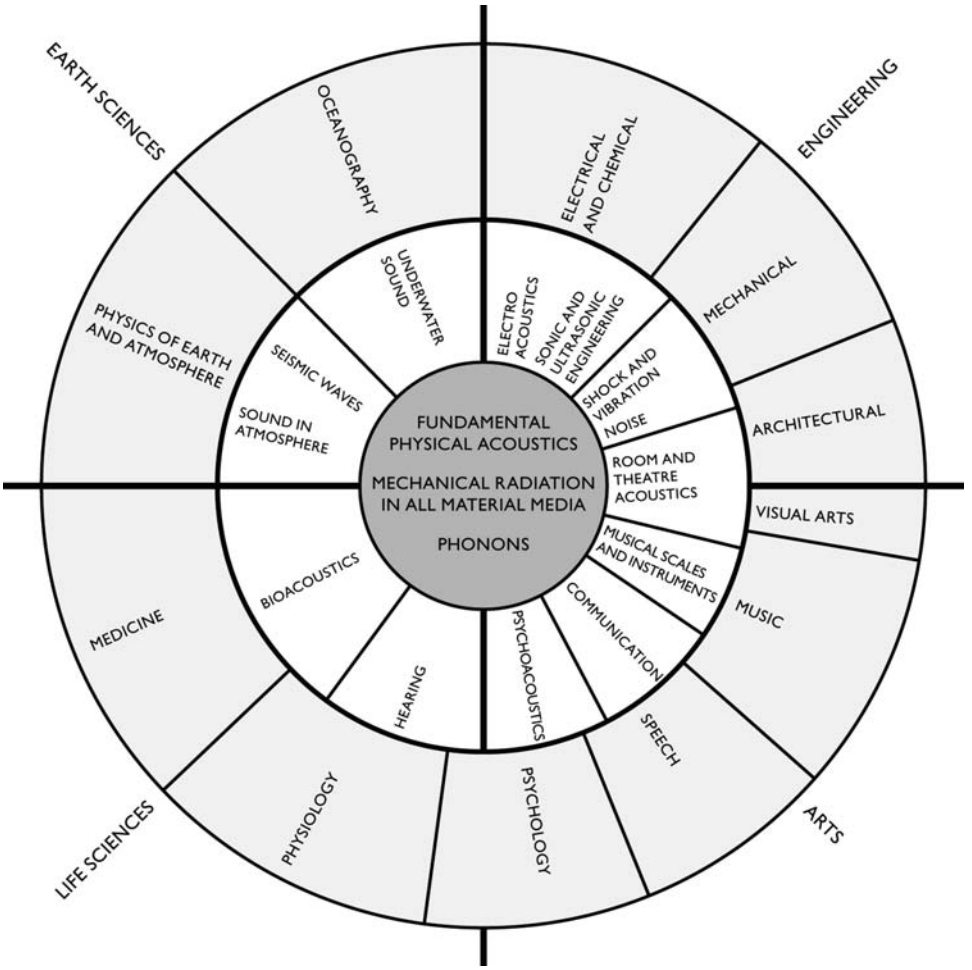

FIGURE 5.1 • This figure has become known as the "Lindsay's Wheel of Acoustics" (R. Bruce Lindsay, "Report to the National Science Foundation on Conference on Education in Acoustics," *Journal of the Acoustical Society of America* 36 [1964]: 2242).

garding the specifics of the chart's layout (for example, some might say that psychoacoustics also falls within the category of music, rather than only within psychology and speech as the chart indicates), I believe the chart outlines the general practice of the scholars in the fields indicated.

In summary, the figure shows the division of music's ontology and epistemology from the other areas of intermaterial vibration. Thinking about voice, listening, sound, and music from an organological point of view can, while making use of a traditional perspective, lift the scrim that divides music from other related areas of inquiry. Once we are aware of this division we can also appreciate its randomness, develop an awareness of the connections, the definition of the knowledge area, the practices of the inquiry, and the necessary insights gleaned, and engage with them. We can then use that knowledge to understand more about how vibration operates on us, drawing on knowledge in areas that are connected through what the chart visually presents as its core: fundamental physical acoustics.

From the point of view of vibration, human entities constitute only one of the many materialities through which energy is transmitted and transduced. It is the full spectrum of transmission and transduction of sound vibration that is taken into account in explicit studies of the impact of vibration in positive (therapy) and negative (regulations regarding health hazards) terms.[45] However, these areas of vibrational inquiry are often bracketed off from the study of music and its aesthetic, social, historical, and cultural considerations. As in the limiting of musical study to the examination of only certain vibrational frequencies, I believe the exclusion of what is commonly considered the non- or lower-aesthetic applications and impacts of vibration—for example, music therapy—leaves the study of music per se and our knowledge about its power incomplete.[46]

Douglas Kahn has also observed the bracketing of sounds or energies that were granted "musical or aesthetic status."[47] Specifically, the two different modes to which he refers are those created by wind and natural electromagnetic activities. Kahn finds it ironic that Henry David Thoreau's description of sounds produced by telegraph lines vibrating in the wind[48]—vibrating strings have been aestheticized since antiquity when heard in nature or from constructed instruments, including the Aeolian harp—are taxonomized as a piece of music. The irony arises because the sounds produced by telecommunication lines ("natural radio," heard by Thomas Watson, when, as Kahn describes it, "the long iron telephone text line acted unwittingly as a long-wave antenna"[49]) were not aestheticized until much later. Kahn asks why the sounds "created by the wind [were] granted musical and aesthetic status through the category

of the Aeolian, while the sounds created by the natural electromagnetic activity were not, even though they were heard musically and aesthetically, could occur on the same line, and were produced in the same environment?"[50] In many aspects, my question about sound's epistemological status is not unlike Kahn's. I might rephrase his question along these lines: What grants certain aspects of energy musical and aesthetic status, how are knowledge and practice formed as a consequence, and what effect does this have on our music making and listening?

Again, if we were to accept an organology of intermaterial matter, we would also need to critically examine the genealogies of various academic fields and their divisions into new areas of inquiry. For example, in a 2007 text, Singiresu S. Rao—a mechanical and aerospace engineer who wrote one of engineering's basic textbooks—traces his profession to the general topic of vibration, which formerly united fields that today are entirely separate.[51] In *Vibration of Continuous Systems*, he locates the origin of engineering in "the earliest human interest in the study of vibration," specifically in the form of experimentation with musical instruments.[52] Humans, Rao writes, have "applied ingenuity and critical investigation to study the phenomenon of vibration and its relation to sound."[53] In a sweeping historical overview of vibrational study, Rao writes about key characters in the history of vibrational study fundamental to mechanical and aerospace engineering.[54]

The physicist R. Bruce Lindsay, creator of what has become known as the "Lindsay's Wheel of Acoustics" shown above (figure 5.1) and a respected member of the Acoustical Society of America, was much concerned with the historical and philosophical aspects of energy and entropy. In a 1966 article, he offered a historical overview of the "problems of acoustics" according to the field's tripartite division: the production, propagation, and reception of sound.[55] After tracing the history of these areas, Lindsay ends his overview with a cautionary note to some of his colleagues, those "physicists who are carried away by the glamor of high-energy physics and the properties of the solid state." While these physicists may think that "the future of a so-called 'classical' field of physics like acoustics lies wholly in its technological applications and that as physical science it is 'played out' . . . there is no ground for assuming that man will ever run out of questions about acoustics any more than he will run out of questions about the nucleus and the theoretical particles that inhabit it or can be created from it," Lindsay boldly claims. "What is, of course, true," he underlines, "is that as investigation proceeds, the boundary lines between the various types of natural phenomena that mankind has artificially erected for purposes of convenience are becoming fuzzier and more

unrealistic. The aim of the science of the future is a meaningful synthesis."[56] Lindsay takes this point from the history of acoustics, an extremely interdisciplinary endeavor in which each area of investigation would be diminished if it were not understood as intimately connected to the others.

Rao's and Lindsay's examples of the origins of acoustic and vibration theory are wide-ranging: from stringed instruments in China, India, Japan, and Egypt from 4000–3000 BC to Pythagoras's study of vibrating strings in the sixth century BC; from the seismographic earthquake measurement by the Chinese historian and astronomer Zhang Heng in AD 132 to Galileo's work in the sixteenth and seventeenth centuries—including his measurements taken with a simple pendulum and vibrating strings, which are considered to have laid the foundation for modern experimental science; and from Isaac Newton, whose differential calculus regarding the laws of motion was later applied to previously unsolved problems in mechanics and physics, to Sophie Germain's work on the vibration of plates and shells and Lord Rayleigh's theory on sound and vibration.[57] However, despite millennia of inquiry into vibration, Rao notes that it was only around forty years ago that "vibration analyses of even the most complex engineering systems were conducted using only a few degrees of freedom"—made possible thanks to the 1950s advent of digital computers.[58] As we can see, new applications for the study of vibration continue to be introduced, indicating that there is much more knowledge to be gained.

Throughout this book's first three chapters, I sought to denaturalize the notions on which we depend in order to consider music: music's transmission through air, music as independent of space, and music as trading in sound.[59] In our interest in understanding more about music's complex power, we continue millennia-long investigations into music as vibration. The question that follows is: how may we think organologically about intermaterial vibration, transmission and transduction in general, and spatial specificity and sound specifically?

From the Figure of Sound to Perspectives on Vibration, Transmission, and Transduction

Let us think about vibration, transmission, and transduction by expanding on the foundation that, as an example, twelfth-grade students in the United States are required to know. The National Research Council Committee's standards recommend that by the end of twelfth grade, students know that "the wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. The reflection, refraction, and transmission of waves at

an interface between two media can be modeled on the basis of these properties."[60] This definition of "wavelength and frequency" can be translated for our purposes by relating it to hearing. In these terms, hearing really means to materially participate in the "reflection, refraction, and transmission of waves"—which can also be imagined simply as energy transference.

Energy states' movement across the material with which we are concerned can be divided into two major classes, transmission and transduction. Transmission describes vibration taking "place through an elastic medium by means of wave motion" and refers to vibration or energy that is contained—in other words, mechanical energy in one state remains as mechanical energy in the transformed state, and there is no change in the type of wave motion.[61] Points of transmission include all nodes—for example, the vibrating guitar string, vibrating air inside the guitar's body, the air outside the guitar, and eardrum—of the phenomena that we might think of as guitar music. Transduction describes energy that is transformed from one state to another, such as from mechanical to electromagnetic energy. For example, a transduction takes place during the process of translation from the eardrum's mechanical vibration from the guitar to the electromagnetic signal in the nervous system.

Using our example of the guitar, we can also modify our example to include a transduction that takes place earlier. If we are using an electric guitar, say, the transduction takes place as the signal passes from a vibrating string to the electromagnetic pickup that receives the signal and transmits it through the amplification system and thence to the air again. In the case of hearing, transduction takes place when the vibrational energy is converted from mechanical to electrical—that is, when a sound is transmitted to the air and detected by the human hearing organ—specifically, the organ of Corti, where hair cells serve to transform mechanical vibrations into neural impulses.[62]

Moving beyond the basics that U.S. twelfth graders are required to know, the mechanical engineer Chandramohan Sujatha explains that the study of acoustics originated in the "study of vibrations and the radiation of these vibrations as acoustic waves. [Acoustics] deals with all aspects of production, propagation, control, transmission, reception and effects of sound. These are applicable to sounds created and received by human beings, machines and measuring instruments." Today, acoustics includes the study of "sound and mechanical waves in gases, liquids and solids." Sound available to the human ear, Sujatha writes, "is defined as any pressure variation over and above the mean atmospheric pressure impinging on the ear drum; it encompasses all sounds that the ear can detect, from the weakest sounds which are barely audible to sounds which cause pain and damaged hearing."[63] (According to conventional

audiology, the young, healthy human ear is capable of detecting frequencies in the range of 20 hertz to 20 kilohertz.)

While we privilege those vibrations that are detectable by the naked ear, throughout this book I have argued for the ways in which the production, propagation, control, transmission, reception, and effects of what we do not currently name in music discourse powerfully participate in and shape our overall musical experiences. It might be these infrasound (below 20 hertz) and ultrasound dimensions (above 20 kilohertz), dealt with in acoustical studies not concerned with music, toward which DeNora gestures in her term "musicking as a 'Silent' Practice."[64] It may also be that these vibrational modes are not transmitted through the eardrum or the inner ear, but throughout other areas of the human body. Furthermore, while acousticians distinguish vibration as motion through solid material (viewing acoustic waves as disturbances of the air), we sense vibration indirectly, through the air motion induced by the vibration. And this air motion can elicit vibrations in a solid mass.

If we move beyond the field of music to examine wider scholarship on vibration, we learn that the "human reaction to vibration is a function of amplitude and frequency of acceleration applied to the body, direction (vertical and horizontal) and character of the motion (linear or rotation)."[65] We also learn that while the human body overall has a low-frequency resonance, it does not vibrate as a single mass. Indeed, beyond the ear, different parts of the human body have their own natural frequencies. As a consequence, individual body parts resonate with the overall vibration—resonance that leads to amplification or attenuation of various vibrations in particular areas of the body. Clearly, expanding our inquiry into listening based on the figure of sound to include the understanding of intermaterial vibration as "amplitude and frequency of acceleration applied to the body" allows us to more thoroughly explore the possible material ramifications of music—and thus we may also expand our understanding of the meanings we make with music. I turn now to a few preliminary suggestions regarding where areas that were previously naturalized through the figure of sound can be expanded.

In chapter 1, I posited that sound is materially transmitted and that music is uniquely and unrepeatably realized in each material node. Because discussions about music have been limited to the logic of the figure of sound, this phenomenon has primarily been discussed in relation to areas of resonance and loudness. Thinking organologically, each body or object, even if it appears to be wholly inanimate, is constantly in motion at the molecular level. By the same token, every object vibrates, quite naturally, at certain frequencies.[66] Resonance refers to the coincidence of two phenomena: for example, a glass

resonates because (1) an external sound, vibration, or other force—such as the soprano's high note—matches (2) one of the glass's natural modes of vibration, causing it to vibrate vigorously at exactly that frequency. The story of the soprano who hits a certain high note and shatters a crystal glass may be explained as a phenomenon of resonance: the frequency (tone) of her loud high note coincides with the frequency of a natural mode of vibration inherent in the glass, thereby inducing a vibration vigorous enough to break it.

However, in an organological investigation of intermaterial vibration, the nodes we think of as sound can be investigated as nodes of transmission. And the investigation can be expanded beyond musical instruments into every node that is affected during the experience of music. An organological investigation of intermaterial vibration would consider music in its vibrational realization, in how it is realized by different parts of our bodies, and in how the combination of material nodes reconfigures another node into transmitting or transducing energy uniquely. The boundary drawn around the object, or the liminal space that appears as the boundary is drawn, is reconceptualized from the sound's volume (the perspective of the figure of sound) to a transformation on the molecular level (the perspective of the organology of vibrations) when we consider the shattering of the glass.

For example, the abdomen is highly sensitive to vibration.[67] In the abdomen, resonance in the vertical direction occurs in the 4–8 hertz range and can amplify a vibration up to 200 percent. The neck and lumbar vertebrae amplify vibrations of 2.5–5 hertz up to 240 percent. Certain vibrations even set up a strong resonance between body parts. For example, 20–30 hertz vibrations amplify the head-shoulder resonance by up to 350 percent. Certain frequency regions are especially resonant with organs or body parts that perform specific functions. Vision can be affected due to the 20–90 hertz correlation with the resonance of the eyeball. Sujatha's vibratory model of the human body is reproduced in figure 5.2. In addition to taking into account how vibrations affect distinct regions of the body differently, it is also necessary to consider that the body's sensitivity to vibration is affected by its general posture (for example, whether it is standing, lying, or sitting).[68]

Excitation of a vibrating system can take the form of displacement and/or velocity (the rate of positional change) of the mass element or elements. The change imparts potential and/or kinetic energy to the system. Due to the initial excitation, the system is set into oscillatory motion, which can be called *free vibration*. It is during this free vibration that an exchange takes place between potential and kinetic energies. Within a conservative system, the sum of

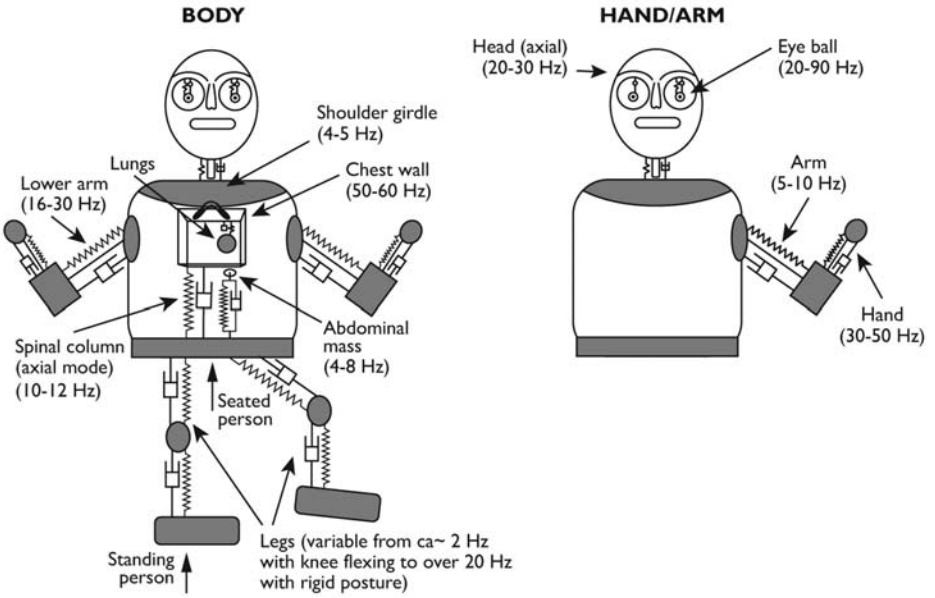

FIGURE 5.2 • "Vibratory Model of the Human Body" adapted from Chandramohan Sujatha, *Vibration and Acoustics: Measurement and Signal Analysis* (New Delhi: Tata McGraw Hill Education, 2010), 295.

potential energy and kinetic energy is constant at any point in time. Theoretically, the system continues to vibrate, but in practice the surrounding medium (for example, air) causes dampening or friction, and thus energy loss takes place during motion. Therefore, for the system's vibration to be maintained in a steady state, the energy that dissipates due to damping must be continually replaced. This means that a vibrational impulse is not stable or independent of material circumstances. Its excitement depends on the general vibrational condition (say, in an enclosed area versus in the open air), the concentration of masses (such as bodies), and other material characteristics.

Among other spatial and relational investigations, an organological inquiry into intermaterial vibration could explore the dynamic between the body's sensitivity to vibration and how the body is affected by oscillatory motion or reconfigured by the extended material vibrating continuum of which it is part. This dynamic not only raises questions about the body's response to vibration; it also asks how this process works within a given material configuration, and how that response affects the body's expression. Because impedance is mis-

matched, transferring energy from air to the human body is not as easy as transferring energy from mass to mass. Like my examinations of Snapper's underwater opera project, further examinations of the body's particular material configuration and relation to mass in the acts of making and listening to music could lead to new insights into musical experience, as well as suggest specific material configurations and interactions with music.

In chapter 2, I discussed the always already spatial aspect of sound. For most animals, including humans, the ability to localize sound is due to the placement of the two ears as far apart on the head or body as possible. This placement, and additional information gathered as the head moves to collect more data, results in the ability to hear in stereo and locate sounds in space. Because the two ears are situated differently in relation to the sound source, we draw on two distinct sources of information to compute sound's spatial relation to us. Its location is understood in terms of its three-dimensional position and velocity.[69] Additionally, we understand sounds within enclosed spaces by distinguishing direct from reflected sonic signals. That is, we compute the difference between the original sound source and sounds emitted from other locations. This perceptual procedure, referred to as the precedence effect, allows us to automatically localize a sound to, say, a person's moving mouth, rather than to other surfaces that reflect the sound.[70] Thus, Jens Blauert writes, "the totality of all possible positions of auditory events constitutes auditory space." He concludes: "The word 'space' used in this expression is to be understood in the mathematical sense, as a set of points between which distance can be defined."[71]

Not only is sounded sound always already spatially and relationally specific (and thus would benefit from being studied as such), but our perception of this specificity is complex. Therefore, thinking through the issue of sound's specific spatial placement and relationality to the listener, or of receiving vibrational nodes, organologically can provide some tools that may help us sort out the issue's complexity. Even when we become aware of sound's spatial specificity, that localization is not a straightforward matter. For example, in outlining the major principles of the "psychophysical territories of spatial hearing," Blauert shows that different sensory organs (including the presence of one or two ears, vision, balance, touch, and reception of tension) participate in the process of locating sound, and that a number of different notions beyond monaural and binaural theories for air-conducted sound must be engaged to interrogate these phenomena (including bone, visual, vestibular, tactile, and motional conduction theories).[72] Auditory events may occur in any directional relation to the person who senses the sound: inside his or her body or behind objects, near or

far. Additionally, factors such as familiarity with the sound and the specificity of human anatomy play a role in identifying and locating auditory events.[73]

Keeping these nuances in mind, Blauert's terms "locatedness" and "localization" can be useful in looking more deeply into spatial specificity and relationality. He uses the term "locatedness" to describe "the spatial distinction" of a sound: "The locatedness of an auditory event is described in terms of its position and extent, as evaluated in comparison with the positions and extents of other objects of perception, which might be other auditory events or the objects of other senses—in particular visual objects."[74] In short, the concept of "locatedness" facilitates a discussion that takes into account the complexity of sound as it is sensed within space. For instance, while the position of a sustained sound in a reverberant room is not easily pinpointed, a short sound in an anechoic chamber can be precisely located.

"Localization," Blauert explains, "is the law or rule by which the location of an auditory event (e.g., its direction or distance) is related to a specific attribute or attributes of a sound event [physical sound source], or of another event that is in some way correlated with the auditory event [in which the sound sounds like it is emitted]."[75] Localizing a sound seems pretty straightforward. However, the *sound event*, the *physical sound source*, and the *auditory event* are not identical. For example, under certain circumstances, the same sound event can yield simultaneous yet differing auditory impressions. Furthermore, Blauert reports, "localization varies within certain limits from one subject to another and undergoes nondeterminable variations over time."[76]

Among other spatial and relational investigations, an organological inquiry into intermaterial vibration could examine the dynamic between localization and locatedness. These terms partially explain the complex nuances of technical descriptions of spatial specificity, its psychoacoustic aspects, and the relationship between sound sources and sounds reflected from reverberating surfaces. The terms also offer just one example of a possible further organological direction of inquiry into both the spatial specificity of the musical event and the way in which the meaning we form around the vibrational impulse is partially based on our spatial sense of it.

In chapter 3, I discussed the naturalization of sound as one of music's currencies and suggested that what we think of as sound might be better understood if we conceive of it as vibration. However, an organological investigation into the matter would quickly reveal that the phenomenon is more complex than this. That is, while I posit that what we have identified as sound is a species of vibration and would be more accurately and usefully described as such, the twist is that while music is not necessarily sound, not all sound is related to a

causal event. In other words, sound signals and auditory events are not necessarily related, and an auditory event has not necessarily been preceded or caused by corresponding mechanical vibrations or waves.

Thus, an organological inquiry into the naturalization of sound would, first, investigate the nuances of the phenomenon that we understand as sound—beyond the confines of the assumption that sound is caused by intermaterial vibration. Some auditory events that are not caused by a sound signal but by other factors could include auditory hallucinations, disease conditions (such as tinnitus), or sound experienced as the result of artificial stimulation of the acoustic nerve.[77] Our organological inquiry could also encompass ranges of vibration including "'mechanical vibrations and waves of an elastic medium, particularly in the frequency range of human hearing (16 Hz to 20 kHz)."[78] Moreover, any investigation must be mindful of the way in which, as Blauert observes, these "physically measurable changes of position" are based on what is primarily perceived visually, and of the fact that the range of vibrations and waves with which we are concerned are limited to those that fall within the "frequency range of human hearing."[79] In other words, an organological approach to the question of sound would inquire into the limitations and ramifications of certain causes of sound (that is, why traditionally priority is given to inquiry into shared or sharable experiences instead of hallucinations?) and into the privileging of certain modes of experience (human over other animals) and nodes of materiality as the basis for vibration (human entity over object).[80]

In chapter 4, I posited that what could be understood as action is intermaterial vibration. An organological inquiry into intermaterial vibration would thus include an inquiry into bodies' oscillatory motion, the simplest form of which can be expressed as harmonic motion. Sujatha offers some examples of simple harmonic motions, including rotor rotation at constant speed, swing motion, orbiting satellites, and tuning fork vibrations. I draw on Sujatha's work to consider a chain of events from acoustic signal to vibration, created under the general condition of air: muscular activity (energy and vibration) activates the laryngeal area, and vocal sound is produced; sound waves in the vocal tract vibrate through the mouth and propagate through the air. Sound reaches listeners directly through the air, or, after being reflected off walls or other surfaces, interacts with the middle and inner ear and excites further vibrations of the basilar membrane and outer hair cells. An electrochemical reaction takes place, which converts the vibration and impact of the hair cells into potentials transmitted to the central nervous system.[81]

This area of knowledge is heavily relied on by traditional (acoustic) instrument makers and, in any time period, by developers of new instruments—

including those making use of electromagnetic forces. For example, piezo ceramic sensors have been developed to measure pressure, acceleration, strain, or force. The piezo—the name comes from the Greek term for "press" or "squeeze"—converts mechanical vibrations to electrical vibrations, or charge.[82] Piezo microphone technology thus works with intermaterial vibration in taking advantage of a disturbance, change, or fluctuation in a relaxed or natural state or axis (of mass, chemicals, electronics, or air).[83] This process allows audiences to detect the material's vibration sonically.[84]

Generations of artists have been interested in energies in various forms, and an organological study of such energies would take into account the study of unwanted vibration—which, within the framework of the figure of sound, is often referred to as "noise"—as well as the study of generating vibration.[85] In the former area, an understanding of vibration's natural occurrence is sought to, for example, build bridges and other structures without inadvertently constructing one that will fail due to naturally occurring vibration. Examples of controlled levels of vibration include drills, engines, and trains traveling on tracks. Indeed, "if the frequency of excitation of a structure coincides with any of its natural frequencies, resonance occurs." Hence, the "failure of major structures like bridges, aeroplane wings and buildings is due to resonance."[86] A 1940 incident that became a recent meme is the YouTube video of the Tacoma Narrows Bridge collapse.[87]

We may recall that "any system which possesses mass and elasticity is capable of vibrating."[88] The study of vibration is divided into two major areas: free and forced vibration.[89] Sujatha explains: "Free vibration is due to forces inherent in the system, while forced vibration is due to externally impressed forces."[90] Resonance occurs when a frequency coincides with a structure's range of excitation. For example, the "typical natural frequency" of a variety of "systems" (the term Sujatha uses for what we might call a "thing") ranges from an offshore oil rig (1 or 2 hertz), a bridge (1–10 hertz), the human trunk (2.5–5 hertz), human vertebra and an SUV's compartment cavity (100 hertz), and a hard disk drive and turbine blade at a high-pressure stage (100–1,000 hertz).[91] Since any body having mass and elasticity has the potential for oscillatory motion, we can appreciate the continuous field through which music is realized.

It is the body's potential for oscillatory motion on which a piece of equipment, a musical instrument such as the piezo microphone, traditional instruments, and vocal and listening organs and bodies and the mass within which they are situated capitalize. And it is this phenomenon that reconfigures our understanding of the boundary objects and related liminal spaces between violin, voice, ear, air, water, or whatever mass transmits the vibrations to which

we attend, or that we actively create. It is these spaces between that are broken down under the organology of intermaterial vibration framework.[92]

To be sure, my preliminary suggestions for an organological inquiry into intermaterial vibration are only sketches for where an investigation that goes beyond the figure of sound might ultimately find itself. However, I hope to have offered provocative examples that can suggest some of the ramifications of nudging investigations into music away from the figure of sound. On the surface level, these sketches simply confirm the clear diagnostic forwarded by Brian Kane. "The way to argue against the ideology of sound-in-itself is to demonstrate that sound is always already social."[93] I second Kane and add that the act of identifying a sonic entity, and indeed the ability to do so, is a process that is always already dependent on participation in the "cultural lifeworld."[94]

Kane calls for an investigation that "specif[ies] the relation between forms of sociality and the sounds made."[95] While I also agree fully with this position, what *Sensing Sound* seeks to communicate is that, even in the act of formulating the proposal that the thick event is sound, the figure of sound—a designation assigned by the person interacting with that thick phenomenon—has been set. A person's participation in the "cultural lifeworld" would be facilitated by subscribing to the notion that the thick event of music is best understood as (and limited to) sound. If we add to Kane's diagnostics the recollection of Benjamin Piekut's poignant formulation, "every musical performance is the performance of a relationship," we may begin to sense the ramifications of conceiving music through the figure of sound.[96] The practice of imagining the thick event as knowable sound is performed through naming, singing (or playing), and listening, and it takes place simultaneously with, prior to, and through the "forms of sociality and the sounds made" that Kane urges us to investigate.

The ramifications lie beyond those involved in an inquiry into music per se. The world is, in large part, mediated through a given naturalized acoustic reality.[97] As listeners, we are always positioned in relation to the world via naturalized concepts through which it is formed, and thus, we end up rendering ourselves in these static terms. Moreover, our relations to others are rendered through naturalized modes. Such static terms are proxies for the thick event and stand in the way of inquiry into the complexities of intermaterial relations.

Relationality

I began this book by recalling the question about the sound of a tree falling in a forest. Shifting our attention from whether the falling tree makes a sound if no one is there to hear it to the observation that there will be no sound unless the tree actually falls makes it clear that there must be a physical act that produces sound. Up to this point, this project has posited that the physical act warrants as much attention as the resulting phenomenon; indeed, I have suggested that the event and the practice of sound production occur prior to sound's presence. At the moment when you hear a sound, the forces that initiate it, shape it, and propel it into existence have already carried out their work. We have come to understand that the sound you hear at any given moment therefore cannot be changed: subsequent sounds can be made to differ from previous ones only by adjusting the actions that precede them. Just as the tree must fall to make sound possible, the action of singing must take place for there to be a subsequent vocal sound. From this position, we have drawn the conclusion that what we call singing is therefore not only a matter of sound, but it may result in sound. And I have suggested that, in terms of impact, the sound produced is secondary to the action that produced it.

But if singing is activity alone, and if the sounds produced are secondary, of what does listening consist? Instead of defining singing as the sounds produced by vocal cords and listening as their reception by eardrums, I have proposed that singing and listening are continuously unfolding physical activities and experiences that engage the total human body. We are never privy to sound in the form in which it is transduced through another person's materially specific body. That is, including culturally and historically situated physical senses in deliberations about sound helps inform and shape not only the discussion of our experience of sound but also each specific, embodied, sensory sonic experience. This suggestion is not without precedent. As I have discussed throughout the book, others—including Judith Becker, Steven Connor, Tia DeNora, Steve Goodman, Tomie Hahn, Julian Henriques, Charles Hirschkind, Seth Kim-Cohen, Matt Rahaim, and Michel Serres—have similarly addressed listening's multisensory nature.[98]

When we trace singing and listening back to their grounding in action through an organological approach, we may come to understand that they are conjoined activities. Sound ultimately reverberates throughout the body that hears it; by definition, this is the process that allows a listener to hear a sound. Recall that we are never privy to sound as it is transduced through another person's materially specific body; therefore, sound cannot be reduced to an objec-

tive index or object. Moreover, tracing singing and listening to action shows us that listening is not passive in its relationship to singing: the listener does not merely receive what he or she hears. As a result, listening, like singing, should be defined as the transmission and transduction of sound.

We may therefore think about propagation, transmission, and transduction—specifically the transduction of aural vibration, especially in the 20 hertz to 20 kilohertz range—as the common denominator of material mass, muscle activity, sound, and hearing: the elements that constitute singing.[99] If singing and listening are the actions that give rise to sound—in the vibration that surges through the singer, and in the material that envelops the singer and listener—does this sound, this vibration, have a beginning or end? It does not. The vibration is expressed as transmission or as transduction, and depending on how we define a node within that continuous field, we may define its beginning and end. But the vibration or energy in itself does not imply or express a bounded object with a beginning or ending point.

The following formula may help us to understand these interlocking relationships and summarize the argument I have made thus far in the book:

If [s] and [l] are [v] and [v] is [r];
And, if [b] is [v];
Then, also [b] is [r].

[s] = singing; [l] = listening; [v] = vibration across bodies, causing change;
[b] = being; [r] = relational

Singing and listening are particular expressions of the processes of vibration. What we understand as sound ultimately reverberates throughout the material body that produces and senses it; it is precisely because sound—undulating energy—is transduced through the listener's body that it is sensed. On the one hand, when we produce music we ourselves are affected by the process. On the other hand, by projecting music out into the air, we have an impact on the world around us. We do not engage with music at a distance but, by definition, we do so by entering into a relationship that changes us. The most extreme definition of music possible, then, is vibrational energy—and, at times, transformation through that vibrational energy, which is an always already unfolding relational process.

Music arises in the confluence between the materiality we offer up and the vibrational force that is put forth into the world. As a consquence, (1) to participate in music is to offer oneself up to that music; (2) to put music forth into the world is to have an impact on another; and, therefore, (3) it is as propaga-

tors and transductional nodes of that thick event of music—the full vibrational range, including sub- and ultrafrequencies—that we participate in and are privy to music.[100] What connects singing, listening, and sound, then, is vibration. Indeed, what connects the physical, full-body activities and experiences that take place during both singing and listening is the transmission and transduction of vibration. That is, if music is not something external and objective but is transmitted from one material node to another, music indeed puts us into an intrinsic dynamic, material relationship to both the so-called external world and each other. Musical discourse then shifts from the realm of the symbolic to that of the relational.

From the Relational to the Thick Event

Throughout this book, I have continually returned to the relational aspects of sound, music, singing, and listening. Typically, when people discuss a particular facet of what I have called the thick event, there is an assumption that it constitutes the entirety of that event—for example, the sound of a falling tree, which is actually only one of the many aspects of the full experience of a tree falling in the forest. If we make this assumption, we may think that understanding the nuances of a particular facet of an experience can provide an understanding of the thick event. However, if we explore each isolated phenomenon as a way of grasping one aspect of the thick event, we realize that no single aspect is the event. The process of putting these aspects, traditionally understood in isolation, into relationship with each other foregrounds the absences, lacunae, or shadows that suggest a more complex event (that is, the thick event). And this, in turn, emphasizes the isolation of each aspect and the fact that one aspect cannot be dealt with alone, if we wish to engage the full event.

In this way, relationality erases itself. By first showing the multiple "slices" involved in the whole, and how they interact as a whole, relationality leads us back to dealing with the whole as an experience, rather than as an isolated idea. As we set up a process that prompts thinking relationally through aspects of sound, music, singing, and listening, this linking presumes isolated aspects that are connected. In other words, once the thick event is recognized experientially, then a return to naming conventions, to using pieces to represent the whole, diverts our attention from the next step: dealing with the rediscovered thick event as intermaterial vibrations within which we ourselves are situated, and to which we ourselves contribute.

In chapter 4, I considered how a thick event could be reduced and naturalized. For example, I discussed the breathing exercise commonly given to classical singers that instructs them to inhale as if they were smelling a rose. While I deduced that this exercise was devised from a careful analysis of correct inhalation technique and that its naming served to enable future repetition and pedagogy, the exercise favors certain aspects of the thick inhalation event and isolates others from its complexity. Moreover, this process of selection and its naming often ends up replacing the full action on which it was based. That is, the naming and the directions designed to accomplish the exercise seem to suggest that the name itself—not the full event on which it was based—is the goal.

In the same way that the direction to "inhale as though you are smelling a rose" is an approximation of a full inhalation, the term and concept of vibration is a placeholder for something that is much fuller and more complex than any name and concept can possibly contain. As I have discussed throughout the book, and in this chapter in particular, interdisciplinary material investigation of some musical parameters led me to this concept and term. However, in the same way that relying on the "smelling a rose" exercise can lead to the complete inhalation from which the exercise was first derived, describing the operatic works of Juliana Snapper and Meredith Monk as intermaterial vibrational unfoldings fleshes out naturalized concepts such as sound but still reduces the thick event. In other words, to reduce opera or other musical events to verifiable parameters hardly captures the thick event. As this book has sought to illustrate, setting performances in different material and spatial configurations, denaturalizing musical parameters through performance, or actualizing explications rather than paraphrasing them into confirmable parameters may all serve to retain the thick event.

Unexpectedly, then (at least for me), an investigation of twenty-first-century opera does not necessarily bring us back to a study of or about music. Instead, it has taken me to the location of the artists and musicians themselves. The word *poetry* names the very essence of art (namely, *poiêsis* or "bringing into being"),[101] hence Heidegger claims that "*All art . . .* is *. . . essentially poetry*."[102] This suggests not only that interacting with music and seeking to engage it is art, but also that engaging the music itself—and the voices, artists, and musicians themselves—may bring us closest to the knowledge about the music.

As soon as we attempt to name and explicate the thick event—that which is brought into being—we position ourselves outside it and, by definition, approach it from a single point of view or engage it through one dominant

sense—in which case we are already defining the thick event as sound (for example) and thus asking questions about just one of its aspects. As I have discussed throughout the book, through this process the thick event is carefully parsed in the interest of arriving at measured and controlled verifiable knowledge. In contrast, the current that swept me up while heeding the call of the artists and the music studied here led me to want to contribute to bringing into being. We may then revise our formula:

If [r] serves to show the connection between
naturalized [s], [l], and [v],
when we pay attention to the [te],
[r] is already contained and subsumed within the [te].

[s] = singing; [l] = listening; [v] = vibration across bodies, causing change;
[b] = being; [r] = relational; [te] = thick event

Singing and listening are aspects of a thick event and are distinguished from it only through naming. In the same way, relationality through intermaterial vibration is only a placeholder for the thick event. As Luigi Russolo puts it, "to enrich means to add, not to substitute or to abolish."[103]

Everything and Nothing, and Not Even That

The sonorous . . . outweighs form. It does not dissolve it, but rather enlarges it; it gives it an amplitude, a density, and a vibration or undulation whose outline never does anything but approach. The visual persists until its disappearance; the sonorous appears and fades away into its permanence. —JEAN-LUC NANCY, *Listening*

In reading contemporary vocal works as materially situated and realized, *Sensing Sound* has offered analytical perspectives intended to develop a greater understanding of the nuanced range of human encounters with music and has proposed that certain aspects of human relations reveal themselves poignantly in song. Considering Jean-Luc Nancy's formulation, "The sonorous . . . outweighs form,"[104] I have demonstrated that, in encounters through and with music, we are physically touched and we tangibly touch others. Whether we are performing, listening, or engaging in scholarship, what is at stake in music is nothing less than the fundamental human experience of touching and being touched. It is precisely because music is the site of such transactions that, even when disciplines beyond music study it closely, music yields unique knowledge. While conceptualizing music through the figure-of-sound paradigm delineates the limits of musical phenomena and the insights that they can

produce, conceptualizing music as material transduction and physical touch opens the inquiry to transdisciplinary relevance and consequence.

However, if I take on my own proposition that the designations *sounds*, *musical parameters*, and *musical entities* are intermaterial vibration—or, better yet, thick events—in understanding that they only come into relief through identification with a priori parameters, there is still a crucial area on which I have yet to turn a critical organological lens. Returning to the falling tree, I have already identified what the classic question implies: it severs certain parts of the vibration, inserting them into the identifier *sound*. I also argue in that regard that, if you were there, you might be more concerned with the possibility that the tree would fall on you than with the sound. Focusing more narrowly on this question, we may continue to apply the material vibrational organological lens. In my assumption that something—a human—can be pinned underneath the tree lies the presumption of a knowable entity, that of the human being. This conceptualization presumes identification between material energy and human form. Such an assumption implicitly asks: Where does the human being begin and end? Where is the perimeter of the potentially injured entity? What holds it together as a unified entity? What is it that could be injured? Is the skin cell that falls off immediately prior to the tree's descent injured? Is the hair injured? Are the atoms that make up a cracked bone injured? If we believe that these aspects do not make up an injured entity, why is this? And if we do not doubt, and we sense that a human being could indeed be injured, why is that?

In understanding vibrations as both sound and aspects of the thick event, the designation *human entity* is thrown into relief following a preconceived concept of human form. There is no essential human form besides an a priori idea that holds that form together.[105] In other words, without this engaged idea, we would not hold the reference according to which we see a human form pinned underneath a tree. As the question of the falling tree's possible sound is both limited and directed by deep assumptions regarding the ontology of sound and music, so is the idea that it is a human who would be pinned under the tree. As I hinted at above, if we were to apply a different scale to the scene, we would not form an understanding that what we witnessed was a human body under the tree. On a scale with higher resolution, we would understand only that molecules were shifting. On a broader scale, we would understand only the relation between shifting landmasses.

Therefore, mapping the dynamics arising between nodes that can be understood to form relationships is merely mapping the relationships between ideas fixed to a priori ideals and confined segments of the continuous field of vibra-

tion and energy. If we question identification, releasing its functional power, there is no one stable and knowable music that has the capacity to both restore and destroy. As we move toward the end of this book, what I suggest is this: if there were no identifying a priori orientations—not only for the building blocks we understand as constituting music, but also for the entity we understand as experiencing and making meaning through that music—we would be unable even to identify that entity as a human being. And in that case, there would be no entity that could be injured by music. Without identification, not only does the illusion of a single stable and knowable music evaporate, but also there is no human being to be restored or destroyed by it.

In becoming aware of the power of identification, we may come to realize that what we have identified as a human body could as easily be identified as flesh, bone, or skin cells, thousands of which detach themselves from the so-called human body every minute. And when we stand on the ground, if we release the anthropocentric framework that divides our perception into identifications of human flesh and dirt, we could understand ground, feet, nails, ankles, knees, and so on as a continuous field of atoms.

If we can occupy that porous and unbounded place, unattached to and thus released from identification and its ramifications; if we can participate in a zone of experience where a priori identifications dissolve;[106] then we will participate in the thick event as everything, and as nothing—within a mode in which not even that is true.[107]