22

APPROACHING SOUND

Tara Rodgers

> I am sitting in a room different from the one you are in now. I am recording the sound of my speaking voice and I am going to play it back into the room again and again until the resonant frequencies of the room reinforce themselves so that any semblance of my speech, with perhaps the exception of rhythm, is destroyed . . .
>
> (Chadabe 1997: 75)

So begins the voice of Alvin Lucier in a 1980 recording of his composition, *I Am Sitting in a Room* (1969), a prominent work in electronic and experimental music history. As heralded by these opening words, Lucier's recording unfolds over 40 or so minutes, with 32 iterations of the spoken text played back into a particular room—the living room of his house in Middletown, Connecticut (Lovely Music n.d.; Lucier 1980: 37). Lucier played each iteration of the recording into the room, re-recorded it with a microphone onto tape, and then spliced these together in sequence. The "resonant frequencies of the room"—the pitches reproduced most prominently because of a room's dimensions and materials—gradually transform, and eventually take over, the distinct contours of Lucier's voice and words. If a listener does not know the premise of this composition and starts the recording 30 or more minutes in, the sounds seem more akin to haunting oscillations of a pipe organ or accordion than to the deliberate intonations of a male speaking voice that set the piece in motion (Lucier 1990). The material qualities of the room and tape medium are central to how this project is conceived; the rhythms and irregularities of Lucier's speaking voice also contribute unique dimensions to the composition, even as the sounds grow more abstract.

The score for *I Am Sitting in a Room* includes the text to be read as well as instructions for performing the piece with two tape recorders, a microphone, and a loudspeaker (Lucier 1980: 30–31). Over the years, many artists have performed and re-interpreted it. Recent variations demonstrate how digital audio coding formats, such as MP3 compression, transform sound quality in ways analogous to the effects of room ambience and tape recording that Lucier explored in his original composition (Sterne n.d.). A key artistic contribution of Lucier's piece—the captivating thing that keeps it relevant—is that the repetition of the exercise exposes auditory processes and effects that are barely discernable in everyday encounters with sound and shows how these physical phenomena can inspire creativity. I reference *I Am Sitting in a Room* at the outset of this chapter precisely because it encapsulates key issues confronted by soundmakers and theorists: relationships and boundaries between sounds and other sounds, bodies and audio technologies, sounds and spaces, self and others.

I am writing this essay on a laptop that serves not only as a tool for writing but also as a hub of my own soundmaking practice (Rodgers 2015b). (I use "soundmaking" and "soundmaker" to refer to diverse ways of working creatively with sound, such as music performance and production, DJing, circuit bending, sound art, and design.) You are sitting in a room or inhabiting an environment different from the one I am in now, undoubtedly with new or different ways of working with sound at your disposal. Creative practices and available tools vary over time with complex cultural forces that result in technological change, and always with each soundmaker's cultural location and identity. The intersections of such factors as race, gender, geographic location, ability, and socioeconomic status inform access to resources, the amount of time available for creative pursuits, and the aesthetic contours of sonic expressions. For this volume on media studies and digital humanities, then, I write from a particular time and cultural location in the spirit of Lucier's *I Am Sitting in a Room*, attempting to elucidate creative approaches to sound that address enduring questions and concepts even as particular soundmaking tools and practices vary widely, and eventually become obsolete or inaccessible.

The Materiality of Sound

The title and implicit theme of this essay, "Approaching Sound," carries a dual meaning. First, it refers to ways of thinking about sound that provide a foundation for creative projects and practices. Read with a different inflection, the phrase *approaching sound* also acknowledges the physical reality that sound is always approaching us. This is well encapsulated by a common illustration in audio textbooks that shows a human figure on the receiving end of sound waves bouncing around a room, with their directions indicated by arrows (Huber & Runstein 1997: 48; White 2006). Scenes of approaching sound are not always so tidy or implicitly pleasurable; for example, music has been used by the U.S. military as a means of torture, and the impact of sound in contexts of war or policing—such as a bomb exploding in close proximity—can have immediate and devastating effects on the body even before this sensory experience is interpreted as sound (Cusick 2008; Daughtry 2012; Goodman 2012).

Sound consists of audible vibrations that are "a dynamic patterning propagated through a medium . . . a transitory event in time" (Henriques 2011: xvii). In part because of its perceived ephemerality, sound in Western philosophy and cultures is "constantly subjugated to the primacy of the visual, associated with emotion and subjectivity as against the objectivity and rationality of vision . . . in essence, fundamentally secondary to our relationship to the world and to dominant ways of understanding it" (Hilmes 2005: 249; see also Sterne 2003: 1–5). This cultural primacy of the visual infiltrates many aspects of daily life, often in subtle ways. Note that *seeing* stands in for *understanding* in the phrase, "I can see why." Feminist theorists have shown how visual technologies and techniques have bolstered claims to scientific objectivity and fortified uneven distributions of power (Haraway 1988). In one contemporary example of this, biometric technologies used by government agencies to identify and classify citizens—like body scanners at airports—often have an effect of further marginalizing and criminalizing vulnerable populations (Magnet 2011). Such visual technologies and techniques are predicated on the distancing of a knowing subject (in this case, the state and its agents) from bodies under surveillance, which consolidates and sustains power by concealing its modes of operation.

Vibrations—including that specific class of audible vibrations experienced as sound—present alternative ways of apprehending reality that can point toward political sensibilities that emphasize complexity, interconnection, and interdependence rather than modes of distancing and control. Indeed, philosophers have taken up the concept of vibration to reimagine

boundaries between things, and between subjects and objects, because vibration "moves material, and moves through material," and it "can move simultaneously through subjects as well as objects, bridging internal and external worlds" (Trower 2012: 6, 8–9). To flesh out these concepts, we can turn to musicians and composers who have elaborated theories of listening that promote a politics of reflexivity and interconnection. Evelyn Glennie, a virtuosic percussionist and composer who is profoundly deaf, has developed a creative practice and philosophy of hearing based on sensing vibrations throughout the whole body. Glennie claims, "Hearing is basically a specialized form of touch," and her accounts of hearing emphasize the interconnectedness of sight, sound, and touch, as well as the intimate interplay of bodies and musical instruments (1993, 2003). She implies that those who are able to hear well through the ears actually limit significantly their experience of sound (and of the world) by not attending to the myriad ways that vibrations register throughout the body. While Glennie emphasizes whole-body dynamics of sensing sound, the composer Pauline Oliveros's practice of Deep Listening centers on expanding attentiveness to sounds as they are perceived "both acoustically and psychologically" (2005: xxii). Deep Listening can inform improvisation, composition, and being in the world; it aims to expand "attentional dynamics" to sound so that "one is connected to the whole of the environment and beyond" (xxiii). Oliveros has long cultivated expanded consciousness of sound; in *Sonic Images*, a series of prompts first presented in 1972, she asks, "Who is very familiar to you? Could you recognize this person only by the sound of her or his footsteps?" (1984: 52). By challenging her audience to consider how well they know someone by subtle auditory cues alone, Oliveros calls into question cultural tendencies to privilege visual ways of knowing.

Sound Relations: Embodiment, Identity, and Community

To the extent that we are able to isolate "sound itself" as a distinct phenomenon, we can say that it embodies and catalyzes a diffuse set of relations. An artist and critic, Brandon LaBelle, offers a cogent summary:

> Sound is intrinsically and unignorably relational: it emanates, propagates, communicates, vibrates, and agitates; it leaves a body and enters others; it binds and unhinges, harmonizes and traumatizes; it sends the body moving, the mind dreaming, the air oscillating.
>
> (LaBelle 2008: ix)

What happens when sounds are "made?" Textbook accounts are a good place to start; core ideas are remarkably consistent over the last century and document stories of sound that are common in audio-technical cultures. A 1965 *Life Science Library* text explains:

> Sound originates when a body moves back and forth rapidly enough to send a wave coursing through the medium in which it is vibrating. But sound as a sensation must be received by the ear and passed on to the brain, where it can be registered as an event taking place in the world about the listener.
>
> (Stevens et al. 1965: 10)

Over the course of a day, the ear, brain, and/or other parts of the body register proximate and distant vibrations of such elements as another's vocal cords, the wings or legs of insects, strings on a guitar, mechanical vibrations of passing vehicles, or various digital sounds made

audible from the realm of zeros and ones by a digital-to-analog converter on a computer or mobile device. Most of us are routinely exposed to such sounds and sounding bodies as a transitory assemblage. The sound and performance artist, Laetitia Sonami (2004), has said that when she began to work with sound creatively, one of the first things she did was to develop an active-listening exercise: writing down each sound she heard to learn to recognize sounds in isolation from and in relation to one another (see also rsitoy 2015). Sound enrolls the listening body in a web of material connections that transect boundaries of subjects, species, organic and inorganic matter, and bodily interiors and exteriors. Sonami's exercise suggests a way to document one's location within a complex environment connected and transected by sound.

While sound is a formidable material force, it is also "a potent and necessary means for accessing and understanding the world . . . it leads away from itself" (Kahn, cited in Sterne 2012b: 6). Sound's relational aspects and propensities are what make it resoundingly political. Sounds that are organized into music compositions and performances present audible relations of individual elements to complex wholes that provide powerful metaphors through which we can make sense of our selves and relationships to others. Sonic and musical patterns are "an abstraction of the social" (Shank 2014: 244) and also "participate in social formation" (McClary 1991: 7): we learn who we are as socially differentiated bodies and subjects in part through our engagements with sound and music. Because sound is felt by the body in complex ways, it holds particular power to move us physically, emotionally, intellectually, and politically:

> We confront our own bodies through the experience of patterned sounds, and we confront the bodies of others through our interpretations of those patterned sounds . . . [O]ur sense of the social is necessarily affected.
>
> (Shank 2014: 246)

Anyone who has joined with others in voicing a collective chant or cheer at a sporting event or political rally, or who has felt empowered by the sonic rush of a high-volume concert, has sensed this process by which sound and music elicit embodied experiences of identity and community.

Being in the presence of others is, of course, not a requirement for sensing sound and music's meaningful depths and political possibilities. Listening privately to recorded music is a common way that many listeners encounter social differences, such as differences of race and culture, for the first time. Music and songs activate the imagination as "almost-places of cultural encounter that may not be physical places but nevertheless exist in their own auditory somewhere" (Kun 2005: 2–3). Some listeners may use such auditory encounters as prompts for examining their own cultural location, but such reflexivity is certainly not a given. Imani Perry, an interdisciplinary scholar of race and culture, has analyzed how the consumption of hip hop by some white suburban men is an extension of longstanding, problematic patterns in the U.S. of white appropriation of African American music and culture. While suburban white teens may identify their own feelings of social isolation or frustration with elements of hip hop sounds, lyrics, and styles, Perry notes that their circumstances are "an individualized and modest parallel" to the structural racism, economic discrimination, and ever-present threat of violence faced by Black men:

> The question is whether the use of hip hop will remain purely selfish or will translate to a generation of whites who as adults will have a politics that addresses the frustration of broader social marginalization of African Americans.
>
> (Perry 2004: 126)

In some contexts, listening to recorded music alone or with others can foster productive senses of connection and belonging. For example, Susan Driver's research on queer girls and popular culture proposes that music's unique combination of sonic, kinetic, verbal, and non-verbal modes of signification make it "a vital tool in shaping queer youth self-perceptions, imaginative longings, and political commitments" (2007: 196). Jenna, one of her informants, explains:

> Walking around listening to [Le Tigre's] queer music on my headphones sometimes feels like I'm wearing armor . . . it kind of protects me from the straight world I live and work in, especially if I'm having a bad day.
>
> (Driver 2007: 226)

With these examples in mind, we might think of listening bodies as sonic-political transducers. *Transduction* refers to the conversion of one form of acoustic energy into another by microphones, loudspeakers, and even parts of the ear—such as when an electrical signal becomes an audible sound wave as it passes through the technology of a loudspeaker (Huber & Runstein 1997: 20–22). Transduction serves as a useful metaphor for what both Imani Perry and Jenna describe (see also Keeling 2013 and Helmreich 2015). Sound and music are absorbed by individuals—with varying modes of consciousness and interpretation—and then converted into kinetic and social modes of engaging with others, with the potential to mobilize various kinds of political work in the world.

Sound Limits and Parameters

What are sound's limits? We can approach this question in a few different ways. First, perceptions of sounds are contingent upon the bodies of beholders and relations among them. As the sound artist Bill Fontana notes, "a sound is all the possible ways there are to hear it" (n.d.; see also LaBelle 2008: 235). Sound studies scholar Jonathan Sterne elaborates:

> [T]he boundary between sound and not-sound is based on the understood possibilities of the faculty of hearing—whether we are talking about a person or a squirrel. Therefore, as people and squirrels change, so too will sound.
>
> (Sterne 2003: 11–12)

The range of frequencies associated with "normal" human hearing (20 to 20,000 Hz) varies widely among human subjects according to environmental context as well as physical ability, which changes for everyone over time due to such factors as illness, exposure to sound, and age. And, while we likely have a mental image of an ear that is particular to the ears we see on ourselves and companion species, the ear as a sound-sensing organ takes myriad shapes and locations on the bodies of other species—such as on the abdomens and legs of common insects ("Vibrational Communication" 2011; "Listen Up" 2012).

Capacious definitions of sound might accommodate a multispecies vibrational ecology that is felt across this diversity of ears; more bounded approaches to sound seek to understand one species' (or one culture's or community's) auditory norms and communication practices. David Dunn (1992, 1996, 2001; Dunn & van Peer 1999) has explored interspecies communication in many of his sound works: for example, by staging a duet outdoors between an analog electronic oscillator and a mockingbird, and by using underwater recordings to amplify for human listeners the complexity of sonic communication in "the emergent mind of the pond."

Maryanne Amacher (1999) took a different approach in her compositions and performances, mining the limits and idiosyncrasies of human auditory perception. Amacher researched and produced what she called "third ear music," in which an avalanche of frequencies played at an extremely high volume triggers the perceptual phenomenon of oto-acoustic emissions—meaning that listeners' ears seem to emit sounds while also receiving them (see also Amacher 2008 and Ouzounian 2006).

A soundmaker's palette encompasses various parameters of sound, such as frequency, loudness, duration, and timbre, and it is not surprising to find sonic experimentalists working at the edges and extremes of these parameters. Like Amacher, who pushed at the limits of sound frequency and loudness, others have creatively explored parameters such as duration and timbre. Many of Eliane Radigue's (2003) compositions embody extremes of duration, using sustained tones of the ARP 2500 synthesizer that evolve slowly with barely discernable modulations of harmonics over time (see also Guitton 2009). Radigue works on what she calls the "inside of a sound"—making subtle and precise changes to timbre while the overall composition coalesces around what seems to be one long sound, fueled by its relative constancy of pitch (Rodgers 2010: 54–60). Antye Greie (aka AGF) recounts a story that Radigue once gave her an assignment to work on a single sound in the studio for four days—cultivating a level of craft that challenges the typically fast-moving pace of digital audio editing (Rodgers 2010: 214). On the other end of the duration spectrum, *microsound* aesthetics and practices "treat sound as collections of infinitesimally small particles" (Demers 2010: 71). Iannis Xenakis's *Concret PH* (1958), an early work in this area, was assembled from very short fragments on tape of the sounds of burning charcoal. Contemporary explorations of microsound employ granular synthesis software to amass evolving soundscapes from detailed variations to the pitch, speed, and timbre of extremely small sound fragments in succession (Chadabe 1997: 34–35; Demers 2010: 71–74; see also Price 2005; Carlson 2015). John Cage's *4′33″* (1952) is a well-known composition that innovated in areas of loudness and duration, by embracing silence as a central element (calling attention to the many incidental sounds in a concert hall) and using structured segments of sound and silence (calling attention to the function of duration in music composition) (Chadabe 1997: 25). For examples of explorations at the outer edges of timbre—the harmonic or textural quality of sound that makes the same note played on two different instruments sound distinct from each other—we can look to some contemporary hip hop producers who "work in the red," pushing bass frequencies until they distort in particular ways (Rose 1994: 74–78), and to noise musicians' creative uses of feedback and circuit-bent devices so that "'unimagined sounds happen'" in each performance (Novak 2013: 153–61).

Sound is also delimited by its media of transmission, the acoustic spaces in which it resonates, and the constraints of sound reproduction technologies that play it back. Lucier's *I Am Sitting in a Room* exemplifies how media (such as tape) and acoustic spaces transform the experience of sound. There are many other common examples of these phenomena, such as the reverberant effects of singing in the shower or the eerie sense of quiet brought about by a fresh snowfall to an otherwise bustling neighborhood (Exploratorium n.d.; Fallik 2005). As for how audio technologies frame what we hear, the recording engineer Jamie Tate (2013) playfully depicts this dynamic in his cartoon, "Modern Recording," which illustrates how tens and even hundreds of thousands of dollars' worth of high-end audio equipment are routinely used in professional studios to record music that eventually gets played back through a 99-cent MP3 file and $12 earbuds that reproduce only a fraction of the range of frequencies captured by the recording (see also Sterne 2012a). If we listen through those

earbuds in an environment with considerable ambient noise, such as on a subway ride, the range of audible frequencies is limited even further. In arguably every instance, to attend to sound by listening or feeling its vibrations is to discover how it is ever interdependent with its material and social contexts.

Conclusion: Sound Knowledges in the Making

Every time we cut and paste a piece of an audio file in a digital audio workstation, or reach for a knob on a synthesizer, what we know about sound in that moment is informed by a range of historical and cultural factors. Knowledge of sound circulates in audio-technical discourse and also resides within musical instruments and sounds themselves: "Every field of sonic practice is partially shaped by a set of knowledges of sound that it motivates, utilizes and operationalizes" (Sterne 2012b: 9). Consider the simple wave shapes on a synthesizer interface that mark the kinds of sounds that emerge. Wave metaphors, integral to audio-technical language, are ancient concepts that were sustained by a Euro-American cultural milieu at the turn of the twentieth century in which fascinations with the sea abounded. Writers of acoustics textbooks aligned the physical properties of sound waves with the connotations of fluidity and excess associated with female bodies throughout Western history and philosophy. Late-nineteenth- and early-twentieth-century narratives in acoustics texts also employed themes of maritime voyage, in which the experiential navigation and technological control of sound waves reflected a masculinist and colonialist imagination. Adorned with simple wave shapes and marketed with names like "Odyssey" and "Voyager," modern synthesizers bear traces of this history, while the subjects at the center of electronic music histories—white and male composer/technologists—inherit a certain legacy of the archetypal, intrepid explorer who is tossed by, and must tame, the unruly seas (Rodgers 2016). Along similar lines, Andra McCartney (1995) has documented pervasive metaphors of domination and control in electroacoustic music and shown how some women composers have adopted alternative ways of characterizing their work. The ways that audio technologies are shaped by gender and other modalities of identity "is, at least in part, a discursive process; . . . it unfolds as part of the verbal and textual interactions that accompany music production," whether in the studio or in print or online forums (Porcello 2005: 276; see also Porcello 2004; Tamarisa 2014).

And yet, the fact that linguistic modes of description do not fully capture sonic communications has sparked many novel methods of music notation and creation. Anthony Braxton (1985) has innovated a diagrammatic scheme of music notation, using letters, numbers, shapes, drawings, and colors, with philosophies and meanings elaborated in his *Tri-Axium Writings* (Tri-Centric Foundation 2014). Fred Frith (1999) provided instructions to groups of improvisers for interpreting photographs of inanimate objects; the resulting music is presented on his album *Stone Brick Glass Wood Wire* (see also Sauer 2009 for an extensive collection of graphic scores). These examples illustrate the capacious symbolic imaginary of sonic expression (and the complexity of audio-visual relations) that extends beyond the constraints of descriptive terms.

As soundmakers and sound students, then, we should be attuned to how historically and culturally specific metaphors and descriptive language frame our knowledge of sound, as well as to sound's potential for complex communications of its own kind. Instruments and interfaces are often where these two trajectories join forces: technological designs crystallize sound knowledge into material forms that, in turn, generate more sounds. Knowing an

instrument's history and interrogating the logic of its design can be a productive starting point for creative interruption and innovation. The form of late-twentieth-century analog synthesizers—with oscillator, amplifier, and filter components respectively devoted to the modulation of loudness, pitch, and timbre—is indebted to Hermann von Helmholtz's nineteenth-century theories of perception that analogized this tripartite structure of sound to the properties of color: brightness, hue, and saturation (Rodgers 2015a: 216–17). Many digital audio tools continue to remediate analog styles, such as the graphical user interfaces that resemble analog mixers and software effects processors that are decorated with virtual wood paneling; these older interfaces often persist because they are familiar and remain marketable. But for every software interface that resembles a traditional multi-track mixer with separate channels and faders for each sound, a soundmaker might develop a wholly different visual and tactile method for combining and controlling sounds, based on alternate histories or theories of sound and instrument design, or on other sources of inspiration (see Rodgers 2010: 139–55).

Sound is both a carrier of cultural knowledge and an expressive medium modulated by individual and collaborative creativity. Annea Lockwood's (1989) "sound map" compositions, which combine the sounds of rivers and recorded interviews with people whose lives are shaped by rivers, exemplify this. Listening to a river and how it moves can reveal ecological complexity as well as the cultural and economic histories of a particular location (Rodgers 2010: 114–27). Lockwood's choices of microphones, interview subjects, and recording locations in and around the rivers frame these sonic narratives in specific ways.

The soundmakers' ideas and work I highlight throughout this chapter provide a sampling of creative methods for approaching sound. These methods include attentive listening, modulating sonic parameters and pushing at their limits, experimenting with notation, and interrogating conventions of instrument design. Along the way, cultural theories and analyses teach us about the various ways that sounds, audio technologies, and listening practices have histories and politics.

In my own work, soundmaking generates questions that I try to answer with historical research and cultural analysis; that research and writing, in turn, lends a deeper understanding of the issues and stakes in my creative practice. I also appreciate the argument by the musician and educator, Michael Bierylo, that soundmaking and critical writing can be two separate and analogous projects. In an interview on designing the music production curriculum at Berklee, Bierylo describes how a "track" of music produced for a course in that program functions like a "term paper" elsewhere: "Being able to produce your musical idea is essential to sharing and communicating that idea. The production is part of the process of creation . . . in both subtle and sophisticated ways" (Ableton 2015). Soundmaking and writing may share a common purpose of communicating a concept or argument, yet each emerges from a distinct set of practices—a craft that can be learned and innovated. Approaching sound through both of these critical and creative ways of working can uncover its complex expressive and political power.

Further Reading

Born, G. (1995) *Rationalizing Culture: IRCAM, Boulez, and the Institutionalization of the Musical Avant-Garde*, Berkeley: University of California Press.

Davies, H. (2002) "Electronic Instruments: Classifications and Mechanisms," in H. -J. Braun (ed.) *Music and Technology in the Twentieth Century*, Baltimore, MD: Johns Hopkins University Press, pp. 43–58.

Oram, D. (1972) *An Individual Note of Music, Sound, and Electronics*, London: Galliard.

References

Ableton: Artists (2015) "Berklee's Michael Bierylo on Designing a Modern Music Curriculum," retrieved from ableton.com/en/blog/michael-bierylo-designing-music-curriculum.

Amacher, M. (2008) "Psychoacoustic Phenomena in Musical Composition: Some Features of a 'Perceptual Geography,'" in J. Zorn (ed.) *Arcana III: Musicians on Music*, New York, NY: Hips Road/Tzadik, pp. 9–24.

Braxton, A. (1985) *Tri-Axium Writings, vol. 1–3,* Lebanon, NH: Frog Peak Music.

Carlson, C. (2015) *Borderlands Granular*, retrieved from www.borderlands-granular.com/app.

Chadabe, J. (1997) *Electric Sound: The Past and Promise of Electronic Music*, Upper Saddle River, NJ: Prentice Hall.

Cusick, S. G. (2008) "'You are in a place that is out of the world . . .': Music in the Detention Camps of the 'Global War on Terror,'" *Journal of the Society for American Music* 2(1), 1–26.

Daughtry, J. M. (2012) "Belliphonic Sounds and Indoctrinated Ears: The Dynamics of Military Listening in Wartime Iraq," in E. Weisbard (ed.) *Pop When the World Falls Apart: Music in the Shadow of Doubt*, Durham, NC and London: Duke University Press, pp. 111–44.

Demers, J. (2010) *Listening through the Noise: The Aesthetics of Experimental Electronic Music*, New York, NY: Oxford University Press.

Driver, S. (2007) "'Your Music Changed My Life. I Needed Something Queer': Musical Passion, Politics, and Communities," in *Queer Girls and Popular Culture: Reading, Resisting, and Creating Media*, New York, NY: Peter Lang, pp. 195–232.

Dunn, D. (2001) "Nature, Sound Art, and the Sacred," in D. Rothenberg and M. Ulvaeus (eds.) *The Book of Music and Nature: An Anthology of Sounds, Words, Thoughts*, Middletown, CT: Wesleyan University Press, pp. 95–107.

Dunn, D., with R. van Peer. (1999) "Music, Language and Environment," *Leonardo Music Journal* 9, 63–67.

Exploratorium. (n.d.) "Why Does My Singing Sound So Great in the Shower?" retrieved from www.exploratorium.edu/music/questions/shower.html.

Fallik, D. (2005) "Researchers Keep Ear to the Snow," *Philadelphia Inquirer*, retrieved from articles.philly.com/2005–02–22/news/25444409_1_new-fallen-acoustics-snow.

Fontana, B. (n.d.) "Listen to Sound Sculpture Excerpts," *Bill Fontana website*, resoundings.org/Pages/possible%20ways%20copy.html.

Glennie, E. (1993) "Hearing Essay," retrieved from www.evelyn.co.uk/hearing-essay.

Goodman, S. (2012) *Sonic Warfare: Sound, Affect, and the Ecology of Fear*, Cambridge, MA: MIT Press.

Haraway, D. J. (1988) "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14(3), 575–99.

Helmreich, S. (2015) "Transduction," in D. Novak and M. Sakakeeny (eds.) *Keywords in Sound*, Durham, NC and London: Duke University Press, pp. 222–31.

Henriques, J. (2011) *Sonic Bodies: Reggae Sound Systems, Performance Techniques and Ways of Knowing*, London: Continuum.

Hilmes, M. (2005) "Is There a Field Called Sound Culture Studies? And Does It Matter?" *American Quarterly* 57(1), 249–59.

Huber, D. M. and Runstein, R. E. (1997) *Modern Recording Techniques*, 5th edn, Boston, MA: Focal Press.

Keeling, K. (2013) "Electric Feel," *Cultural Studies* 28(1), 49–83.

Kun, J. (2005) "Introduction: Strangers among Sounds," *Audiotopia: Music, Race, and America*, Berkeley, CA: University of California Press, pp. 1–28.

LaBelle, B. (2008) *Background Noise: Perspectives on Sound Art*, London: Continuum.

"Listen Up: Crickets Have Had Ears on Their Legs for More Than 50 Million Years" (2012) *University of Colorado Boulder News Center*, retrieved from www.colorado.edu/news/features/listen-crickets-have-had-ears-their-legs-more-50-million-years.

Lovely Music, Ltd. (n.d.) "Titles: Alvin Lucier; I Am Sitting in a Room," retrieved from www.lovely.com/titles/cd1013.html.

Lucier, A. (1980) *Chambers: Scores by Alvin Lucier; Interviews with the Composer by Douglas Simon*, Middletown, CT: Wesleyan University Press.

Magnet, S. (2011) *When Biometrics Fail: Gender, Race, and the Technology of Identity*, Durham, NC and London: Duke University Press.

McCartney, A. (1995) "Inventing Images: Constructing and Contesting Gender in Thinking about Electroacoustic Music," *Leonardo Music Journal* 5, 57–66.

McClary, S. (1991) *Feminine Endings: Music, Gender, and Sexuality*, Minnesota, MN: University of Minnesota Press.

Novak, D. (2013) *Japanoise: Music at the Edge of Circulation*, Durham, NC and London: Duke University Press.

Oliveros, P. (1984) "Sonic Images," in *Software for People: Collected Writings, 1963–1980*, Baltimore, MD: Smith Publications, pp. 52–54.

Oliveros, P. (2005) *Deep Listening: A Composer's Sound Practice*, New York, NY: iUniverse.

Ouzounian, G. (2006) "Embodied Sound: Aural Architectures and the Body," *Contemporary Music Review* 25(1/2, February/April), 69–79.
Perry, I. (2004) *Prophets of the Hood: Politics and Poetics in Hip Hop*, Durham and London: Duke University Press.
Porcello, T. (2004) "Speaking of Sound: Language and the Professionalization of Sound-Recording Engineers." *Social Studies of Science* 34(5), 733–58.
Porcello, T. (2005) "Afterword," in P. D. Greene and T. Porcello (eds.) *Wired for Sound: Engineering and Technologies in Sonic Cultures*, Middletown: Wesleyan University Press, pp. 269–79.
Price, S. (2005) "Granular Synthesis: How It Works and Ways to Use It," *Sound on Sound*, retrieved from www.soundonsound.com/sos/dec05/articles/granularworkshop.htm.
Rodgers, T. (2010) *Pink Noises: Women on Electronic Music and Sound*, Durham and London: Duke University Press.
Rodgers, T. (2015a) "Synthesis," in D. Novak and M. Sakakeeny (eds.) *Keywords in Sound*, Durham and London: Duke University Press.
Rodgers, T. (2015b) *Analog Tara / Pink Noises*, retrieved from www.analogtara.net.
Rodgers, T. (2016) "Toward a Feminist Epistemology of Sound: Refiguring Waves in Audio-Technical Discourse," in M. Rawlinson (ed.) *Engaging the World: Thinking after Irigaray*, SUNY Press.
Rose, T. (1994) *Black Noise: Rap Music and Black Culture in Contemporary America*, Hanover and London: Wesleyan University Press.
Sauer, T. (2009) *Notations 21*, New York, NY: Mark Batty.
Shank, B. (2014) *The Political Force of Musical Beauty*, Durham and London: Duke University Press.
Sonami, L. (2004) Interview with the author, 8 May.
Sterne, J. (2003) *The Audible Past: Cultural Origins of Sound Reproduction*, Durham and London: Duke University Press.
Sterne, J. (2012a). *MP3: The Meaning of a Format*, Durham and London: Duke University Press.
Sterne, J. (2012b) "Introduction to Sonic Imaginations," in J. Sterne (ed.) *The Sound Studies Reader*, New York: Routledge, pp. 1–17.
Stevens, S. S., F. Warshofsky, and the editors of *Life*. (1965) *Sound and Hearing*, New York: Time Incorporated, Life Science Library.
Tamarisa, A. (2014) "Muff Wiggler: Sexism in Audio Cultures," *Bluestockings Magazine*, retrieved from bluestockings-mag.com/2014/04/17/muff-wiggler-sexism-in-audio-cultures.
Tate, J. (2013) "Just for Fun," *Rukkus Room Studios*, retrieved from www.rukkusroom.com/Fun.html.
Tri-Centric Foundation. (2014) "Braxton Musical Systems," *The Tri-Centric Foundation*, retrieved from tricentric foundation.org/musical-systems.
Trower, S. (2012) *Senses of Vibration: A History of the Pleasure and Pain of Sound*, London: Continuum.
"Vibrational Communication in Insects and Spiders" (2011) *Map of Life*, University of Cambridge, retrieved from www.mapoflife.org/topics/topic_584_Vibrational-communication-in-insects-and-spiders.
White, Paul. (2006) "The Studio SOS Guide to Monitoring and Acoustic Treatment," *Sound on Sound*, retrieved from www.soundonsound.com/sos/feb06/articles/studiosos.htm.

Audio and Video Examples

Amacher, M. (1999) *Sound Characters (Making the Third Ear)*, Tzadik, CD 7043.
Dunn, D. (1992) *Angels and Insects*, What Next? Recordings, CD WN0009.
Dunn, D. (1996) *Music, Language and Environment*, Innova, CD 508.
Frith, F. (1999) *Stone Brick Glass Wood Wire*, I Dischi di Angelica, CD.
Glennie, E. (2003) "How to Truly Listen," *TED Talk*, February, retrieved from www.ted.com/talks/evelyn_glennie_shows_how_to_listen.
Guitton, M. (2009) *A Portrait of Eliane Radigue* (documentary), retrieved from vimeo.com/8983993.
Lockwood, A. (1989) *A Sound Map of the Hudson River*, Lovely Music, CD 2081.
Lucier, A. (1990) *I Am Sitting in a Room*, Lovely Music, CD 1013.
Radigue, E. (2003) *Geelriandre/Arthesis*, Fringes Recordings, CD Fringes Archive 01.
rsitoy (2015) *the ear goes to the sound: the work of Laetitia Sonami* (documentary), retrieved from earsoundfilm.com.
Sterne, J. (n.d.) "Alvin Lucier Cover," retrieved from sounds.sterneworks.org/projects/alvin-lucier-cover.

THE ROUTLEDGE COMPANION TO MEDIA STUDIES AND DIGITAL HUMANITIES

Edited by
Jentery Sayers

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: Sayers, Jentery, editor.
Title: The Routledge companion to media studies and digital humanities / edited by Jentery Sayers.
Description: New York : Routledge, Taylor & Francis Group, 2018.
Identifiers: LCCN 2017014964| ISBN 9781138844308 (hardback) | ISBN 9781315730479 (ebk)
Subjects: LCSH: Mass media. | Digital humanities.
Classification: LCC P90 .R673 2018 | DDC 302.23—dc23
LC record available at https://lccn.loc.gov/2017014964

ISBN: 978-1-138-84430-8 (hbk)
ISBN: 978-1-315-73047-9 (ebk)

Typeset in Bembo
by Florence Production Ltd, Stoodleigh, Devon, UK