Music and Consciousness 2

Worlds, Practices, Modalities

Edited by

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Advance praise

Producing a worthy successor to the original *Music and Consciousness* volume was always going to be a difficult task, but *Music and Consciousness 2* rises admirably to the challenge. Impressively wide-ranging, yet compellingly coherent as a whole, this is a book that tackles the thorniest of problems in the most lucid of prose. Collectively, these essays make clear both the ability of music to stimulate consciousness studies and the potential for ideas about consciousness to challenge, perhaps even to transform, musicological orthodoxies.

Tomas McAuley, Faculty of Music, University of Cambridge, UK

Music is a productive medium of consciousness. The essays collected in this volume illuminate consciousness as situated, practiced, experienced, and as something that takes shape in the spaces between people and culture. A must read for anyone interested in what consciousness is and where it comes from, *Music and Consciousness 2* showcases music's potent affordances for the study of—in the broadest sense—being in the world.

Tia DeNora, Professor, Sociology, Philosophy, and Anthropology, University of Exeter, UK

Music and Consciousness 2 brings together an ensemble of voices to challenge orthodox ideas and offer new perspectives on issues that cut across multiple disciplines. For those who are seriously studying consciousness, they present advanced music lessons on topics such as performance, improvisation, affect, perception, altered states of awareness, empathy, social interaction, and much more. Not singing to the choir here, they show us that music can move us to reconsider the importance of basic brain-body-environment attunements. In the background one hears the subtle beat of the 4E drum. Turn it up!

Shaun Gallagher, Lillian and Morrie Moss Chair of Excellence in Philosophy,
University of Memphis, USA

Impressive in scope and diverse in methodology, this volume brings together scholars from a rich variety of musical fields to explore the multifaceted and complex phenomenon that is consciousness. The result is as convincing as it is useful, and will be of interest to anyone seeking to understand how musical engagement can make a profound contribution to our grasp of being human.

Nanette Nielsen, Associate Professor, University of Oslo, Norway

This is a new exciting interdisciplinary volume that explores the many facets of the complex relation between music and consciousness. It discusses how listening to music influences our conscious experience, as well as how musicians experience themselves and others in performance and improvisation. It also explores various ways in which music expands human consciousness, enabling us to considerably enhance and enrich our capacity to feel. This volume will certainly appeal to philosophers, psychologists, musicians, and music therapists.

Giovanna Colombetti, Sociology, Philosophy, and Anthropology, University of Exeter, UK

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Chapter 2

Cognitive extension and musical consciousness

Lawrence M. Zbikowski

Cognitive extension in the recording studio

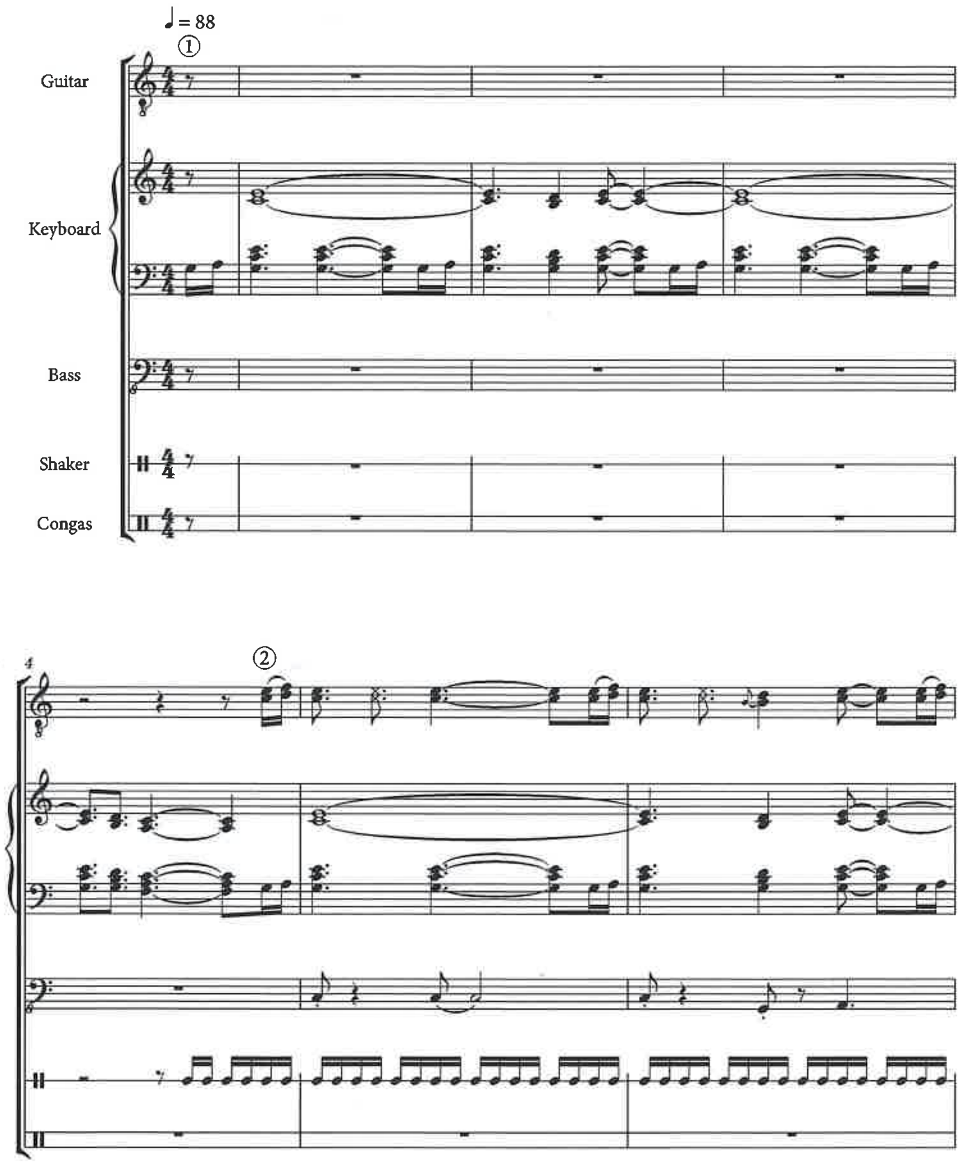
Some years ago, in the course of an account of the cognitive processes involved in creating and listening to musical grooves, I offered an analysis of a rather obscure song recorded in 1985 by Eric Clapton called 'It All Depends' (Zbikowski 2004). What the song provided was a sonic illustration of a musical groove—understood as a large-scale, multi-layered pattern that involves both pitch and rhythmic materials—being assembled, one piece at a time. As shown in the transcription provided in Example 2.1, the first statement of the groove (at ①) is made by unaccompanied keyboards (synthesizers set up to sound a bit like inexpensive electronic organs, played by Chris Stainton and Peter Robinson). For the second statement of the groove (at ②), the keyboards are joined by a shaker (played by Phil Collins), guitar (played by Clapton), and bass (played by Donald 'Duck' Dunn); and for the third statement (at ③), a conga part is added (played by Ray Cooper).

From the perspective I wished to develop in that article, the opening of Clapton's 'It All Depends' demonstrated the role of shared knowledge among a group of musicians: to perform this groove, each of the musicians needed to have knowledge of the other musicians' parts so that the whole could be fitted together. In the terms I developed in my studies of knowledge of this sort, each musician needed to have a conceptual model of the entire groove, components of which they shared with the other musicians in the ensemble.[1] Put another way, the knowledge necessary for the performance of the groove was distributed among the members of the ensemble and took different forms depending on the musician, his instrument, and the part he played in the whole.

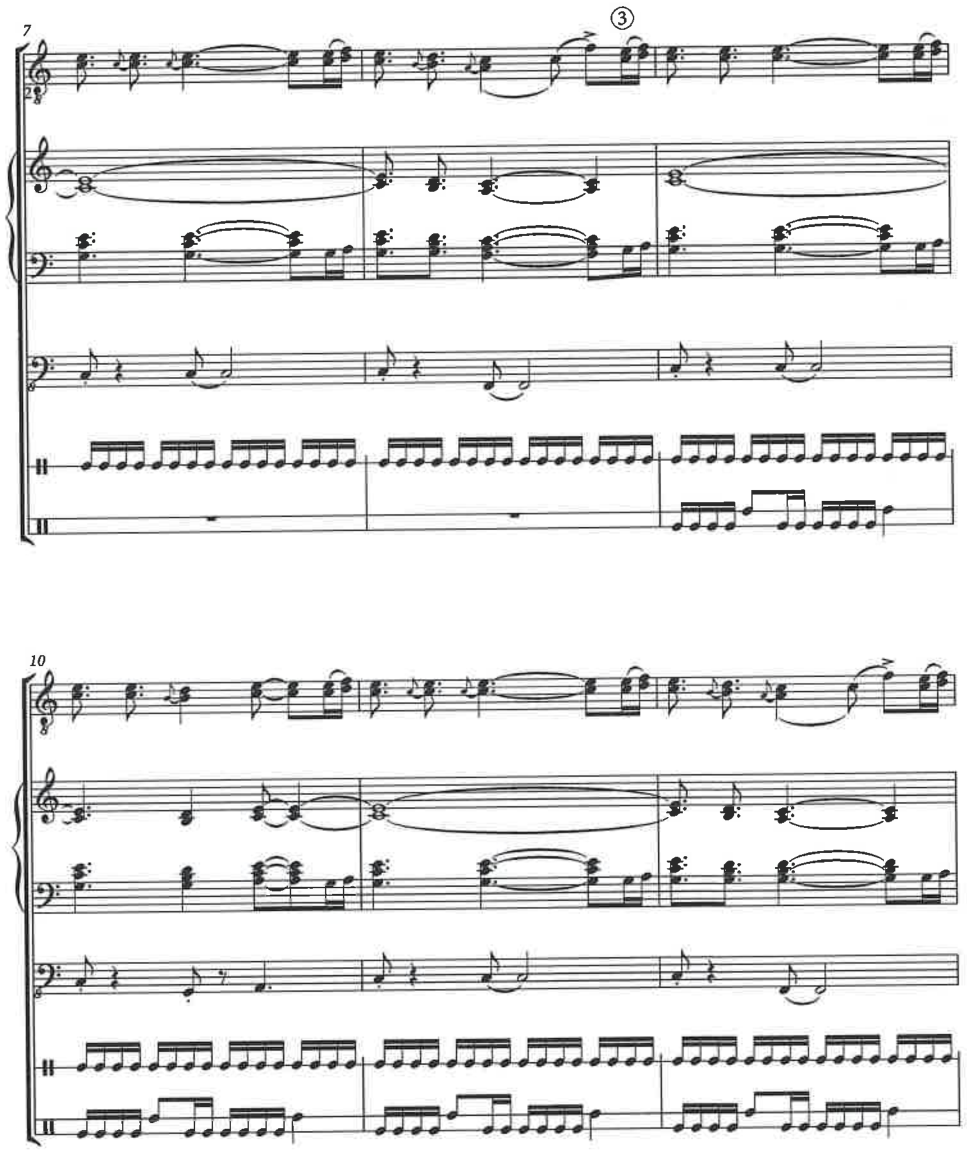
Conceiving of the groove for 'It All Depends' in terms of conceptual models allowed me to develop a fairly robust characterization of the basis for the musicians'

[1] For further examples of my formulation of conceptual models and the ways that they are used in structuring our understanding of music, see Zbikowski 2002, Chapters 3 and 5. I should also note that my choice of pronoun in discussing this example reflects the fact that all of those participating in the ensemble were men.

interactions as they performed, but, in developing my account, I left out the almost-certain presence of an important agent that framed and regulated their interactions. That agent was brought to my attention by Joti Rockwell who, after hearing the recording, suggested that it was almost certainly done with a click track set up by the



Example 2.1 Opening three statements of the groove of Eric Clapton's 'It All Depends' from *Behind the Sun*.



Example 2.1 Continued

producer.[2] As would typically happen, once the musicians had laid down their various parts, the click track would have been switched off or erased. I do not know if a click track was used to record 'It All Depends', although there is a rock-solid consistency

[2] The archetypal click track is simply a recording of regularly spaced 'clicks' or similar sounds which proceed at a tempo appropriate for the tune being recorded and with which musicians can synchronize their performance.

to its rhythmic frame that does not usually come about by chance. What is important for the argument I want to make here, however, is not whether a click track was actually used to make this recording but the role of such technologies in the creation of music. My characterization of the click track as 'an agent' within the recording session is intended to evoke the way technologies can put an absent person 'in the room' with other people, and to suggest how the people in the room interact with the technology. For the musicians on a recording session, then, the click track puts the producer in their midst, and they accordingly cede authority for the tempo and basic rhythmic framework for the session to the click track/producer.

The notion that producers could extend their agency by means of the click track, allowing them to be 'present' among the musicians without actually being in the same room, is one manifestation of the phenomenon of extended cognition recently advanced by a number of philosophers and researchers in cognitive science. The basic idea is that, in at least certain cases, the cognitive processes of individuals stretch beyond their brain and even their body, and out into the world at large. This possibility has some interesting consequences for how we think about consciousness, and in particular about consciousness as it is shaped by musical experience.

In this chapter, I will consider in some detail the way recent work on cognitive extension might shape how we think about musical consciousness, but before I do so I will untangle a few of the ideas I have just activated—the distribution of cognitive resources across the members of a group, the agency of individual actors, and the extension of cognitive resources through material means—the better to understand relationships between them.

Distributed cognition

Research in cognitive science over the past three decades has recognized that cognitive processes typically involve interactions between a number of cognitive systems and subsystems. Cognition is thus seen as distributed across these systems. While this perspective works quite well when considering the organization of the brain—for instance, the visual system interacts with the auditory system as well as the motor system—it is now generally accepted that cognitive processes also encompass distributed interactions between the brain and body.[3] Somewhat more surprisingly, this perspective can also be extended beyond the individual cognizer: in the case of the musicians performing Clapton's 'It All Depends', the cognitive processes that gave rise to the final version of the tune were distributed across the ensemble as a whole. Indeed, any group of humans working together can be seen as a distributed cognitive system that involves the brains and bodies of all those participating (Hutchins 2006: 376).

Distributed cognition is thus an approach to cognitive processes that obtains at different scales and that makes no a priori assumptions about the boundaries appropriate

[3] The literature on the topic is large and the issues are sometimes contentious. For a good discussion, which also engages in substantive ways with the topic of consciousness, see Damasio 1999.

for a particular unit of analysis. When considering the cognitive processes involved in the activities of a performing musician, our investigations may in some cases focus on interactions between various brain systems, in other cases, on interactions between the musician's brain and body, and in still other cases, on the musician's interactions with other performers and the environment within which the performance happens.

Agency

Much has been written about agency in recent years, but for present purposes we can construe an agent as an individual who causes things to happen.[4] In some of the writing on agency, the person to whom things happen is called a patient. For instance if, in the course of a guitar lesson, I took hold of your arm and moved it so that it was in the correct position for playing the instrument, I would be the agent and you would be the patient. Although prototypical examples of agency involve social exchanges, for some analysts a thing can also take the role of a patient: if, in the course of that same lesson, I took my guitar out of its case and put it in my lap preparatory to demonstrating some point, I would again be the agent but the guitar would now be the patient.

Humans have proven themselves particularly good at discovering ways to extend their agency. For example, I could decide, after you had left our lesson, that you needed a bit of additional material to practise before the next lesson. With this in mind, I could write down a melody and mail it off to you. Once you received my musical letter you could take up your instrument and play the sounds that would correspond to the notated melody. Within the basic framework I have described, I would again be the agent and you would be the patient (since I would have caused you to play certain sounds), but my agency would have been extended—reaching across time and space—by means of the musical score. The social anthropologist Alfred Gell, in his work on agency and artefacts, offered a helpful distinction between primary agents (beings who intentionally cause things to happen) and secondary agents (such as musical scores), which are the means by which primary agents distribute their agency (Gell 1998: 20). Returning to the recording of Clapton's 'It All Depends', if a click track was used, it could be seen to function as a secondary agent through which the producer, as primary agent, realized his or her agency.[5]

4 This perspective on agency comes from the work of Alfred Gell (1998: 16), which informs my own approach to agency.

5 Another framework for analysing the relationships I describe here is provided by Actor-Network theory, which would approach all of the entities involved in this exchange—the teacher, the notated melody, and the student—as actors within a network. See, for instance, Latour 2005, Chapter 4, and Sayes 2014. Although there is much to recommend such an approach (not least because it highlights the essential role played by a musical score in the exchange I describe here), I find it somewhat more helpful to adopt Gell's terminology, which captures better the various subject positions involved in the exchange and, as a consequence, the thought processes associated with these subject positions.

Cognitive extension

Although I will consider the notion of cognitive extension in greater detail, for the moment we can think of extended cognition as a mid-level instance of distributed cognition, one in which the focus is on how individuals exploit the resources offered by their body and the immediate environment (Hutchins 2014). To get the performers on a recording session to adopt the right tempo, for instance, a producer could take a drumstick and tap it against the edge of a music stand. The material means engaged—including the producer's body, the drumstick, the music stand, and the resulting sounds (with the understanding that there is feedback among all of these that would affect brain processes)—would become part of a larger system through which cognitive processes were distributed. To get around the problem of introducing unwanted sounds into the session, a click track (heard only through headphones worn by the performers) could be used and would—as would body, drumstick, and music stand—again extend producers' cognitive processes beyond the limits of their brain.

As I noted earlier, the click track could also be seen as a secondary agent through which producers, as primary agents, realize their agency. The notion of secondary agency accords well with the idea that cognitive processes might be extended through material means. That said, whether one approaches the use of a click track on a recording session as an instance of secondary agency or cognitive extension depends on the overall perspective the analyst wishes to adopt. If the emphasis is on the individual, cognitive extension is a natural way to think about how thought processes are shaped by interactions with the environment. If, however, the emphasis is on interactions between individuals, then a perspective focused on agency seems more appropriate. Because I believe any discussion of consciousness should begin with individual experience, in this chapter I shall focus on cognitive extension; because musical practices invariably occur within social settings (or simulacrums of social settings), the topics of agency and distributed cognition will nonetheless remain relevant.

Cognitive extension and the shaping of musical consciousness

This chapter explores how the notion of extended cognition invites us to rethink our ideas about the ways musical practices shape consciousness. This exploration will expand on an idea developed in previous work, where I proposed that the kind of consciousness that is created through musical utterances is markedly different from the kind of consciousness that is created through linguistic utterances (Zbikowski 2011). Part of this difference has to do with the way that musical utterances draw on and exploit cognitive resources of a sort directly implicated in research on cognitive extension.

In the section entitled 'Musical consciousness', I review the approach to musical consciousness I set out in my earlier work (Zbikowski 2011), with particular attention to the part social interactions play in the construction and maintenance of musical utterances. Following that, I offer a brief summary of the notion of extended cognition, drawing principally from the philosopher Andy Clark's work over the past decade. This leads to a further consideration of the relationship between extended cognition and the distributed cognition perspective, as well as the connection between extended cognition and consciousness. I then consider some of the different forms cognitive extension can take in musical practices and reflect on what such examples might tell us about *musical* consciousness. In the concluding section, I return to ensemble performance of the sort exemplified by the recording session for 'It All Depends' to explore how musical sound itself might be construed as an example of cognitive extension and, thus, a means to shape the conscious experience of the musicians who make up an ensemble.

Musical consciousness

I began my previous consideration of music and consciousness (Zbikowski 2011) with a discussion of music for social dance—specifically, the waltz. This had the advantage of getting quickly to one of the distinctive features of musical utterances, which is their close connection with embodied experience. This connection could come about through attempting to match our steps to the music for a dance, but it could also come through emotional responses activated by music, through observing the movements performers make as they give voice to the music, or through imagining how we might move along with, or in response to, the music. There is strong evidence that embodied experience is central to much human thought, but two factors push the role of the body in *musical* understanding to the foreground. First, musical sounds are, for the most part, insubstantial: although we can certainly feel vibrations associated with sounds (especially at the lower end of the frequency spectrum), our typical impression of musical sounds is that they enter our consciousness more or less directly. Connecting such sounds with bodily experiences offers a way to anchor them in an immediate and concrete way. Second (and as a number of authors have observed), the meanings attached to sequences of musical sound can vary widely.[6] Conceiving of those sounds as gaining some of their meaning through embodied experience makes it possible to circumscribe, if not precisely contain, musical meaning.

The importance of embodied experience to the understanding of music demonstrated by my analysis of the relationship between the music and steps of the waltz led me to argue that musical utterances give rise to a distinctive kind of experience, which is in turn associated with a distinctive kind of consciousness. A key pivot in this argument was provided through a consideration of the relationship between consciousness and memory. In brief, it is difficult to develop any principled account of the cognitive processes associated with consciousness without taking into account memory function: as I noted in my 2011 chapter, one of the biologist Gerald Edelman's catch phrases for core consciousness was 'the remembered present' (Edelman 1989). Current evidence suggests that the capacity for memory is not a single unified structure but is divided into systems associated with

[6] There is a rich and complex literature on musical meaning, one that I could not hope to summarize here; for a recent overview, see Clarke 2017. For an engagement with the topic close to what I offer here, see Moore 2012.

perceptual and cognitive subsystems (Rubin 2006). In the case of music, relevant subsystems for memory would include those associated with the recall of pitch relationships, affective valences, and physical dispositions (Zbikowski 2011: 185–6). With all this in mind, I proposed that the interrelated workings of these various subsystems yield a kind of consciousness that is distinctly different from the kind of consciousness associated with language or other communicative media.

Biological memory systems have much to recommend them, but one thing they lack is permanence: because of the nature of the synaptic connections that undergird memory, each time we recollect something we strengthen some of those connections and weaken others, a process that necessarily changes that which we seek to remember. Where the permanence of memory has been a particular concern—for instance, as a way to anchor culturally important practices, or to aid in learning—humans have developed a number of strategies to supplement their memories. These include drawing on the memories of other people (asking another member of the ensemble if they remember whether the melody for the tune we are trying to recall ascends or descends after a particular phrase), consulting external memory aids (such as a musical score), or even using our bodies to rediscover the correct continuation of a melody.[7] All of these are examples of distributed cognition: the relevant memory is provided through accessing the internal memory system of another person, or through information stored in the score or our own bodily actions; and all extend our cognitive resources beyond the bounds of our brains. If, as I have proposed, musical consciousness is shaped by memory functions and if the capacity of our memories can be extended through external resources, it seems likely that such extensions shape musical consciousness. This is certainly a provocative idea, and one that leads to the following question: just what is encompassed by the notion of cognitive extension?

Cognitive extension

Brains, bodies, and material resources

The notion of cognitive extension developed out of ideas about the interweaving of body, world, and action presented in the work of Martin Heidegger (1962) and Maurice Merleau-Ponty (2012), and more recent research in cognitive psychology that demonstrated how interactions with the body shape thought processes (Barsalou 2008; Varela et al. 1991). One of the principal questions raised by this work was where to draw the line when speaking of 'cognitive processes', since such processes are in some cases almost wholly dependent on relatively distal body processes: as a simple example, our concept of texture is shaped in a substantive way by our having touched different surfaces with our skin.

[7] The relationship between distributed cognition and memory research is explored in more detail in Michaelian and Sutton 2013.

One of the clearest and most compelling accounts of the notion of cognitive extension has come through the work of the philosopher Andy Clark in the course of his explorations of the limits and potential of research in artificial intelligence and robotics. In particular, Clark has been interested in how the interactions of bodies with the material world shape the way that problems can be solved. As Clark observes, 'One of the big lessons of contemporary robotics is that the coevolution of morphology (which can include sensor placement, body plan, and even the choice of basic building materials, etc.) and control yields a truly golden opportunity to spread the problem-solving load between brain, body, and world' (Clark 2008: 8). And this strategy, broadly speaking, is not simply a matter of a gradual process of coevolution: Clark notes that the canny cognizer tends to recruit whatever mix of problem-solving resources will yield an acceptable result with a minimum of effort (2008: 13). As a further entailment, Clark proposes that the continuous process of sensing used by biological organisms means that the external scene can function as an information store to be called upon just in time for the task fragment at hand (2008: 15).

All of this leads to a perspective in which the brain and mind are not simply in an intimate relationship with the body, but in which the body's interactions with the outside world become part of how brain and mind are constructed. An example of this process of construction was offered in a review by Angelo Maravita and Atushi Iriki of research related to the notion of a body schema. In their review, Maravita and Iriki described a set of experiments with Japanese macaques that demonstrated how tool use could change the monkey's body schema. Although macaques rarely exhibit tool use in their natural habitat, they can readily be trained to use a small rake to retrieve food that is beyond their unaided reach. The experimenters found that after only five minutes of tool use, the visual receptive field of the monkey had expanded from the hand to include the entire length of the tool (Maravita and Iriki 2004: 79–80). Using the rake had functionally expanded the monkey's body schema to include the resources offered by the rake.

While Clark took results such as these as evidence for the intimate relationship between body and brain, his aim was to move beyond the ways in which embodied experience shapes thought to a consideration of how humans recruit external and non-biological information processing for both temporary and long-term use (Clark 2008: 39–40)—how, in one of Clark's memorable formulations, 'the mind itself leaches into body and world' (2008: 29). To aid this move, Clark suggested thinking in terms of three grades of embodiment: mere embodiment, basic embodiment, and profound embodiment. In his words, 'A merely embodied creature or robot is one equipped with a body and sensors, able to engage in closed-loop interactions with its world, but for whom the body is nothing but a highly controllable means to implement practical solutions arrived at by pure reason' (2008: 42). This, then, is the more or less traditional way that philosophers and artificial intelligence researchers have viewed the body: as a slave system necessary to do the work of the brain (or the central processing unit) but functionally interchangeable with any equivalent system capable of implementing the commands. Contrast this with Clark's second grade of embodiment: 'A basically embodied creature or robot would then be one … for whom the body is not just another problem space, requiring constant micromanaged control, but is rather a resource whose own features and dynamics (of sensor placement, of linked tendons and muscle groups, etc.) could be actively exploited allowing for increasingly fluent forms of action selection and control' (2008: 42). This is, in the main, the approach to embodiment that developed in the last two decades of the twentieth century, one in which the thought processes of the brain (or the central processing unit) are actively shaped through interactions with the body. Clark notes, however, that robotic systems designed along these lines are unable to learn new kinds of body-exploiting solutions in response to damage, growth, or change. By contrast, biological systems—and especially those characteristic of primates—seem to be specifically designed to search for opportunities to make the most of body and world. This insight leads Clark to his last grade of embodiment: 'A profoundly embodied creature or robot is … one that is highly engineered to be able to learn to make maximal problem-simplifying use of an open-ended variety of internal, bodily, or external sources of order' (2008: 42).

Again, the distinctive aspect of a profoundly embodied mind is that it promiscuously exploits both the body *and* the world, forever testing and exploring ways to incorporate new resources and structures into problem-solving regimes (Clark 2008: 42). One example that Clark uses to illustrate this idea is that of contemporary recording technology: he notes that the 'technologies of sampling, stopping, dilating, looping, slowing-down, speeding-up, warping and just generally mixing' reveal hidden structures in musical forms and provide a means of manipulating those structures in real time while monitoring the sounds produced (Clark 2010: 27). Before the advent of recording technology, musicians had to rely on their internal sonic imaginations for the manipulation of sound. Once this technology became readily available, they could use it to manipulate sounds as though they were material objects. Musical thought is thus transformed for those whose musical practice is framed by these technologies, just as the technology of a hammer or rake transforms the way we interact with and think about the material world.

Cognitive extension, distributed cognition, and musical practices

As suggested by my remarks at the beginning of this chapter, there is an intimate connection between the notion of extended cognition and the perspective provided by the distributed cognition approach. This connection was quite evident in Clark's 1997 book *Being There*, which built on ideas about distributed cognition set out in Edwin Hutchins's *Cognition in the Wild* (1995). Hutchins's research on the navigation of large naval vessels showed that components of the task of guiding the vessel through unfamiliar waters were distributed among sailors assigned to the navigation crew, such that each member of the crew represented a cognitive resource within a distributed system (Hutchins 1995). Among the important elements of this system were what Hutchins came to call *material anchors*—for the navigation crew, this included the chart on which they plotted their course—which collected together and preserved a body of information that would have been impossible for any one member of the crew to recall (Hutchins 2005, 2006). By distributing cognitive processes around the human and non-human (tools and technologies) elements of this system, the navigation crew thus availed themselves of different external means for managing and organizing cognition, a state of affairs that corresponds directly with Clark's ideas about extended cognition.

What is important in Hutchins's perspective, however, and what tends to be downplayed in Clark's is the structuring role of culture within distributed cognition systems that involve groups of humans working together. For the navigation crew, the structure is provided by the cultural context of working on a naval vessel. For musicians assembled for a recording session or ensemble performance, structure is provided by the cultural context of musical practices (which may extend to the commercial concerns that inform many recording sessions). Some of the resources exploited by the canny cognizer who is also a performing musician may, in consequence, include the actions and activities of other performers, as well as the environment within which musical performance occurs.

Cognitive extension and consciousness

In his work from the 1990s, Clark made clear that he did not think that consciousness extended beyond the experience of the individual (Clark 1997: 215; Clark and Chalmers 1998: 10). It nonetheless seems clear that the experience of the individual is not simply a matter of what goes on within the brain: the body and, in most cases, the immediate environment are deeply involved in the way experience unfolds. In his most recent work, Clark has adopted an approach to cognition called predictive processing which leads towards an even tighter connection between internal cognitive processes and interactions with the environment: what counts for structure in the external world turns out to be a reflection of the possibilities for embodied action offered by the environment. What emerges is a view of humans as creatures whose bodily needs, condition, and sense of physical presence are central to knowledge-driven, active encounters with a structured and inherently meaningful external world (Clark 2016: 239). And so, while consciousness is still a mark of individual experience, that experience is itself shaped in substantive ways by encounters that stretch beyond brain and skull. This perspective is particularly applicable to the kinds of consciousness that are associated with musical practices, for there is ample evidence—a portion of which I survey in the next section—that musical thought readily spills over into the material world.

Cognitive extension in musical practices

The Guidonian hand

As I noted in my preliminary observations about the circumstances that contribute to the kinds of consciousness that are associated with musical practices, musical sounds are, for the most part, insubstantial. This creates a practical problem—the problem of anchoring musical sounds so that they can be learned and studied—that is only partially solved by connecting those sounds with dispositions and habits of the body. The challenge of music's ephemerality was especially acute for Western musicians during the middle ages, when

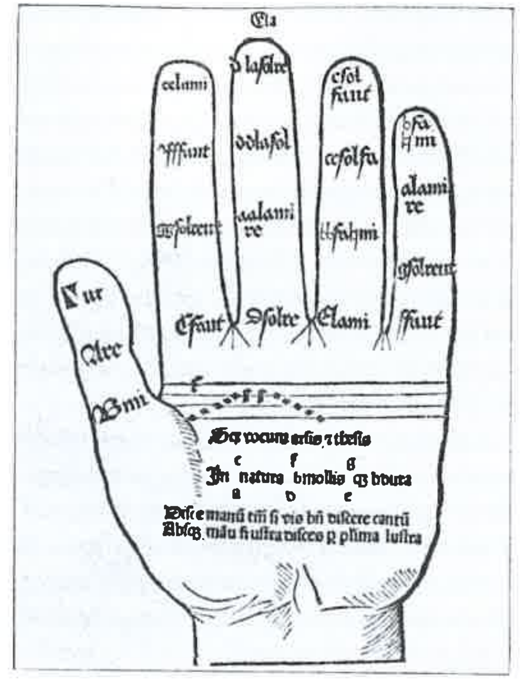


Figure 2.1 Guidonian hand by Hugo Spechtshart of Reutlingen (c.1286–c.1360). The hand serves as a mnemonic for the pitches of the medieval gamut, which begins at the tip of the thumb (gamma-ut, A-re, B-mi), continues across the base of the fingers (C-fa-ut, D-sol-re, E-la-mi, and F-fa-ut), and then spirals across the digits (Sherman and Lukehart 2000: 176–7).
Source: Music-Images/Alamy Stock Photo.

musical practices became firmly linked to religious worship. This linkage had the effect of placing constraints on the performance of music: if the religious function of the music was to be realized, the music had to be performed accurately and consistently. To make this level of performance possible, musicians needed to receive a thorough training. One of the guides for such training that proved particularly robust was attributed to Guido of Arezzo, a Benedictine monk who lived during the early eleventh century CE (Palisca 1978: 49–56). Guido is credited with developing a system of solmization (that is, assigning verbal syllables to musical pitches) that allowed novice musicians to learn to read and to retain musical notation quickly and efficiently. The system was built around three interlocked hexachords, and by means of shifting between these hexachords, musicians could navigate among the 22 pitches that made up the medieval gamut. The system was not without its complications, and so musicians subsequent to Guido developed mnemonics for his solmization that were correlated with the digits of their fingers, yielding diagrams of the sort shown in Figure 2.1.[8]

[8] During the middle ages, a multitude of memory tasks were anchored by the image of the human hand, ranging from those associated with astrological signs and relationships to computation to calendrical

Most significantly for the point I wish to develop here, there is clear evidence that the Guidonian hand served as a material anchor both for solmization syllables and for music's ephemeral sounds. For instance, John Cotto, writing in the twelfth century, observed, 'let him who strives for knowledge of music learn to sing a few songs with these syllables until he knows fully and clearly their ascents and descents and their many varieties of intervals. Also, let him diligently accustom himself to measuring off his melody on the joints of his hand, so that presently he can use his hand instead of the monochord whenever he likes, and by it test, correct, or compose a song' (Palisca 1978: 104). And indeed it was this process of measuring off melodies on the hand that was the reason that almost every one of the extant diagrams of the Guidonian hand shows a *left* hand, the right hand being used to trace a path through the gamut that the musician understood was arrayed on the joints and digits of the hand (Berger 1987: 10).

In sum, then, the Guidonian hand—as a mnemonic device effected/enacted through imagery and motor actions—provided a means by which singers could externalize their thought processes, including those related to the recall of musical structures and the negotiation of melodic intervals. Indeed, it appears that for some musicians of the middle ages, the conception of music was grounded and regulated through the material anchor provided by the Guidonian hand, such that pitches not accommodated within the gamut could be described as being 'beyond the hand'.[9]

Composers and scores

The technology of the score—that is, the gathering of all of the different notated parts for a musical ensemble into one master document—is so familiar to musicians and so ubiquitous across a wide range of musical practices that it can be difficult to imagine a world without it. For performers, it provides a simple and straightforward means to understand how the different parts of an ensemble relate to one another—thinking here of the way members of a string quartet might consult a score in the course of a rehearsal—and for composers, it offers the means through which the work as a whole can be conceived. And yet, as Jessie Ann Owens (1997) and others have shown, there was a significant period of music history during which performers and composers within the Western tradition got along without scores. For her part, Owens focused on the period from 1450 to 1600; before 1450, the manuscript evidence that was crucial to her argument is in short supply, and after 1600, scores began to be more common within the musical landscape.

As a point of departure, it is well to keep in mind that the pedagogy of the period with which Owens was concerned (which, of course, retained many of the practices of the

cycles. See, for instance, the essays and illustrations collected in Sherman and Lukehart 2000. For a further, and insightful, discussion of the role of the Guidonian hand in the conceptualization of music, see Mengozzi 2010, Chapter 3.

9 For a treatment of the ways in which medieval musicians negotiated discrepancies between musical practice and the pitches anchored by the Guidonian hand, see Berger 1987, Chapter 2.

middle ages) emphasized order and memorization. The result was a highly structured knowledge base, the many features of which were mutually reinforcing. Part of this reinforcement for musicians would have been embodied practice: to be a musician was to be a singer, and to give voice to the music of one's teachers and colleagues, as well as one's own compositions (Owens 1997: 12). It should also be noted that imitation was one of the predominant compositional strategies used in music of this period, which meant that the leading vocal strand in a composition served as a model for each of the voices that followed (although this model would, of course, have been at least partially obscured by the entrance of each successive voice). Musicians at higher levels of expertise were also expected to be able to improvise counterpoint, although it seems that the bar for musical production in such cases was set somewhat lower than for fully-worked compositions (Owens 1997: 68).

Musicians did, of course, make use of notation, which (as was recognized even at Guido's time) served as an invaluable tool for teaching and as a means to coordinate performances. That said, the choirbooks in common use during the fifteenth and sixteenth centuries simply gave individual performers what they needed for their performance—in this they were not unlike the 'lead sheets' that jazz performers still use—and as such were of little help to composers who needed to develop a conception of how all of the various strands of a multi-voice work related to one another. A format Owens and others have called the quasi-score, in which all of the parts of a composition would be gathered on one page, was also in use, but inasmuch as the parts were not aligned with one another they still presented a formidable challenge to musicians' aural imaginations. There are a few instances in which something like a score appears in treatises, but in all cases discovered thus far its use was limited to explaining how tablatures for keyboard or lute were created (Owens 1997: 42).

In any event, it seems clear from the manuscript evidence that composers from this period did indeed write their multi-part works without recourse to a score. To do so, as Owens notes, would have required a different sort of musical memory than that with which we are familiar. Owens brings this to the fore in her discussion of the advice Thomas de Sancta María gives in his 1565 treatise on improvisation. Owens notes that Sancta María counsels the student interested in improvising to undertake a close study of the compositions of others

> to see how the imitation works, to study the entrances of the individual voices and their placement relative to cadences, to study and remember all the cadences, to note all the consonances and dissonances, and to study the variety in the imitation of subjects. The impression is of careful study, one line at a time, and then line against line. The student is to keep in his memory the cadences and the melodic progressions so he may use them in his own improvisations (*fantasie*). We can assume from passages like this one that musicians must have had aural memories or habits of reading (perhaps voice by voice) quite different from ours. (Owens 1997: 54–5)

This is a point Owens also emphasizes in a postscript to *Composers at Work*, where she lists five main results of her study. The fourth of these concerns the matter of memory: as Owens observes, 'we need to invoke a different kind of memory to explain how composers could read and compose in separate parts. We need to free ourselves from the habit of score-based thinking and try to enter a very different conceptual world' (Owens 1997: 313).

Whether because of improvements in printing technology, the availability of less expensive paper, changes in musical style, or some combination of these and other factors, as the sixteenth century gave way to the seventeenth, multi-part scores gradually became a more common resource for musicians who needed to understand—or patrons who needed to see—how all of the voices in a composition came together. To my knowledge, there is as yet no full account of how this came to pass. What does seem clear, however, is that the introduction of scores reduced the demands made on the cognitive capacities of musicians who required a synoptic view of a composition. Rather than keeping separate musical lines in their memories, composers and students could let the score serve as an external form of memory, effectively extending an important cognitive process—memory—out into the world. Over time, the score also became the equivalent of a navigational map for those making their way through a piece of music, and thus a means to coordinate the contributions of different performers. In this way, the proliferation of the technology of the score transformed the way musicians thought about music, moving them from the very different conceptual world alluded to by Owens into one in which the holistic conception of multi-part musical compositions became, if not quite a commonplace, at least a ready possibility for those with access to a score.

Musicians and instruments

To some extent, the received view of musicians' relationships with their instruments has been similar to the perspective Clark characterized as mere embodiment, with the instrument regarded as 'nothing but a highly controllable means to implement practical solutions arrived at by pure reason' (Clark 2008: 42). Recent research, however, has shown that this view is far too limited. For example, in a set of experiments focused on how musicians' knowledge of their instruments shapes their understanding of music, Drost et al. (2007) asked experienced pianists to play either a C major or C minor chord on a muted MIDI keyboard in response to the appearance of the appropriate triad, notated in treble clef, on a computer screen. At the same time that the notation appeared, the pianists heard either a C major or C minor chord in one of five timbres: piano, organ, guitar, flute, or voice. On some trials, the chord that appeared on the screen and the chord the participants heard were congruent; in others, the stimuli were incongruent (meaning that the pianists saw, for instance, a C major chord but heard a C minor chord). The study found that response times for incongruent trials were only affected (they became longer) when the pianists heard the incorrect chord with a piano or organ timbre: if the timbre was that of a guitar, flute, or voice, the response times were not affected. Interference thus occurred not only when pianists heard their own instrument—the piano—but also when they heard the organ. The authors proposed that this was because both instruments belonged to the same category (keyboard instrument), distinguished in part by the instruments' physical affordances. To exclude the possibility that it was simply the case that

organ and piano sounds have intrinsic properties that make them easier to recognize, the authors conducted a similar set of experiments with experienced guitarists playing chords on the guitar, and produced similar results: response times for incongruent trials were only affected when the guitarists heard the incorrect chord with a guitar timbre (Drost et al. 2007: 531–2).

The close coupling between musician and instrument demonstrated by these experiments is a topic explored in much greater detail in Jonathan De Souza's *Music at Hand*. Drawing from philosophical perspectives provided by Heidegger and Bernard Stiegler, James J. Gibson's ecological theory, and research in cognitive psychology by Lawrence Barsalou and others, De Souza develops a compelling argument for the role that musical instruments play in shaping musicians' conceptions of sound. As De Souza points out, musical instruments, through the material stability that they offer, provide the invariance that enables players to coordinate sound with tacit and explicit bodily knowledge (De Souza 2017: 15). For instance, because pianos are for the most part quite similar to one another, musicians know that a given set of actions on a piano keyboard will give rise to a given set of sounds. Musicians' conceptions of musical sound thus come to be directly linked to, and mediated by, a material object.

This set of circumstances is, of course, susceptible to change. As frequently happens, musicians will modify their physical actions on a piano to create novel sounds—for instance, by reaching inside the piano to damp the strings with one hand while playing the keyboard with the other hand. Such modifications set up an interactive loop in which musicians' actions give rise to new musical possibilities, which then encourage further modifications of their actions and still other novel sounds. De Souza demonstrates the effect of a loop like this with close analyses of the ways Bob Dylan, Sonny Boy Williamson II, and Howard Levy use the diatonic harmonica. Dylan, for his part, almost never bends (or deflects) pitches on the harmonica and tends to play melodies in chords rather than as single notes; his performance style—which some reckon to be rather primitive—thus reflects the raw affordances of the harmonica's technology (De Souza 2017: 63–7). Sonny Boy Williamson, working within the tradition of blues performance, employs what harmonica players call cross-harp position, using a B-flat harmonica for an F blues. This provides Williamson with the flat seventh typical of the blues scale and also allows him to take advantage of the pitch bends that are readily available in the lower register of the instrument, but which do not seem to have been imagined by the original designers of the harmonica (De Souza 2017: 67–70). Howard Levy—a virtuoso on the instrument—makes use of a technique called overbending to further transform the diatonic harmonica into a fully chromatic instrument, which makes it possible to use a single diatonic instrument to play blues in six different keys (De Souza 2017: 70–2).

The expansion of musical possibilities represented by these different performance styles—spanning the range from sounds for which the instrument was specifically designed, to sounds that re-purpose and modify its basic affordances, to sounds associated with a rather different instrument (that is, the chromatic harmonica)—gives a glimpse of the ways musicians' interactions with their instruments shape their conception of musical sound. I should emphasize that my focus here is not on situations in which musicians first have a specific sound in mind and then, through the accomplished technique of the skilled performer, direct their body to take actions on the instrument to produce this sound. It is instead situations in which the musician—through what Howard Levy calls 'stubborn experimentation' (De Souza 2017: 71)—uses the instrument as an extension of the thought processes through which new sounds are created. Situations such as these, along with others discussed by De Souza, further demonstrate the close coupling of musician and instrument suggested by the experiments of Drost and his colleagues, and point to the way musicians actively recruit the resources of their external environment to develop their conception of music.

Musical practices, material anchors, and extended cognition

Both the Guidonian hand and the musical score are relatively straightforward solutions to the problem of representing the ephemeral sounds of music through external memory devices. In this, they are similar to any number of artefacts used by humans to manage long-term memory, providing both a durable store and a coherent system of organization. Less apparent, but equally important, both the hand and the score serve as topographical maps upon which sequences of musical sound can be traced: with the fingers of the right hand by the medieval musician, or with the eye (and perhaps also the hand) of the Renaissance composer. If it is the case that musical consciousness is shaped by the resources of memory—and there really does not seem to be a way to have the former without the latter—it stands to reason that musical consciousness must be shaped by material devices such as these in more or less subtle ways.

In the case of musicians' interactions with their instruments, the transformation of musical memory is more profound. Thanks to the countless hours musicians spend in practice, the instrument becomes a remarkable memory store, associated both with motor movements and specific sounds. As such, it can fully invade musical consciousness: for many musicians, to think of a musical passage is to think of a sequence of sounds given voice through specific instrumental means. The cognitive processes behind the creation or recollection of that sequence of sounds are in consequence extended out into the world through the instrument, and reflect back into the kind of consciousness that occupies the performing musician.

Although the way musical instruments shape consciousness seems particularly apparent to me (as a guitarist, I find that my conception of many musical passages is inextricably bound up with how they would be obtained or would sound on the instrument), issues related to what constitutes a cognitive process and how such processes might be extended out into the world leave a number of questions about cognitive extension and musical consciousness unanswered. Let me now add to and perhaps clarify these questions by considering how musical sound itself could be construed as one of the ways the mind leaches out into the world, especially as that sound is used to guide the interactions of performing musicians.

Musical consciousness and cognitive extension

Musical sounds as a manifestation of cognitive extension

Towards the end of his path-breaking *Thinking in Jazz*, the ethnomusicologist Paul Berliner took up the issue of interactions between the members of a jazz ensemble, which is typically comprised of a rhythm section with musicians on drums, bass, and piano joined by any number of soloists (Berliner 1994: chapter 13). Berliner begins his exploration of these interactions with the rhythm section, focusing on the interplay between the drummer and bassist that sets up the groove so essential to the sound of jazz ensembles (with 'groove' in this case understood as a consistent yet flexible rhythmic pattern that provides the foundation for a jazz performance). He goes on to consider the way that the harmonic material provided by the pianist inflects and responds to the drummer and bassist's groove, and how the musical exchanges between the musicians establish a framework for the performance as a whole. Berliner then turns to the soloists' interactions with the rhythm section, noting the process of give and take that pervades the performance environment:

> within the reciprocal relationships between soloists and supporting players, interesting ideas that originate in any part can influence others, leading to various kinds of imitative interplay. [Trumpeter] Lonnie Hillyer 'plays well' with [drummer] Leroy Williams because he can 'draw from him'. Hearing Williams play a tasteful rhythmic pattern in his drum accompaniment, Hillyer might 'play it back to him'. Conversely, Williams might hear Hillyer 'play a certain rhythm and play it back'. (Berliner 1994: 358)

What is important for my consideration of cognitive extension and musical consciousness—and what is apparent throughout Berliner's chapter—is that all of these interactions occur with little or no support from language or even visual cues. Indeed, practically all of the communication described by Berliner is effected through musical sounds that are produced so as to create the collective musical utterance that is the aim of jazz performance. These sounds are, for the musicians, the concrete manifestation of the thought of their colleagues. Quoting the drummer Akira Tana, Berliner observes: 'After a rhythm section becomes accustomed to particular soloists, it can "follow their train of thought and complement it"' (1994: 364). Again, the train of thought to which Tana alludes is one that is made evident principally through musical sound.

The sounds that musicians produce, then, serve to extend musical thought out into the world for the appreciation and apprehension of others. In this they are like spoken language, which has been offered as a clear example of cognitive extension by Clark and others.[10] If, however, we keep our focus on ensemble performance, we can note an important difference between the way musical and linguistic sounds are used: in ensemble

[10] For the initial proposal of language as an example of cognitive extension, see Clark and Chalmers 1998: 12–13. For an expansion of this viewpoint, see Spurrett and Cowley 2010, and for an opposing perspective, see Rupert 2010.

performance, musical sounds are typically produced with a view to contributing to a larger sonic structure. Inasmuch as this larger structure relies on sounds produced by other musicians, the whole is an example of distributed cognition: within the traditions of ensemble performance, producing any musical utterance relies on the cognitive capacities of all of the musicians involved. And because musicians, in the course of performance, necessarily respond to and interact with the sounds produced by their colleagues, their consciousness is actively shaped by the thoughts of those colleagues as revealed through sound. Berliner records the bassist Chuck Israels speaking directly of this transformation: 'No matter what you're doing or thinking about beforehand ... from the very moment the performance begins, you plunge into that world of sounds. It becomes your world instantly, and your whole consciousness changes' (Berliner 1994: 348).

Consciousness, extended cognition, and musical practices

Let me now return to my opening example to draw together some of the various strands I have pursued in my consideration of cognitive extension and musical consciousness. One thing that seems evident is that the performance of a musical groove such as that which provides the framework for Clapton's 'It All Depends' illustrates the distribution of cognitive resources across a system of humans working together. This system will not only involve the knowledge each musician brings to the task (their conceptual model of the groove, which they share with the other performers) but also the instruments they play, the equipment used to make the recording, and all the various individuals (engineers, technicians, producers) who facilitate the recording process. The consciousness of each participant is thus embedded within a distributed system dedicated to the cultural practice of making music.

Another thing that seems evident is that each person involved in this distributed cognitive system will have some sense of their contribution to the system. That is, they will have a sense of their own agency, a consequence of their conscious intention to shape events as they unfold. In that the cognitive system that provides the infrastructure for these events is also a social system, individuals will equally have a sense of the agency of others involved in the session. The complex, intertwined relationships that result—with multiple agents, multiple patients, along with manifold instantiations of primary and secondary agency—are ones that will, of necessity, shape the conscious experience of each person participating in the session.

And so, while consciousness will remain an individual matter, the way it unfolds in musical practices almost invariably involves a range of strategies that extend cognitive processes out into the world. Although the use of different sorts of technologies (including musical instruments and click tracks) is one of the obvious ways that the thought processes of musicians are extended beyond brain and skull, it is also apparent that one of the important clues ensemble musicians have about what their colleagues are thinking are the sounds they produce.

In my previous work I proposed that the kind of consciousness associated with attending to music is substantively different from the kind of consciousness associated with

attending to language, in large part because musical practices exploit memory systems that are focused on the salient features of dynamic processes rather than on lexical knowledge of relationships between objects and events. In exploring the relationship between cognitive extension and musical consciousness, I have highlighted another distinctive aspect of musical communication, which is the way that it exploits distributed cognitive processes. This exploitation is particularly evident in the performances of musical ensembles, but it is also indicated by the various resources external to the mind of the musician—resources such as musical scores and instruments, and perhaps even musical sound—that extend musical thought out into the material world. To think of technologies or material artefacts as involved with our inner thoughts—that is, to think of them as extensions of our cognitive processes—can certainly take us to strange and uncharted territory. And yet, when I am playing music with you, I can only know what you are thinking (musically) through the sounds you produce. Those sounds extend your cognitive processes out into the world to shape your consciousness and mine. From this perspective, musical sound itself becomes a technology or an artefact—however ephemeral—that speaks directly to thought processes that are profoundly human.

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Chapter 3

Music as affective scaffolding

Joel Krueger

Introduction

4E approaches in cognitive science see mind as embodied, embedded, enacted, and extended. They observe that we routinely 'offload' our thinking onto body and world. Tilting our head to make sense of a rotated image or text, for example—instead of rotating an internal representation—reduces information-processing demands (Risko and Gilbert 2016). Similarly, we use gesture to represent solutions to mathematical problems (Goldin-Meadow, Nusbaum et al. 2001), sketchpads to scaffold artistic creation (Loughlin 2012), models to better understand scientific theories (Toon 2015), and smartphones, search engines, and cultural institutions to support memory (Gallagher and Crisafi 2009). These 'beyond-the-head' targets of our offloading generate ongoing feedback loops that transform our cognitive profiles in real time and, in so doing, help us negotiate complex cognitive tasks. From a 4E perspective, understanding how minds work requires looking beyond heads and taking into account the different ways bodily, social, and material resources scaffold access to new forms of thought and experience (Clark 2008; Menary 2010; Shapiro 2011).

4E theorists have recently turned to music cognition: from work on music perception (Clarke 2005; Kersten 2014; Krueger 2009, 2011a; Leman and Maes 2015; Matyja and Schiavio 2013) and musical emotions (Cochrane 2008; Krueger 2014a, 2014b; Schiavio et al. 2016; van der Schyff and Schiavio 2017; Witek et al. 2014), to improvisation and music education (Elliott and Silverman 2015; Geeves and Sutton 2015; Schiavio and Høffding 2015). In this chapter, I continue this trend. I argue that music, like other tools and technologies, is a beyond-the-head resource that affords offloading and via this offloading, music can (at least potentially) scaffold access to new forms of thought, experience, and behaviour. I focus especially on music's capacity to scaffold *emotional consciousness*, including the self-regulative processes constitutive of emotional consciousness—although I will say some things about how music can scaffold other cognitive processes, too. In developing this idea, I consider two aspects of music that have been largely overlooked in the philosophical literature: its 'material' and 'worldmaking' character. I apply these considerations to two cases studies: music as a tool for religious worship, and music as a weapon for torture.