Chapter 14

Empathy, enaction, and shared musical experience: evidence from infant cognition

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Introduction

Empathy is a kind of intimacy, an immediate sharing of experience and understanding.[i] In what follows, I consider how shared musical experiences can bring individuals into intense forms of communion and understanding—even during the earliest stages of life. The basic idea is that music can be thought of as an "aesthetic technology" (DeNora 2000) for co-constructing, with others, new relationships and shared experiences; it is a tool jointly used to create opportunities for empathic connection and basic forms of communication. The more radical idea defended below is that music dynamically motivates even the earliest infant–caregiver interactions. Various studies indicate that infants seem poised from birth to respond to music in relatively sophisticated ways, perceptually speaking. They are active perceivers. Moreover, within these early interactions, music plays—or at least *can* play—a crucial role in drawing out and guiding early communicative exchanges. And these early instances of active and shared musical experiences, I suggest, provide insights into how we interact with music both alone and with others later in life. This chapter is therefore a consideration of shared experiences of music—specifically, a consideration of how music functions as a tool for driving rudimentary forms of empathic connectedness. Most of the discussion that follows focuses on how infants hear and respond to music. I use "empathy" fairly broadly to refer to our basic capacity to experience and engage with the thoughts, feelings, and intentions of others in an immediate (i.e. non-inferential) way.[ii] Music is thus a tool for driving primitive but experientially rich forms of empathy.

In developing this idea, I stress the enactive character of shared musical experience.[iii] Shared musical experiences depend crucially on sensorimotor features of the animate body. To highlight this feature of shared musical experience, I characterize such experiences as dynamic processes of (1) joint *sense-making*, enacted via temporally extended patterns of (2) *skillful engagement* with music that are (3) synchronically and diachronically *scaffolded* by the surrounding environment. The discussion below treats these three aspects in turn, arguing that they collectively afford the unique sort of intimacy—empathy—possible within shared listening experiences.

So what?

What is the theoretical significance of this way of thinking about the social and enactive dimensions of musical experience? There are at least two reasons why this thesis is philosophically compelling. First, it challenges what the psychologist John Sloboda calls the "pharmaceutical

model" behind many philosophical and psychological treatments of music listening. According to Sloboda, this model rests on the idea that music listeners "are the passive recipient of musical stimuli which have the psychological effect they do because of the way that the human brain is constructed, on the one hand, and the way that music is constructed, on the other" (Sloboda 2005, p. 319). Music listening is thus largely a passive experience. Listeners passively contemplate a musical work and respond to it in a purely structural way, that is, in terms of whatever musical meanings a composer has seen fit to embed within a piece's compositional structure. However, this is a quite restricted way of thinking about musical experience in that it overlooks the active way that musical meanings are dynamically constructed, even by infants. Listeners, I suggest, have a great deal of perceptual autonomy in what they do with music: how they listen, what sort of meanings they choose to enact, and how they actively engage with music to forge relationships and shared experiences.

Second, there is a tendency in some circles to see music and musical experience as somehow inessential to the business of everyday life. Steven Pinker (1997) famously calls music "auditory cheesecake." Since it has no clear adaptive function, according to Pinker, music is ultimately a pleasurable but evolutionarily irrelevant artifact lacking developmental sustenance:

> Compared with language, vision, social reasoning, and physical know-how, music could vanish from our species and the rest of our lifestyle would be virtually unchanged. Music appears to be pure pleasure technology, a cocktail of recreational drugs that we ingest through the ear to simulate a mass of pleasure circuits at once. (Pinker 1997, p. 528)

I argue that this pharmaceutical view of musical experience is simply mistaken. Not only does it ignore the active dimension of musical experience, it also overlooks the ways that music and musicality are deeply embedded in everyday life, informing and shaping our relationships and communicative practices. Indeed, without music as a regulating force, our social and emotional lives would change dramatically.[iv] Moreover, as the discussion below will show, "musicality" is an essentially quality of fundamental forms of embodied interpersonal communication. Basic rhythms and expressive contours of these pre-linguistic bodily engagements have an inherently musical character. Music itself is, once again, a crucial aesthetic technology that we regularly employ to deepen social intimacy and to train the young in communicative practices essential to their social being. In short, music enhances and refines our affective capacities and empathic relatedness. It plays a critical role in shaping our sociality.

Intersubjectivity and "communicative musicality"

The notion of a developmentally primitive "communicative musicality" (Malloch 1999) has recently received much attention.[v] It captures the musical patterns that are part of the infant's earliest social engagements with others—that is, the affectively governed dynamics of "coordinated companionship" characterizing healthy infant–caregiver interactions (Trevarthen and Malloch 2002, p. 11). Importantly, this early musical interaction is pre-linguistic. It is contoured through the fine-grained inflection of expressive vocal and bodily gestures that bring infant and caregiver into a state of felt attunement (Malloch 1999) or a kind of musical empathy. For instance, caregivers around the world intuitively adopt certain forms of expression calibrated to stimulate the infant (Trainor and Heinmiller 1998, p. 78). This includes things like exaggerated movements, facial expressions, and gestures, as well as "infant-directed" speech consisting of raised pitch, slowed tempo, elongated vowels, and slow pitch contours with large frequency ranges modified to capture the infant's attention and draw out their innate communicative capacities (Stern *et al.* 1985; Papousek and Papousek 1987; Malloch 1999). These exaggerated sound features are often found in music, giving

these structured patterns of engagement a quasi-musical character.[vi] Additionally, these mutually coordinated patterns appear to facilitate interpersonal understanding. They afford an immediate and direct kind of experiential access to the thoughts, feelings, and intentions of others insofar as these are articulated in and through the dynamics of bodily expressiveness (Gallagher 2008; see also Zahavi 2001; Thompson 2001; Krueger and Legrand 2009; Krueger 2011b). The notion of "communicative musicality" thus emphasizes the immediate way that feelings and experiences are coordinated and shared within interpersonal contexts via the musicality of the expressive body.

According to Colwyn Trevarthen and Stephen Malloch (Trevarthen and Malloch 2002; Malloch and Trevarthen 2009), communicative musicality harbors three dimensions: *pulse*, *quality*, and *narrative*. "Pulse" refers to "the regular succession of discrete behavioral events through time, vocal or gestural, the production and perception of these behaviors being the process through which two or more people may coordinate their communications" and anticipate future communicative interactions (Malloch and Trevarthen 2009, p. 4). Communicative pulses provide the forward momentum driving our interpersonal exchanges. "Quality" refers to "the modulated contours of expression moving through time" (Malloch and Trevarthen 2009, p. 4). This includes both psycho-acoustic attributes of various vocalizations as well as attributes of direction and intensity of bodily gestures. Pulse and quality come together to form temporally extended "narratives" of expression and intention which emerge within sequences of joint gesture and vocal exchange. These affect-driven "'musical' narratives allow adult and infant, and adult and adult, to share a sense of sympathy and situated meaning in a shared sense of passing time" (Malloch and Trevarthen 2009, p. 4). Just as these qualities are essential to music, so, too, the argument goes, are they integral dimensions of our interpersonal engagements. It is the common "musicality" of our skillful bodily-affective encounters that, even before the development of language, allows us to "share time meaningfully together, in its emotional richness and its structural holding" and to forge communicative connections that link us in immediate, and immediately *felt*, ways (Malloch and Trevarthen 2009, p. 5). If infants can sensitively engage with these quasi-musical qualities, it appears that they emerge from the womb ready to enact the expressive rhythms and melodies that establish basic forms of social understanding.

I now want to further explore this notion of "communicative musicality" by looking at ways that music, particularly in shared listening contexts, facilitates a deep form of empathy and interpersonal intimacy. For while communication may in fact have a musical character, as Trevarthen and Malloch suggest, music itself, I suggest, is immediately recognized (even by the very young) as an environmental structure that affords the cultivation of social relationships and shared experience. With their suggestive notion of "communicative musicality," Trevarthen and Malloch seem to use "musicality" in a metaphorical way when describing the character of early forms of social interaction. But music, I suggest, can be a tool for refining our inherent socio-communicative musicality—bodily skills at the root of our capacity for empathy. An extended consideration of neonate music therapy will demonstrate how this is so.

Shared musical experience: joint sense-making

Christopher Small (1998) has coined the verb "musicking" to emphasize the active and situated nature of musical experience in all its variegated forms. According to Small, musicking is "to take part, in any capacity, in a musical performance, whether by performing, by listening, by rehearsing or practicing, by providing material for performance (what is called composing), or by dancing" (Small 1998, p. 9). This broad definition is Small's attempt to situate music and musicality within the common practices of everyday life. Additionally, it is compatible with Malloch and

Trevarthen's notion of "communicative musicality." According to Small, the primary function of music is to establish interpersonal relationships. Small thus argues that "music's primary meanings are not individual at all but social," and that they are, moreover, "fundamental to an understanding of the activity that is called music" (Small 1998, p. 8).

To return to the main thesis, the first proposal that I want to defend is that, as a form of active and socially situated musicking, shared listening episodes are episodes of "joint sense-making": cooperative processes of meaning construction and appreciation. Sense-making within the literature on enactive cognition is seen as a relational and affect-laden process by which an organism actively generates a meaningful world (Varela *et al.* 1991; De Jaegher and Di Paolo 2007). By "joint sense-making," I also have in mind something akin to what the phenomenologist Alfred Schutz, in writing about musical experience and communication, has called a "mutual tuning-in relationship": a primitive, bodily-affective resonance and empathic understanding that grounds all antecedent forms of linguistic communication (Schutz 1951, p. 161; see also Gendlin 1997). Schutz defines this connection as a relationship in which "the 'I' and the 'Thou' are experienced by both participants as a 'We' in vivid presence," one which "originates in the possibility of living together simultaneously in specific dimensions in time" (Schutz 1951, pp. 161, 162). Making music together—which, like Small, Schutz insists includes both performing as well as listening since the interpretive activity essential to the latter is itself a kind of experiential composition (Schutz 1951, p. 170)—is thus a cooperative activity. It discloses the primitive way that subjects share experiences, feelings, motives, and, most crucially, *felt understandings* independently of linguistic expression. This is because the "meaning structure" of such communicative episodes, according to Schutz, "is not capable of being expressed in conceptual terms; they are founded upon communication, but not *primarily* upon a semantic system used by the communicator as a scheme of expression and by his partners as a scheme of interpretation" (Schutz 1951, p. 159). Rather, the resonance and understanding within these instances is established by a pre-linguistic, affectively charged relation—again, what Malloch and Trevarthen term "communicative musicality."

Joint sense-making, at least in the form I am concerned with here, is therefore a process that unfolds prior to linguistic competence. As the notion of communicative musicality is meant to highlight, infants are motivated from the start by a primitive drive for affective connection, a basic need to affiliate that quickly blossoms into more articulate desires to share experiences and enter into sympathetic communion with others (Rochat 2009, p. 23). A great deal of empirical research supports the idea that newborns emerge from the womb with an innate or "primary intersubjectivity" (Trevarthen 1979): a range of embodied practices, such as imitative capacities (Kugiumutzakis 1999) and an attunement to the timing and emotional quality of bodily expressions (Gopnik and Meltzoff 1997; Nadel *et al.* 1999) that allow the infant to interact with caregivers in meaningful (and musical) ways. Part of this "primary intersubjectivity" also consists of a perceptual sensitivity to the emotive values carried by harmonic and melodic parameters of the human voice (Trevarthen 2002, p.25). As Trevarthen observes there:

> [The] expressive signals of the whole body, but especially of face, voice and hands, are coherent in a single subjective or "embodied" time and space from birth. While the infant's knowledge and skills are at their most rudimentary, a vitality of action awareness is already there.

This action awareness and perceptual sensitivity to the musicality of communicative interactions is the root of joint sense-making.

To see how shared musical experiences are episodes of joint sense-making, consider the interactive character of neonate music therapy. Music therapy refers to a cluster of music-based practices, techniques, and clinical interventions designed meet an individual's social, psychological,

physical, and spiritual needs within an ongoing therapeutic relationship (Magee and Davidson 2000). These interventions are designed to give patients of all ages the opportunity to explore and share emotions (Bunt and Pavlicevic 2001). While traditionally geared toward adults and children with various disabilities or mental health problems, there has in recent years been an increased focus on music therapy for neonates. This focus has arisen in response to what Tia DeNora terms the "paradox of cure in the neonatal unit"—namely, the idea that the very environment created to help the infant thrive (i.e. the neonatal intensive care unit or NICU) may instead exhibit features that inhibits their healing and psychological and physiological well-being (DeNora 2000).

A major problem is that the NICU furnishes an exceedingly unfriendly sonic world for the infant. In addition to the consistent flow of doctor and nurse activity, this sonic world is peppered with myriad sonic disturbances (e.g. the sound of respirators, bottles clanking on top of the incubator, amplifications of the infant's disorganized state via the heart monitor, etc.) generated by the very technology used to care for the infant (DeNora 2000, p. 80; see also Haslbeck 2004). This uninviting soundworld has the adverse effect of upsetting basic life processes and neonatal biorhythms which, in turn, negatively affect sleep regulation and state lability (Kaminski and Hall 1996, p. 46). So, after many months of becoming accustomed to soothing intrauterine sounds and rhythms, the transition from the womb to the NICU is a particularly harsh journey—one which may impede the neonate's healthy development (Collins and Kuck 1991, p. 24). Neonate music therapy has thus been developed to counteract this possibility.

Though research in this area is relatively young, there appear to be many positive benefits of neonate music therapy: reducing stress; providing stimulation in stimulation-deprived environments; promoting bonding with parents; facilitating neurologic, communication, and social development; exhibiting calming effects on pre-term and full-term infants; increasing oxygen saturation levels and shortening hospitals stays (Standley 2001, p. 213); facilitating various kinds of physiological and microbehavioral stability including stable heart rate, blood pressure, color, feeding, changes in posture, muscle tone, less frantic movements, rhythmic crying, cessation of grimacing, and regularization of sleep/wake cycles (DeNora 2000, p. 81). Beyond these psycho-biological benefits, neonate music therapy (as we will see below) also helps cultivate bodily skills essential to communication—including, for example, the temporal coordination of bodily movement and affective expression as well as sensitivity to the timing and rhythm of interactive turn-taking.

Given these psycho-biological benefits, playing music for babies within therapeutic contexts might be thought of as a form of "entrainment": the alignment or coordination of bodily features with recurrent features of the environment (Haslbeck 2004; Clayton *et al.* 2005).[vii] And the positive outcomes of music therapy—again, the fact that neonates are entrained to regulate their internal bodily states and expressive movements with positive recurrent features of this musical environment—affirms that music is an aesthetic technology being successfully "employed to meditate tensions between endogenous (bodily) and exogenous (environmental) processes within neonatal intensive care units" (DeNora 2000, p. 79). Music, it would seem, is balm for the neonate's embodied soul.

But why characterize neonate music therapy as an instance of joint sense-making? I suggest that there are three dimensions to this process that mark it as an instance of joint sense-making. First, the music is mutually (if implicitly) recognized as *experientially salient*, as a meaningful environmental structure to be attended to and engaged with. Second, the music is also mutually recognized as *affording communicative possibilities* between joint listeners. Third, the musical context is mutually used to generate *a shared attentional framework* which establishes a new domain of felt intimacy.

Like adults, infants, too, seem to appreciate and respond to music as an experientially salient feature of their perceptual environment. They implicitly recognize music as presenting an auditory structure qualitatively distinct from the unstructured ambient noise of their surroundings—and in music therapeutic contexts, as something they can use with others in meaningful ways. For example, both full-term and pre-term infants attend more fixedly to music than they do to other ambient noises; this suggests a preference for the sonic coherence and organizational structure of music in contrast to contingent environmental noise (Butterfield and Siperstein 1972; Standley 2001). Though infant activity tends to decrease in response to auditory stimuli generally, the most significant decreases are caused by music, further suggesting that music is a preferred auditory stimulus (Kagan and Lewis 1965). Other studies have found that infants are surprisingly discriminating listeners. Beyond merely tuning in to overarching musical patterns, they are also able to pick out and attend to fine-grained auditory properties of music such as pitch, melody, tempo, and musical phrase structure (Trehub and Trainor 1993; Trehub and Schellenberg 1995; Schellenberg and Trehub 1996; Trehub *et al.* 1999). Three- to six-month-olds can vocalize a matched pitch to sung tones (Wendrich 1981) and learn to turn toward a loudspeaker whenever they perceive a change in background melody (Trehub *et al.* 1987). Another study found that 2-month-olds are capable of remembering short melodies and later discriminating a remembered melody from other melodies (Plantinga and Trainor 2009). Infants are thus capable of hearing and responding to the particular sound features that carry a piece's expressive content. Even the very young possess the perceptual skills needed to find music perceptually captivating because of its emotional expressivity (Nawrot 2003).

Beyond merely exhibiting the perceptual skills needed to discriminate between music and noise, however, infants also seem to experience music as affording communicative possibilities. For example, Haslbeck (2004) found that, over the course of several music therapy sessions, the pre-term neonates in her study gradually became active participants within the sessions, intentionally seeking interpersonal contact via the music (which consisted of slowly sung melodies supplemented with a hand resting gently on the infant's chest or back). This interpersonal contact emerged via bodily entrainment. The infants enacted whole-body "rhythmic dialogues" with the music (Haslbeck 2004, p. 9). These dialogues (i.e. instances of communicative musicality) were established via a coordinated rhythmic alteration between the sung lullaby and the infants' bodily responses. Both sucking/swallowing and regularized patterns of respiration were observed to mimic the rhythmic alterations of the sung melody (e.g. sucking at the end of melodic phrases) (Haslbeck 2004, p. 9). More tellingly, the infants gradually initiated eye contact, summoned an increasingly attentive and engaged posture, and exhibited increased mouth movements (playing with the tongue, mouthing the vowels being sung, such as "o" and "u") and vocalizations during the sessions. Other movements included opening and closing of hands, wrinkled brows, and eyes opening and closing in sync with the rising or falling of the sung melody (Haslbeck 2004, p. 11). This opportunity for social contact within music therapeutic contexts is crucial—something that the infants in Haslbeck's sessions actively sought out—given the isolation of the pre-term infant's life inside the incubator.

Finally, the infants, working in concert with the caregiver, used the musical context to enact a shared attentional framework which, in turn, generated a new domain of felt intimacy. This was accomplished by a mutual temporal orientation to features of the rhythmic dialogue being shared. Haslbeck found that some of the infants responded to variations of melodic phrasings (e.g. pauses in the singing or changes in timing) by coordinating their own movements (e.g. respiration, sucking, hand movements, etc.) with these perceived variations. Describing an instance of this mutual temporal orientation, Haslbeck writes that one infant, Nelly, "does not only recognize a temporal

structure, she creates this temporal experience. She begins to orient herself, perceives my offer of contact and actively performs a first continuous interaction" (Haslbeck 2004, p. 10). To return to Schutz, it thus appears that, within the music therapeutic context, the infant appreciates and responds to the opportunity to enact a musically informed "mutual tuning-in relationship" with the caregiver, one that "originates in the possibility of living together simultaneously in specific dimensions in time" (Schutz 1951, p. 162).

An objection to this line of argument is that these descriptions simply attribute too rich a musical phenomenology to infants by suggesting that they are capable of hearing (much less appreciating) music *as* music.[viii] First, it may be objected that prolonged attention is in itself insufficient to establish aesthetic preference and/or appreciation. For example, passers-by tend to stare intently at road accidents, and it's unlikely that they are responding appreciatively to the aesthetic properties of the scene. Why assume that something like this is going on when babies attend fixedly to music? Second, being affected by music (as it appears babies are) does not establish that they can pick out music as qualitatively distinct from noise; rather, it merely affirms the relatively trivial point that they can perceptually distinguish between different kinds of noise. Moreover, non-human animals are also affected by music but we're unlikely to attribute aesthetic appreciation of music to them. For example, in an unpublished study, the psychologists Adrian North and Liam MacKenzie found that a thousand Holstein cows at two dairies produced 3% more milk over a 9-week trial period when played slow, relaxing music than when played fast music (i.e. over 120 beats per minute) or no music at all.[ix] Similarly, a 1998 study found that "playing the radio to chickens is an easy practicable way of enriching their environment and, perhaps, of helping to reduce their fear of new noises" (Jones and Rayner 1999). Sixteen per cent of 100 farmers surveyed in the study claimed that playing music increased egg production. But again, it's unlikely that the cows or chicken hear the music *as* music.

In response, it surely must be granted that speculating about the phenomenology of infant consciousness—much less animal consciousness—is a difficult affair. However, given the totality of behavioral evidence, it's not clear that these objections stick. First, the claim here is not that prolonged attention is both necessary and sufficient to establish musical appreciation. Rather, prolonged attention—when embedded within a repertoire of other behavioral responses comprising what I discuss above and below under the rubric of bodily entrainment—indicates that infants are, or can become, selectively aware of and orient themselves toward distinctively musical environments. In other words, the analogy with car crashes fails. Unlike with musical cases, no processes of bodily entrainment issue from prolonged attentiveness to car wrecks. Yet infants seem to implicitly recognize music as affording entrainment, and they often respond accordingly.

As I discuss below, part of these responses consists of active, self-initiated engagements with music. Moreover, it's not necessary that infants possess propositional knowledge of music to hear it as such (I shall say more about this later). Rather, it's sufficient for the purposes of this discussion that they simply pick it out of their sonic environment as qualitatively distinct from other noises—that is, as experientially *different* in terms of presenting an exploratory profile inviting bodily entrainment. For instance, studies have found that pre-verbal infants spontaneously display tempo-sensitive rhythmic motions of their body with music—this rhythmic bodily motion is, moreover, a source of positive affect—but that they don't exhibit this behavior in response to speech or other arrhythmic ambient noise (Zentner and Eerola 2010). Other studies have found that some parrots are capable of similar rhythmic coordination (Patel *et al.* 2009; Schachner *et al.* 2009). So, evidence suggests that infants and possibly some non-human animals hear and respond to music as music—that is, as phenomenally distinct from ambient noise, and as affording distinctive

exploratory profiles and entrainment possibilities—even if they lack the necessary propositional or conceptual capacities to classify it as such.

A similar line of objection concerns whether or not music therapeutic interactions involving neonates are cases of genuine sense-making, that is, shared processes in which partners actively construct mutually appreciated *meanings*.[x] Again, it might be argued that neonates simply lack the necessary cognitive capacities to appreciate the significance of these experiences to characterize them thus. However, the sort of sense-making (and simultaneously, meaning-*appreciating*) activity I am attributing to infants is not equivalent to a reflective or higher-order cognitive appreciation of the encounter. Rather, it is something more basic. It is inherent within the temporally flexible rhythms and mutual coordination of expressiveness that motivates these interactions.

To elaborate further: it is well-known that babies become distressed when their mother, after actively engaging with the infant for some time, suddenly assumes a still and unexpressive face—despite the infant's efforts to continue the interaction (Tronick *et al.* 1979). However, babies also become agitated and distressed when, while interacting with their mother in real-time via a double TV monitor, the live footage of the mother is suddenly replaced with recorded footage from earlier within the same interaction (Murray and Trevarthen 1985). In the latter case, the temporal coordination of that interaction has been disrupted; the infant's sensorimotor expectancies are no longer being fulfilled in a reliable and satisfying way. In other words, the interactive normalcy of the encounter—as well as the interpersonal meaning associated with this normalcy (i.e. the fact that the infant actively solicits a unique response based upon its own expressive contributions to the engagement)—is compromised, and the infant's distress response reflects an appreciation of this fact. Likewise, the infant's sensorimotor responses to the touch and singing of the music therapist indicate a similar appreciation of the interactive normalcy governing music therapeutic encounters. The infant seems to be responsively attuned to the interpersonal salience of the singing and the touch—and they intentionally enact a range of temporally sensitive entrainment responses to further motivate the back-and-forth dynamic of the encounter. Their active and intentional participation is in this way a primitive grasp of the meaning of the interactive episode. They skillfully perceive and respond to the particular expressive contingencies that give that interaction a unique social character. They play an active role in regulating this instance of social coupling.[xi]

Shared musical experience: skillful listening

In addition to comprising an instance of joint sense-making, shared musical experiences are also instances of skillful perceptual engagement. These cooperative "musickings" are jointly enacted musical *doings*. To continue with the discussion of neonate music therapy: infants, I suggest, possess an implicit sensorimotor knowledge that allows them to use music in an active, skillful, and self-aware way, to regulate their affective states and to establish and refine interpersonal relationships. This implicit sensorimotor knowledge is what gives all of us (including neonates and infants) experiential access to the expressive qualities of music.[xii] Additionally, it allows us to access music as something that we can use to actively do things with.

The sensorimotor knowledge I am here concerned with is the skills-based knowledge of how modulations of bodily movement and attentional focusing affect sensory change. For instance, when we perceive a visual scene, movements of the head or body change the way that occluded objects (e.g. part of a bush obscured by a tree standing in front of it) gradually reveal themselves as we move closer to or around them. We possess similar knowledge of how bodily movements and attentional modulations shape the character and content of musical experience. Rudimentary sensorimotor knowledge is thus the implicit practical understanding that, as an embodied agent,

I possess the sensorimotor skills needed to secure experiential access to different features of my world by using my body in different ways.[xiii] Being sensitive to the sensorimotor contingencies (i.e. the reliable ways that movement modulates experiential content) governing my relation to perceptual objects is what it means to be a "skilled" embodied perceiver (see O'Regan and Noë 2001).

In developing his sensorimotor account of perceptual consciousness, Alva Noë offers two conditions under which an object can be said to be perceptually available in experience (Noë 2009). A perceiver must implicitly understand

> in a practical, bodily way, that there obtains a physical, motor-sensory relation between the perceiver and the object or quality, satisfying two conditions:
>
> (i) Movement-dependence: movements of the body manifestly control the character of the relation to the object or quality
>
> (ii) Object-dependence: movements or other changes in the object manifestly control the character of the relation to the object or quality. (Noë 2009, p. 476)

When I say that babies know how to do things with music, what I mean is that babies implicitly recognize that the sensorimotor relation between themselves and the expressive qualities of music satisfy these two conditions. That is, they immediately recognize music (including the particular sound features that convey its expressive content) as something they can do things with, and they also immediately recognize how to use their bodies to do the things they want to with music. So, they know, for example, that moving their head slightly in one direction will allow for more focused attention to an especially pleasing part of a musical piece, bringing about a desired affective response; and they know that allowing their head to linger in that position will continue to afford this focused listening and affective response, at least until the sound source moves and they must adjust their body accordingly. Similarly, they know that turning their head the other way will suppress or push away (if ever-so-slightly) unpleasant aspects they find sonically uninviting. Babies thus have an implicit mastery of basic sensorimotor contingencies that govern the way that they are responsively attuned to different affordances in their environment—including expressive sound features within music. Musical qualities afford this interactional engagement.

As we saw in the previous section, neonate music therapy is a kind of coordinated interpersonal engagement—an active sharing of expression and feeling. This coordinated engagement emerges from a primitive sensitivity to the rhythm and direction of movement in others, which is "the natural regulator of social life for even very simple animals" (Trevarthen 2002, p. 26). This sensitivity is also manifest in the infant's responsive sensitivity to the dynamic qualities (e.g. rhythm and direction) of musical expression. The ability to appreciate the expressive aspects of music and coordinate shared interpersonal responses around these aspects is itself a sensorimotor skill. It is an example of active and skillful perceiving, I suggest, because within musical contexts neonates exhibit (1) a *selective orientation* to musical sounds, along with (2) a more fine-grained *critical discrimination of particular musical sound features*, both of which are enacted via (3) a *sensorimotor (i.e. vocal and gestural) engagement* with the music. Again, this is what it means to say that babies know how to use their bodies to do things with music.

As was noted earlier, neonates exhibit a selective orientation to musical sounds. They attend more fixedly to music than to other ambient noises (Butterfield and Siperstein 1972; Standley and Madsen 1990; Standley 2001). And via turning and focusing on the music (or conversely, fidgeting and turning away), they can actively foreground it within their perceptual field (or actively make it recede). Infants thus pick out music as something they can do things with, as something that affords unique experiences by virtue of the fact that "[a]coustically, music is unlike any other

sound; it is more pleasant, soothing, and interesting than noise and uses highly preferred frequencies and harmonics selected through centuries of refinement and development of a specific music type" (Standley 2001, p. 212). Moreover, as was also noted above, infants are surprisingly discriminating listeners. They are able to perceive fine-grained musical properties such as pitch, melody, tempo, and musical phrase structure (Trehub and Trainor 1993; Trehub and Schellenberg 1995; Schellenberg and Trehub 1996; Trehub *et al.* 1999). In this sense, they emerge from the womb as skilled listeners.

However, not only can neonates and infants perceptually discriminate between music and noise. Beyond this, neonates and infants present the perceptual skills needed to actively *appropriate* music for emotion regulation and interpersonal coordination. This is an important distinction. For it is one thing to hear music as music, but it is something else to *use* music, to act on music as an experientially salient environmental structure. However, there are empirical indications that infants both pick up on and exploit music in this way. Multiple studies have indicated that infants prefer listening to, and show heightened emotional responses toward, infant-directed "musical" speech, as opposed to adult-directed speech, where the former refers to "sing-song" speech intentionally modified to be pleasing to the infant: raised pitch, slowed tempo, elongated vowels, and slow pitch contours with large frequency ranges (Trainor and Heinmiller 1998, p. 78). Infants focus on (i.e. "use") musical speech since it affords emotionally pleasant and stimulating exchanges with caregivers.

They seem to do something similar with music, too. Despite the fact that they have no conceptual knowledge of musical scale structure or prior exposure to music, infants display an evaluative preference for consonant over dissonant musical intervals.[xiv] Not only can they perceptually discriminate consonant from dissonant interval notes, their prolonged looking indicates an affective preference for the former—even when they are embedded within a more sonically complex "naturalistic context" (Trainor and Heinmiller 1998, p. 83).[xv] Zenter and Kagan (1998) found similar results. However, not only did infants look significantly longer at consonant melodies, the infants in Zenter and Kagan's study also *used* the consonant melodies to regulate their affective states, that is, to bring about a more inquisitive and emotionally balanced state in relation to their sonic environment. The infants fretted less, exhibited less motor activity (i.e. they were less fidgety and more absorbed in the music), and vocalized more (i.e. expressed interest in the music) during the consonant melodies (see also Leonard 1993). Similarly, recall Haslbeck's (2004) findings that, over the course of multiple sessions, the pre-term infants in her study would synchronize bodily movements such as sucking (both rhythm and intensity), tongue and mouth protrusions, and eye opening and closing, with the rising and falling of sung lullaby melodies. So, it appears that the infants in these and other studies engaged with and actively appropriated the sonic structures in their immediate environment by engaging bodily with the music.

With age and experience these sensorimotor skills continue to develop and become more refined. Other research indicates how infants develop a richer understanding of how the ways that we move shape what we hear. For example, Jessica Philips-Silver and Laurel Trainor found that movement influences auditory encoding of rhythm patterns in both infants (Philips-Silver and Trainor 2005) and adults (Philips-Silver and Trainor 2007). In the earlier series of experiments, 7-month-old infants were trained by listening to an ambiguous 2-minute rhythmic pattern (i.e. a pattern lacking accented beats). During this training, half of the infants were bounced on every second beat and half were bounced on every third beat. As a result, the infants expressed a more prolonged interest in the auditory test stimulus with the metrical form [every second beat accented (the duple form) in one stimulus, and every third beat (the triple form) in the other] that matched the metrical form of their training bouncing (Philips-Silver and Trainor 2007, p. 1430). This was also the case when

they were blindfolded. A further experiment showed that personal bodily movement was necessary to establish this metrical preference. Watching the experimenter bounce during the ambiguous rhythm training failed to establish a preference for either of the auditory stimulus versions (Philips-Silver and Trainor 2007, p. 1430).[xvi] A similar set of experiments was later done with adults (Philips-Silver and Trainor 2007). Unlike the infants, of course, the adults could engage in their own "bounce training." But like the infants, the adults' synchronized movements of their bodies determined how they heard an ambiguous musical rhythm (Philips-Silver and Trainor 2007, p. 543). Once again, they had to personally bounce their own bodies, and not watch a video of another doing it, in order for their experience of the ambiguous rhythm to covary relative to their particular bounce training (e.g. bouncing on every second or on every third beat). But their sensorimotor training determined how they enacted the content of their experience of the ambiguous rhythm.

Bodily movements in this way modulate the listener's enactive relation to different features of the musical piece, such as meter and melody. Bodily gestures are a form of attentional focusing and the vehicle of perceptual construction. The animate body becomes a vehicle for voluntarily drawing out features of a musical piece (e.g. expressive aspects, rhythmic beats, or melodic progression) and foregrounding them in our attentional field. This drawing out is an enactive gesture in response to felt affordances within the music. The listener perceives the inner space of the piece as a space that can be entered into, experientially, and by doing just this shapes how the experiential content of the piece-as-given becomes phenomenally manifest. In short, "we hear what the body feels" (Philips-Silver and Trainor 2007 p. 544). What the body feels are sensorimotor contingencies—possibilities for interaction, movement, and coordination that determine the character and content of musical experience. Sensitive music listening is thus a kind of skilled coping with a sonic world, a kind of listening with our muscles. As Dewey (1934/1980, p. 237) notes, "sounds *come* from outside the body, but sound itself is near, intimate; it is an excitation of the organism; we feel the clash of vibrations throughout our whole body".[xvii] Musical pieces are therefore not simply constellations of acoustic properties or "pre-ordained gestures" (Iyer 2004, p. 168) collectively transferred from composer to listener (i.e. as within the pharmaceutical model of musical experience). Rather, even for neonates, a piece is actively engaged with in a bodily way. It contains sonic information that summons forth the perceptual and motor skills of the attentive listener absorbed within its spatial, temporal, and rhythmic duration.[xviii]

Shared musical experience as social scaffolding

The bodies we use to engage with music in active ways are always *situated* bodies, embedded in encompassing biological, social, and cultural worlds. Ideally, the infant's world is a socially rich world, full of stimulation and opportunities for interpersonal engagement. But beyond merely providing a rich phenomenological buffet of information from which the infant can selectively pick and choose, the environment plays a crucial enabling role in the development of the infant's social skills and interpersonal sensitivity. With respect to our burgeoning sociality, the dyadic unit of infant–caregiver interaction becomes an intimate relational circuit that drives and nurtures the child's psychological and physiological development. This dyadic unit itself—and again, the relational spaces and gestural and vocal transactions that compose it—is "scaffolding" guiding the child's communicative endeavors and supporting its burgeoning social intelligence.[xix] This persistent environmental scaffolding makes an active contribution to the development of social skills and cognitive processes. Environmental scaffolding, in the sense I am using the term here, thus plays two essential roles in driving cognitive processes and guiding behavior. First, it provides persistent

structures supporting both the synchronic and diachronic development of emotional and communicative performances. Second, it places *organizational constraints* on the development of these processes. The context determines both the form these processes take as well as the developmental trajectory they assume. Music, I suggest, often serves as environmental scaffolding that makes an active contribution to both the development and form of our social intelligence.

To begin to see how this is so, consider first Kenneth Kaye's work on the origins of social intelligence. Kaye has shown that breastfeeding—which consists of affective cycles of touch and movement—may play a crucial role in the infant's cognitive development (Kaye 1982). Kaye observes that breastfeeding constitutes the most immediate and complex form of social interaction that neonates and mothers engage in soon after the child is born (Kaye 1982, p. 37). He further notes that human infants are the only mammalian infants who breastfeed in short bursts. When human infants pause in their feeding, all mothers—including new mothers who report never having held a baby before their own—instinctively jiggle the infant as a bodily prompt to resume feeding. This jiggling seems to work; infants are more likely to resume feeding in the pause just after jiggling than they are during the jiggling or if they had not been jiggled at all (Kaye 1982, p. 38). This behavioral interaction is significant in that it is arguably one of the earliest instances of social understanding. The mother communicates a non-verbal intention; the infant perceives and responds to this intention. The give-and-take dynamic of this exchange provides the temporal template for the infant's future communicative encounters: "the mother's actions serve to organize this most basic and repetitive interaction between infant and mother, providing the prototype… for turn-taking interactions in general" (Wexler 2008, p. 111). The infant's behavior is guided and supported by the persistent presence of the mother's touch, as well as the bodily prompting provided by the jiggling. This interactive turn-taking is thus a primitive social skill; it is first learned within the physically intimate, gestural proto-conversation of breastfeeding. This and other research (some of which was cited earlier) indicates that infants are born with

> highly organized action systems that allow them to maintain close physical contact with caretakers they depend upon for their survival… It all starts with an innate endowment of prefunctional action systems to which caretakers are in turn instinctively attuned in order to dispense with the intensive care neonates need for their survival. (Rochat 2009, p. 25)

But again, the point is that the interactive dyadic unit *as a whole* is the social scaffolding upon which these social skills develop and emerge.[xx]

Music is a kind of social scaffolding. Music affords the cultivation of primitive social skills like interactive turn-taking and the temporal coordination of bodily movement and affective expression. As we've already seen, neonate music therapy (much like the majority of our day-to-day musical experiences) doesn't consist of mere passive listening. Rather, it is an enactive and embodied *doing*, a form of skillful perceiving. Moreover, it involves ongoing affective cycles of touch and movement—in addition to the active perceiving of the music itself. As Trevarthen and Malloch observe, "[w]hile the primary mode of awareness for the music therapist is aural, touch and observed bodily gesture also play a part in the reception of interpersonal 'presentations' that hold therapist and client in relationship" (Trevarthen and Malloch 2000, p. 5).

Infant-directed sing-song speech is a persistent auditory feature of the infant's early environment. This gives the infant's world an inherently musical character from the start. As was discussed earlier, caregivers around the world instinctively fall into musical patterns of communication and expression with infants. And they use similar intonation contours in similar contexts—for instance, employing rising contours to attract an infant's attention; smooth or falling contours to calm the infant; and sharp, flat contours to discourage naughty behavior (Fernald

1991; Papousek 1992). Moreover, caregivers sing to infants with the intuitive understanding that lullabies promote both emotion regulation (i.e. alter an infant's affective state) as well as sleep (Trehub and Trainor 1993, 1998). Attentive caregivers "are exquisitely sensitive to the perceptual abilities of their infants, singing to them more slowly, at a higher pitch, with exaggerated rhythm, and in a more loving or emotionally engaging manner than when singing alone" (Trainor and Heinmiller 1998, p. 78). As was briefly noted earlier, infants exhibit a clear preference for and heightened emotional response toward this sort of melodically expressive speech (Trainor and Heinmiller 1998), preferring happy-sounding melodically expressive speech to neutral-sounding speech (Singh *et al.* 2002).

Musical speech thus scaffolds the infant's behavior and emotional responses in two senses. First, it *synchronically* supports particular episodes in particular contexts. Within a specific encounter, the infant negotiates emotional feedback received from the caregiver (in addition to musical speech, accompanying cues like facial expressions, movements, gestures, and touch) by reciprocating with her own vocal and gestural responses—responses which in turn govern the tone, intensity, and affective coloring of the caregiver's subsequent responses. The ongoing dynamics of this temporally extended reciprocal feedback, unique to the context of that particular encounter, shape the character of the infant's emotions and communicative intentions within that context. Second, infant-directed, musical speech *diachronically* scaffolds the development of the infant's broader repertoire of emotional, social, and communicative skills. By repeatedly encountering infant-directed musical speech as a persistent feature of its social world, the infant progressively exploits this speech (and again, the accompanying non-verbal emotional cues) to cultivate the skills central to social life: skills like perceptual sensitivity to the open-ended, turn-taking processes and shared temporality of interpersonal exchanges; the ability to coordinate affect and expression; tuning in to the face as a rich source of emotional and social information, etc. As environmental scaffolding, infant-directed speech is thus a tool that infants use to develop and refine their emotional life.

As should now be clear, music can fulfill a similar scaffolding function. This is, in part, because babies are almost constantly surrounded by music. In addition to using musical patterns of speech, there is much evidence that we naturally sing to babies—and we do it almost constantly. Mothers in every culture sing to their infants (Trehub and Trainor 1998). This particular sort of maternal singing, in contrast to other forms of singing, is contoured with greater emotional expressiveness, higher pitch level, and slower tempo (Trainor *et al.* 1997; Trehub *et al.* 1997). Though fathers sing less to infants than mothers do, when they do sing it is characterized by a heightened emotional and expressive character (Trehub *et al.* 1997; O'Neill *et al.* 2001). Other research has found that even pre-schoolers sing more effusively in the presence of infant siblings (Trehub *et al.* 1994). It is clear that "the presence of a baby seems to influence the emotions of caregivers or bystanders, one consequence of which is highly expressive singing" (Trehub 2002).

Music and musical speech surround infants as a persistent informational structure within their environment. Given their sophisticated listening skills, as well as their preference for music and musical speech, it is thus an ever-present feature of their world, ready-to-hand for exploiting and exploring emotional expression. Within a music therapeutic context, the scaffolding function of music is manifest in both a diachronic as well as a synchronic sense. Within these contexts, music becomes a focused and intensified manifestation of the musicality that shapes the infant's social world. As argued above, music therapy sessions are instances of shared listening. Moreover, they are processes of joint sense-making, processes of mutual musical engagement in which a shared attentional framework is erected and a new domain of felt intimacy emerges. Synchronically, music facilitates fine-grained affective attunement between infant and caregiver. The coordination

or bodily entrainment that occurs is a result of the infant perceiving and responding to regularities within the music (e.g. textural qualities and melodic and rhythmic patterns[xxi]), regularities that beckon for deeper perceptual exploration.

In addition, within the synchronic or short-term temporal context of individual encounters, music, such as the sung lullaby of a caregiver, scaffolds the infant's affective negotiation of that context. Rising melodic contours, for instance, beckon the infant to engage further, to remain alert and poised for further interaction; downward contours indicate the conclusion of an interactive period. As the evidence surveyed above indicates, the infants perceive and respond to these melodic vitality affects (Stern 1985). They pick up on the expressive character of the music; the whole-body rhythmic dialogues they enact (e.g. coordination of respiration, sucking, eye movement, vocalizations, etc. with melodic contours of the music) reflect an ongoing appropriation of the music as a persistent informational structure within the infant's environment. More simply, they appreciate the music as something they can do things with (i.e. as affording communicative possibilities, as well as possibilities for emotional self-regulation)—and crucially, *they do things with it*.

In a long-diachronic sense, repeated encounters with music assist the infant in developing and fine-tuning emotional and social skills (Shenfield *et al*. 2003). Music entrains the infant to enter into and creatively participate within the shared time of interpersonal exchanges and to negotiate the melodic contours of these exchanges. To reaffirm an earlier point, perhaps the most important social skill that music (and musical speech) entrains is sensitivity to the flexible temporal parameters of interpersonal engagement, a sensitivity that is a precondition for negotiating meaningful shared experience. Music scaffolds the developmental acquisition of key features of the infant's emotional and social repertoire. It is, once again, a tool that infants actively exploit in the cultivation of their social being and the bodily skills essential for their empathic access to others.

Final thoughts

In this chapter I have investigated shared musical experiences, particularly insofar as they afford affectively powerful, and developmentally primitive, forms of empathic connectedness. Focusing especially on neonate music therapy, I have argued that shared musical experiences are very often dynamic processes of (1) joint sense-making, enacted via temporally extended patterns of (2) skillful engagement with music that are (3) synchronically and diachronically scaffolded by the surrounding environment. The animate body has been an important part of this story. For, as is now clear, the body is actively utilized as an expressive vehicle from birth. But an intriguing suggestion, which has emerged throughout the course of this investigation, is that even the earliest encounters with music are simultaneously encounters with the lived body. Thus music can train the young (and surely, the not-so-young!) in using the musicality inherent within the expressive capacities of the lived body. Research on neonate music therapy seems to confirm this, drawing our attention to the subtle rhythms and dynamic valences of affect and movement that fund primitive forms of bodily self-experience—as well as, importantly, the way that these subtle experiences are crucially interwoven with the experience of being in relation to others. The face, voice, hands, and feet—as well as an embodied appropriation of time and space (i.e. the temporal and visuo-spatial dynamics of our communicative exchanges)—from the very beginning are used to construct and convey shared motives and feelings. Music affords an active exploration of these embodied social skills, one that then continues as we mature both physiologically and aesthetically.

Notes

i I am grateful for exceedingly helpful critical comments from Stephen Davies, Jenefer Robinson, and Tom Cochrane on an earlier draft of this essay. I am also grateful for comments from audiences in Durham and Copenhagen.

ii This "direct perception" way of characterizing empathy is in line with the model of empathy found within the phenomenological tradition. See, for example, Zahavi (2001), Gallagher (2008), and Krueger (2012).

iii By "enactive," I mean to emphasize the way that skillful bodily action and perceptual experience are fundamentally intermingled. On this active view of perception, perceptual experience is enacted, or brought forth, by an agent's actively doing things in and to the world (see Varela *et al.* 1991; Noë 2004). For a longer discussion of enaction within the context of musical experience see Krueger (2009).

iv This is not to suggest that all cultures use and relate to music in precisely the same way. Music plays different roles in different cultures. But the fact that nearly every known culture practices some form of music (singing, dancing, religious rituals, etc.), or has a form of communication that can be called "musical," suggests that music is universally recognized as a potent tool for social bonding and organization (see DeNora 2000).

v See Malloch and Trevarthen (2009) for an extensive collection of papers devoted to this topic.

vi According to the *super-expressive voice* theory (e.g. Juslin 2001), music's expressiveness stems from its ability to sound like and, in many ways, *exceed* (in terms of speed, intensity, timbre, etc.) the expressive aspects of the human voice.

vii Similarly, Trevarthen and Malloch (2000, p. 11) note that "music is therapeutic because it attunes to the essential efforts that the mind makes to regulate the body, both in its inner neurochemical, hormonal and metabolic processes, and in its purposeful engagements with the objects of the world, and with other people."

viii Many thanks to Stephen Davies for raising this objection.

ix See <http://news.bbc.co.uk/2/hi/science/nature/1408434.stm>

x I'm very grateful to Jenefer Robinson for pressing this point.

xi For more on the notion of "sense-making" and interactive meaning from an enactive perspective see De Jaegher and Di Paolo (2007)and Fuchs and De Jaegher (2009).

xii For more on this idea, see Krueger (2009, 2011a).

xiii This pre-reflective experience of being an embodied and situated agent, i.e. an ecological sense of embodied selfhood, seems to already be in place at birth, and to provide the infant with a minimal form of basic self-consciousness long before it acquires a conceptual or reflective awareness of self (see Gallagher 2005, pp. 65–85).

xiv Roughly speaking, consonant intervals are stable (i.e. pleasant-sounding) and require no resolution. Dissonant intervals exhibit a "tense" quality that requires resolution to a consonant interval (see Huron 2006).

xv Instead of simply playing bare notes for the infant, a second experiment modified a Mozart minuet to produce different versions with predominantly consonant or dissonant intervals, which was then played to the infant.

xvi See http://www.sciencemag.org/cgi/content/full/308/5727/1430 for samples of the experimental sound stimuli.

xvii For more on this idea, see Nussbaum (2007) and Walton (1997).

xviii Trevarthen (1999) and Trevarthen and Malloch 2000) report a vivid example of this sort of sensorimotor engagement. They describe a 5-month-old baby, born blind, who "without prompting or

training, and, indeed without her mother being aware of her graceful rhythmic gestures, conducts portions of the melodies of famous Swedish baby songs . . . with her left arm and hand" (Trevarthen and Malloch 2000, p. 13). Trevarthen describes how the infant's arms rise and hands widen when the swelling of the song intensifies, and how her hands suddenly close and drop when the stanza concludes. Presumably, the infant experientially feels that the dynamic qualities of the music afford this sort of active engagement.

xix I readily admit that "scaffolding" is an inelegant term. Moreover, it is potentially misleading given the rather static picture the term summons (in contrast to the inherently dynamic character of music). However, the idea of environmental scaffolding plays an important role in work on situated cognition, according to which the very context in which cognition takes place provides essential enabling conditions for the cognitive processes needed to experience that environment. In this sense, then, I want to take a situated approach to musical experience—and the ugly term "scaffolding" helps emphasize this situated character.

xx Some may object to characterizing this interaction as a case of genuine social understanding since it is not immediately clear that the infant recognizes the mother's intention in resuming feeding; experimental data show that children take several years to become genuine mind-readers (i.e. capable of recognizing and responding to others' intentions). But this presupposes that mind-reading or "mentalizing" (Whiten and Perner 1991) is necessary for even rudimentary forms of social understanding and thereby begs the question. However, this mentalizing presupposition has recently been challenged from multiple perspectives in both philosophy and psychology. This debate is too large to discuss here (see, e.g., Hobson 2002; Gallagher 2008; Gallagher and Zahavi 2008; Reddy 2008; Fuchs and De Jaegher 2009; Rochat 2009 Krueger 2011b, 2012).

xxi By musical "textures" I am referring to the overall quality of a piece of music, its sonic complexity. Gentle music with "thin" textures and no abrupt modulations of volume or tempo reduces alerting responses in infants (Standley 2001, 2002) and thus affords a stable and inviting sonic world for the infant. For more on how infants perceive and appropriate specific sonic invariants such as musical textures and patterns see Krueger (2011a).

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