Chapter 11

Precursors to the performing arts in infancy and early childhood

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Abstract

Across cultures, aspects of music and dance contribute to everyday life in a variety of ways that do not depend on artistry, aesthetics, or expertise. In this chapter, we focus on precursors to music and dance that are evident in infancy: the underlying perceptual abilities, parent–infant musical interactions that are motivated by nonmusical goals, the consequences of such interactions for mood regulation and social regulation, and the emergence of rudimentary singing and rhythmic movement to music. These precursors to music and dance lay the groundwork for our informal engagement with music throughout life and its continuing effects on mood regulation, affiliation, and well-being.

Keywords

Music, Dance, Infants, Singing, Mood regulation, Social regulation

The arts are generally considered to involve skill and imagination in the creation or appreciation of aesthetic objects or experiences. Nevertheless, aspects of the performing arts, especially music and dance, contribute to our lives in many ways that are unrelated to artistry, aesthetics, or expertise. Those contributions are especially apparent in participatory rather than presentational musical cultures (e.g., Turino, 2008). In presentational cultures, as exemplified by concerts of Western music, there is a large chasm between highly trained performers and consumers, with music regarded primarily as a product rather than a class of activities. By contrast, members of participatory cultures like Shona villagers in northern Zimbabwe deemphasize distinctions between specialists and nonspecialists, the principal focus being on the social aspects of communal music making rather than the sonic consequences (Turino, 2008). Most cultures fall somewhere between participatory and presentational extremes. For example, informal musical activities in Western societies, like singing and dancing with family and friends (e.g., Newfoundland kitchen parties,
Emphasize participation rather than presentation. Moreover, traditional villages in Zimbabwe and elsewhere are no longer free from Western music and cultural practices.

Early musical experiences, regardless of culture, are primarily participatory, with mothers singing and moving with infants in a casual and intimate manner. Here, we focus on such precursors to music and dance in infancy, emphasizing their role in mother–infant communication, infant mood regulation, and social development. Music and dance occur together in many of the world’s cultures (Savage et al., 2015), with some languages using a single word to designate both domains (Bohlman, 2002). Interestingly, there are reciprocal influences of music and movement in the brain. For example, listening to musical rhythms, even in the absence of movement, generates activity in brain areas involved in motor control (e.g., Grahn and Brett, 2007). Moreover, rhythmic movement to music enhances the perception of auditory rhythms (e.g., Manning and Schutz, 2013). These sensorimotor interactions may underlie the motivation to move to music and its positive emotional consequences (Janata et al., 2012) as well as our ability to perform such movements without explicit training (McAuley et al., 2006).

In the following sections, we summarize the perceptual skills that underlie infants’ preparation for music and dance, the nature of parent–infant musical experiences, and the implications of music and movement experiences for infants and young children. We contend that these early musical experiences provide a foundation for the lifelong links of music to mood regulation, social regulation, and well-being, which dominate the functions of music in everyday life.

1 EARLY PERCEPTUAL FOUNDATIONS

1.1 THE NEWBORN PERIOD

Sensitivity to various musical properties of sound sequences is evident in newborns, who are typically assessed with electrophysiological measures during sleep. After limited exposure to a repeating rhythmic pattern, the newborn brain exhibits pronounced responses (event-related potentials) to the omission of metrically salient beats, which implies sensitivity to the temporal structure of music (Winkler et al., 2009). Differential neural responses are also evident for changes in tempo (Háden et al., 2015), pitch direction (ascending vs descending) (Carral et al., 2005), pitch intervals (two vs seven semitones) (Stefanics et al., 2009), and consonance/dissonance (Perani et al., 2010).

1.2 BEYOND THE NEWBORN PERIOD

Once infants remain awake for extended periods, a greater range of methods can be used to assess their processing of musical patterns. As early as 2 months of age, infants differentiate a newly (and briefly) familiarized melody from an unfamiliar melody (Plantinga and Trainor, 2009) and a newly familiarized rhythm from a
contrasting rhythm (Demany et al., 1977). Like adults, infants perceive music in a relational manner, recognizing specific melodic contours (e.g., rise–fall) across variable pitch levels (Trehub et al., 1987) and specific rhythmic groupings across variable tempos (Trehub and Thorpe, 1989). Moreover, their perception of musical meter is influenced by the movement they experience while listening (Phillips-Silver and Trainor, 2005). Infants also exhibit long-term memory for instrumental (Plantinga and Trainor, 2005) and vocal melodies (Mehr et al., 2016; Volkova et al., 2006), with memory for vocal melodies being more detailed and enduring. After 5-month-olds are exposed to a song for 1 or 2 weeks, they recognize it 8 months later, distinguishing it from a contrasting song with the same lyrics and rhythm (Mehr et al., 2016).

2 EARLY LEARNING AND ENCULTURATION

The foregoing perceptual abilities are considered culture-general—indeoendent of culture-specific exposure or learning. Naturally, cross-cultural differences in pitch and rhythmic structure necessitate such learning, which is usually achieved by incidental exposure to the music of one’s culture. The acquisition of culture-specific structure may be particularly rapid for rhythmic structure and more protracted for other aspects of music. Although Western 6-month-olds, unlike Western adults, can detect subtle changes to non-Western and Western rhythms, adult-like processing advantages for Western rhythms emerge by 12 months of age (Hannon and Trehub, 2005a,b). There are parallels in Western infants’ equivalent detection of in-key and out-of-key changes to melodies, reflecting culture-general processing, and adults’ much greater ease of detecting out-of-key changes (Trainor and Trehub, 1992), reflecting implicit, culture-specific (implicit) knowledge of the notes that belong in a key. Children do not exhibit implicit knowledge of key membership until about 4 years of age (Corrigall and Trainor, 2014).

3 EARLY EXPERIENCE WITH MUSICAL VOCALIZATIONS

3.1 MATERNAL SPEECH

Maternal speech to preverbal infants exhibits a number of song-like characteristics including elongated vowels, distinctive pitch contours, and positive emotion (e.g., Fernald, 1989). Such speech also incorporates a limited number of individually distinctive tunes (i.e., consistent interval sequences that are unrelated to conventional musical intervals) with varying verbal content (Bergeson and Trehub, 2007), much like the common reuse of tunes for different children’s songs (e.g., ABC; Baa Black Sheep; Twinkle, Twinkle, Little Star). Because maternal speech is unconstrained by prescribed pitch and rhythmic patterns, its “melodies” and timing are considerably more variable than those of song (Corbeil et al., 2013).
3.2 MATERNAL SINGING

Despite the widespread availability of recorded music and musical toys, maternal singing remains the primary source of early musical exposure (Ilari, 2005). Caregivers around the world sing regularly—often many times daily—to their infants (Trehub and Gudmundsdottir, 2015). These sung performances for infants (infant-directed or ID) differ systematically from self-directed (SD) performances of the same songs in their higher fundamental frequency ($F_0$), slower tempo, greater temporal regularity, greater amplitude modulation, and heightened emotional expressiveness (Nakata and Trehub, 2011; Trainor, 1996). Although ID singing is quieter overall than SD singing, the variable amplitude of ID singing correlates positively with pitch height, highlighting the pitch contours of songs (Nakata and Trehub, 2011). Interestingly, parents are unable to reproduce all features of their usual ID performances in their infant’s absence (Trehub et al., 1997) or when the infant is equally close and audible but merely out of view (Trehub et al., 2016). Presumably, infants’ presence and visibility have consequences on maternal affect, as reflected in mothers’ intimate and affectively positive tone of voice. Another remarkable aspect of mothers’ singing to infants is its stereotypy. When mothers sing the same song to infants on different occasions, they sing it in a nearly identical manner, usually at the same pitch level and tempo (Bergeson and Trehub, 2002).

Naïve listeners, regardless of culture, gender, or musical experience, readily differentiate ID from SD versions (Trainor, 1996; Trehub et al., 1993, 1997) and versions featuring in-view from out-of-view infants (Trehub et al., 2016). When participants in these studies provide explanations for their judgments of each pair, their responses invariably refer to parents’ voice quality, for example, the “smiling sound,” “soft voice,” “sense of involvement,” or “warm voice” rather than pitch and tempo differences (Trehub et al., 1997, p. 504). Maternal performances to preschool children differ from ID performances in more subtle ways, but listeners are still successful in identifying the intended audience (Bergeson and Trehub, 1999).

Maternal singing is generally described in terms of its acoustic features, but that description is necessarily incomplete. Western mothers usually sing to infants in face-to-face contexts that include frequent smiling—much more smiling than when talking to infants (Trehub et al., 2016). Incidentally, smiling also alters the shape of the vocal tract, resulting in vocalizations that sound happier than otherwise (Tartter and Braun, 1994).

Western mothers’ songs of choice are conventional play songs (Trehub et al., 1997) performed in a lively manner, sometimes accompanied by rhythmic actions. Mothers in many non-Western cultures maintain almost constant physical contact with infants during the day and night (Hrdy, 2009), and they sing lullabies rather than play songs (Trehub and Gudmundsdottir, 2015). In fact, they usually sing their infants to sleep, in contrast to Western mothers, who expect infants to fall asleep on their own or, if need be, with help from commercial sleep machines (e.g., Munchkin Nursery Projector & Sound System) or smartphone apps (e.g., Baby Shusher, White Noise Ambience). In short, musical interactions between mother and infant...
are largely playful for Western dyads but largely soothing for non-Western dyads. By virtue of their constant proximity to mother and their presence at community activities, non-Western infants have a wider range of live musical experiences than Western infants—non-ID as well as ID music.

3.3 INFANTS’ ATTENTION TO ID SINGING

Audio-only ID renditions of song capture infants’ attention more effectively than SD renditions (Trainor, 1996), even for newborn listeners (Masataka, 1999), raising the possibility of innate responsiveness to vocal expressions of positive affect. In line with that view, audio recordings of happy-sounding ID speech and singing are equally effective at capturing infant attention (Corbeil et al., 2013; Costa-Giomi and Ilari, 2014). With audiovisual and visual-only recordings, however, ID singing is considerably more engaging to infants than ID speech (Costa-Giomi, 2014; Nakata and Trehub, 2004; Trehub et al., 2016), highlighting the importance of visual aspects of singing.

In addition to the ID manner of singing, other aspects of singing style influence infant attention. For example, soothing ID recordings induce self-focused behavior in infants, and playful ID recordings induce greater focus on their surroundings (Rock et al., 1999). In the context of live mother–infant interaction, playful singing elicits greater attention to mother than does soothing singing (Cirelli et al., 2017).

3.4 MOOD-REGULATORY CONSEQUENCES OF ID SINGING

For ID singing to be an effective mood regulator in infancy, it would have to sustain infant attention and composure, delaying or alleviating distress as necessary. In fact, the onset of fussing or crying is delayed substantially when 7- to 10-month-old infants listen to continuously repeating recordings of a foreign ID play song rather than an ID recitation of the song lyrics (Corbeil et al., 2016). Even in an unstimulating, nonsocial context (dimly lit room, no toy or parent in sight), infants listen to the sung rendition for 9 min (on average) and to the spoken rendition for 4 min before becoming visibly upset.

When distress is induced in 10-month-old infants (by having a previously interactive mother become unresponsive), maternal multimodal singing is significantly more effective than maternal multimodal speech in reducing infant arousal and distress (Ghazban, 2013). In this context, mothers’ playful singing is more effective than soothing singing, but soothing singing is more effective than speech. It is unclear whether the greater efficacy of playful songs stems from their greater familiarity for Western infants, their temporal regularity—both of which would enhance their predictability—or their faster tempo.

Caregivers’ responsiveness to infant distress rather than their responsiveness in general predicts infants’ attachment security (McElwain and Booth-LaForce, 2006) and subsequent proficiency in self-regulation (Leerkes et al., 2009). Presumably the
efficacy of parental response is at least as important as the frequency of response to infant distress. Accordingly, caregivers’ systematic use of singing to alleviate infant distress may have enduring as well as immediate consequences.

Singing to infants is likely to have favorable effects on singers as well as listeners. Aside from the fact that singing in general enhances mood (Dunbar et al., 2012), its success in sustaining infant interest (Corbeil et al., 2016; Nakata and Trehub, 2004) and ameliorating distress (Ghazban, 2013) would enhance feelings of parenting efficacy. Such feelings of efficacy are often elusive for mothers of very premature infants, who have an elevated incidence of anxiety and depression relative to mothers of full-term infants (Miles et al., 2007). Maternal singing to infants in conjunction with kangaroo care (skin-to-skin contact) in neonatal intensive care decreases maternal anxiety relative to kangaroo care alone (Arnon et al., 2014). A large-scale study in the United Kingdom found that daily maternal singing to infants was correlated with self-reports of lower depressive symptoms as well as higher levels of well-being, self-esteem, and mother–infant bonding (Fancourt and Perkins, 2018). It is possible, however, that these correlations were mediated by preexisting differences in maternal adjustment and well-being.

### 3.5 SOCIAL CONSEQUENCES OF ID SONGS

Songs have social significance for infants, especially the songs that caregivers sing. Under some circumstances, 5-month-olds direct greater visual attention to an unfamiliar person after hearing her sing a familiar song than to another person who sang a different song with the same lyrics and rhythm (Mehr et al., 2016). Those circumstances necessitate a parent as the source of initial song exposure rather than comparable exposure by means of a musical toy or video-chat experience. Although infants remember the melodies from nonsocial contexts (e.g., musical toys), songs acquired in live interactive contexts have social as well as musical meaning (Mehr et al., 2016).

Song familiarity also has consequences for infants’ prosocial behavior. Specifically, 14-month-olds help an unfamiliar singer more (by retrieving dropped objects) when she sings a familiar song rather than an unfamiliar song, and the extent of their help is correlated with parents’ frequency of singing the song (Cirelli and Trehub, 2018). This finding is consistent with the social significance of familiar songs and the manner of familiarization (Mehr et al., 2016).

In view of the stereotypy of maternal songs—nearly identical performances on different occasions (Bergeson and Trehub, 2002)—it is reasonable to think of them as bonding rituals. Like other rituals, whether cultural or religious (e.g., ritual handwashing), the manner of execution is more important than the outcome (e.g., clean hands) (Merker, 2009). Just as cultural or religious rituals are markers of group identity, maternal songs may be markers of dyadic identity, accounting perhaps for their efficacy in infant mood regulation (Ghazban, 2013) and the favored status of unfamiliar individuals who sing the mother’s songs (Cirelli and Trehub, 2018; Mehr et al., 2016).
4 EARLY MUSIC PRODUCTION: SINGING

The onset of singing is difficult to pinpoint because of the challenges of distinguishing rudimentary speech from singing. Nevertheless, 12- to 24-month-old infants produce vocalizations that are more song-like—more extended vowels, for example—after hearing an experimenter sing rather than speak (Reigado and Rodrigues, 2017). The clearest evidence of infants’ singing intentions occurs when mothers successfully engage infants in games that involve completing the lines of familiar songs (e.g., *Twinkle, Twinkle, Little _____*) (Trehub and Gudmundsdottir, 2015). These call-and-response duets often appear within a month or two after the child’s first birthday, sometimes before the onset of speech (see Fig. 1 and a video of a duet with a 16-month-old infant: https://nyu.databrary.org/volume/554/slot/23425/0,26300/asset/102590). Such coordinated singing, while highly engaging for the performers, is typically inaccessible to interlopers (e.g., researchers) unless surreptitious recording occurs. Casual observations reveal that infants’ line endings are mostly on time (i.e., neither too early nor too late), which implies internal representation of the song and its underlying pulse.

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**FIG. 1**

This 16-month-old is engaging in a call-and-response duet with his mother, singing *Twinkle, Twinkle, Little Star*. See the full video at: https://nyu.databrary.org/volume/554/slot/23425/0,26300/asset/102590.
Just as adults engage in solitary, SD singing in the shower and elsewhere, toddlers do as well, at times during solitary play and at other times in bed. Singing in the crib serves various functions including self-soothing (Sole, 2017), which may ease the separation from family members and the transition to sleep. SD singing, which continues through the preschool period, differs in several respects from the singing observed in social contexts (Dean, 2016). Preschoolers tend to sing conventional songs in social contexts, which facilitates coordination with others, and they engage in more improvisation and exploration in solitary contexts.

The singing capabilities of toddlers and preschoolers are thought to be limited by their focus on words at the expense of tunes (e.g., Welch et al., 1998) and their restricted pitch range (Rutkowski and Miller, 2003). For self- or parent-selected songs recorded at home, however, toddlers’ pitch range and pitch contours approximate those of the target songs (Gudmundsdottir and Trehub, 2018). In short, social and contextual factors influence early singing and shed light on its functions, but those influences pose challenges for assessments of singing proficiency.

5 EARLY MOVEMENT TO MUSIC

Physical contact and movement are ubiquitous during mother–infant musical interactions in many non-Western cultures. At times, however, Western caregivers hold and rock infants while singing a soothing song or bounce them to the beat of a lively song. Contact and movement, even in the absence of vocalization, are effective in soothing infants. For example, maternal carrying reduces infant arousal and fussing (e.g., Esposito et al., 2013), and gentle rocking reduces crying and accelerates sleep (Ter Vrugt and Pederson, 1973). In general, high levels of physical contact between mothers and infants are linked to lower overall crying (Gormally et al., 2001). Because music has favorable consequences on arousal and emotion regulation (Corbeil et al., 2016; Ghazban, 2013), as carrying, holding, and rocking do, their combined use should be particularly effective.

5.1 SOCIAL CONSEQUENCES OF SYNCHRONOUS MOVEMENT

Moving in time with others, or interpersonal synchrony, promotes a range of affiliative behaviors. For example, cooperation, liking, and trust are enhanced among adults who engage in synchronous tapping, singing, or walking (Hove and Risen, 2009; Wiltermuth and Heath, 2009). Synchrony is thought to encourage prosociality by promoting attention to others (Macrae et al., 2008) and feelings of similarity between self and other (Valdesolo and Desteno, 2011). Synchronous behavior has been linked to neuronal hormones that are implicated in social bonding (Machin and Dunbar, 2011) and breastfeeding (Franceschini et al., 1989; Nelson and Panksepp, 1998). For example, interpersonal synchrony is enhanced by oxytocin administration (Gebauer et al., 2016) and increases endorphin release (Tarr et al., 2015).
Musical engagement is often associated with high levels of interpersonal synchrony. In formal as well as informal settings, the movements of dancers, singers, and musicians are aligned to the common underlying beat structure in the music. Importantly, the social effects of synchrony are tied to the timing of specific movements as opposed to their form. In other words, movement coordination—including antiphase movement—underlies the effects of synchrony (Cross et al., 2016). These patterns of coordinated movement, which are a common feature of musical engagement, are necessary for collaborative music making. According to the social bonding hypothesis (Dunbar, 2004), the facilitation of group cohesion underlies the prevalence of musical behaviors. Musical engagement in a social context leads to interpersonal synchrony, which in turn leads to enhanced prosociality.

The prosocial consequences of interpersonal synchrony are also evident in infants. When 12-month-olds are rocked in synchrony with a teddy bear that has social attributes (i.e., face and periodic verbal comments) and out of synchrony with a similar bear, they reach preferentially for the bear that had moved synchronously (Tungcanç et al., 2015). No such preference is evident for synchronously over asynchronously moving toys that lack social attributes (i.e., brightly colored boxes that emit mechanical sounds). These results parallel adult findings in indicating affiliative consequences of social as opposed to nonsocial synchrony (Launay et al., 2014).

Studies with 14-month-old infants indicate that interpersonal synchrony also facilitates infant prosociality (Cirelli, 2018). In the first study of this series (Cirelli et al., 2014a), an assistant held and gently bounced infants, while rhythmic instrumental music (Twist and Shout by the Beatles) played in the background. An experimenter faced the infant and bounced in synchrony or out of synchrony (too quickly or too slowly) with the infant for approximately 2 min. Infants then participated in a series of helping tasks in which the experimenter dropped various objects “accidentally” (e.g., markers needed for drawing a picture), providing infants with several opportunities to help by returning the dropped objects. Infants who had experienced synchronous movement with the experimenter returned twice as many dropped objects as those who had experienced asynchronous movement. Subsequent studies indicated that this increased helping was directed selectively to the synchronous partner and her “friends” but not to others (Cirelli et al., 2014b, 2016b). The implication is that synchrony promotes socially relevant bonding rather than generalized affiliative behavior.

When mothers bounce infants to the beat of songs they sing or music they hear, both members of the dyad experience high levels of interpersonal synchrony. These synchronous experiences may facilitate mother–infant bonding. Maternal singing may also generate subtle external or internal infant responses that are synchronized with the mother’s song or movements. For example, when 6-month-olds watch a video of ID singing, increased looking at the singer’s eyes is aligned with the beat of the song (Lense, 2017). For adults (Nozaradan et al., 2011) and infants
brain activity is synchronized with the beat of auditory rhythmic patterns even in the absence of movement. Presumably, mothers’ internal responses are synchronized with her own singing, raising the possibility of synchronous internal responses in the dyad.

6 PRODUCTION OF MUSICAL MOVEMENTS

In addition to the passive movement that infants sometimes experience while listening to music, listening also influences self-generated movement. Most 2- to 4-month-olds reduce their movement when exposed to audio recordings of rhythmic music (Fujii et al., 2014), in line with links between attention and movement reduction in young infants (Bacher and Robertson, 2001). For 6-month-olds, intense attention to audiovisual displays of maternal singing is initially accompanied by comparable movement reduction (Nakata and Trehub, 2004). For a subset of very young infants, however, listening to rhythmic music results in increased rhythmic movement (Fujii et al., 2014). Infants ranging from 5 to 24 months of age move rhythmically to audio recordings of rhythmic music but not to recordings of speech (Zentner and Eerola, 2010). Their movements, although rhythmic, are not synchronized with the music, but infants exhibit more positive affect during transient episodes of greater synchrony (Zentner and Eerola, 2010). Infants show glimmerings of tempo flexibility (faster movement for faster tempo measured via electromyography) at 18 months of age (Rocha and Mareschal, 2017) and increased tempo adjustments at 2.5 years of age (Provasi and Bobin-Bègue, 2003). Needless to say, infants and toddlers engage in much more frequent and more vigorous dancing at home than in the laboratory (see Fig. 2 and a video of an 8-month-old moving to music: https://nyu.databrary.org/volume/554/slot/23424/0,41984/asset/102588).

Preschoolers engage in considerable rhythmic movement to music, but their movements are often unsynchronized with the music (Eerola et al., 2006). Precision of synchronization improves through the childhood years, reaching adult levels at about 10 years of age (Drake et al., 2000; McAuley et al., 2006). Movement to music is also influenced by the social context. For example, children as young as 2 engage in spontaneous drumming with a peer, starting and stopping their drumming bursts in a relatively coordinated manner (Endedijk et al., 2015). Preschoolers’ accuracy of synchronization to a drumbeat is enhanced by the presence of a social model but not a drumming machine (Kirschner and Tomasello, 2009).

7 IMPLICATIONS BEYOND INFANCY

7.1 MOOD REGULATION

As noted, caregivers sing and move rhythmically, with favorable consequences on infant arousal and mood. Once infants and young children acquire rudimentary music production skills, they use them autonomously at home and elsewhere for playful
and self-regulatory goals (Custodero et al., 2016; Dean, 2016; Sole, 2017). Children’s spontaneous singing typically includes rhythmic movements (Custodero et al., 2016), so music and movement are as inseparable for children as they are for adults in many cultures (e.g., Bohlman, 2002). Informal self-generated movement to music is likely to have mood-regulatory consequences for children, in line with the mood-regulatory consequences of recreational dance (Burkhardt and Brennan, 2012).

The specific songs that parents sing repeatedly have primacy for early mood regulation and subsequent self-regulation. Preschoolers also become highly familiar with songs from their favorite television programs and the characters who sing them (Volkova et al., 2014), those songs often entering their production repertoire. When children gain access to personal listening devices, tablets, or the TV remote control, which occurs increasingly early, their musical tastes become more autonomous, allowing them to select recordings to satisfy their momentary interests and needs (Lamont, 2008).

By adolescence, music listening is a ubiquitous means of mood regulation, whether for prolonging positive moods or ameliorating negative moods (Saarikallio and Erkkilä, 2007; ter Bogt et al., 2016). Music preferences from this period often persist through middle and later adulthood when early musical memories often evoke memories of highly emotional events (Schulkind et al., 1999). In late adulthood, songs from adolescence and early adulthood become important sources of nostalgia and positive feelings, enhancing vitality and quality of life (Laukka, 2007).

**FIG. 2**

This 8-month-old is moving rhythmically and expressing joy while watching the opening theme from “Dora the Explorer.” See the full video at: https://nyu.databrary.org/volume/554/slot/23424/0,41984/asset/102588.
7.2 SOCIAL REGULATION
Musical rituals between mother and infant may provide the foundation for social regulation by means of music throughout the life span. Although solitary singing and moving to music have positive effects on the mood of untrained individuals (Bernardi et al., 2017; Valentine and Evans, 2001), musical activities with others facilitate interpersonal coordination and social bonding (e.g., Valdesolo et al., 2010). Very young children exhibit rudimentary coordination when drumming with a peer (Endedijk et al., 2015) and enhanced coordination when drumming with an adult (Kirschner and Tomasello, 2009). By school age, children are often chanting together in play or sports contexts and singing in school or community choirs. These and other coordinated musical activities facilitate social bonding and prosociality throughout childhood and adolescence (Kirschner and Tomasello, 2010; Tarr et al., 2015).

The social benefits of communal musical engagement are evident well beyond adolescence. In middle and late adulthood, anticipated social rewards often motivate individuals to participate in choirs, musical ensembles, or dance programs (Coffman, 2002; Hackney et al., 2007), and such participation generates the expected rewards (e.g., Coffman, 2002). Interestingly, older adults report that music listening enhances their sense of social connection even when separated from others (Groarke and Hogan, 2016).

7.3 SOCIAL IDENTITY
Music preferences are linked to social identity, beginning with the musical rituals between mother and infant that cement social bonds and dyadic identity. This dyadic identity facilitates infants’ affiliative behavior toward others who behave “like mom,” for example, by singing the songs that she usually sings (Cirelli and Trehub, 2018; Mehr et al., 2016).

From the preschool period, children’s social identity extends beyond caregiver and family to peers and wider social networks. Identification with a social group helps children forge new relationships (Kupersmidt et al., 1995), expanding their musical repertoire and encouraging further socialization on the basis of shared musical knowledge (Soley and Spelke, 2016).

In adolescence and early adulthood, musical taste and preferences become “badges of identity” that influence social preferences (North and Hargreaves, 1999) and romantic attraction (Zillmann and Bhatia, 1989)—preliminary signals of potential similarity between others and ourselves rather than a reliable basis for long-term relationships. Regardless, music streaming services, sharable playlists, and social media platforms (e.g., posts of presence at concerts) increase the visibility of these “badges” and therefore the contribution of music to social identity. There are notable discrepancies between publicly and privately endorsed preferences (Finnäs, 1989), which highlight the distinction between social and personal identities. Music preferences also shape the nature of musical engagement in social
contexts—concerts attended, music choices for social gatherings, and the music and artists that are topics of discussion with others. At a broader level, music can serve as a marker of cultural identity or shared knowledge among members of ethnic groups, religious groups, or nations.

### 7.4 WELL-BEING

Across cultures and age groups, joint music listening has been linked to enhanced cohesiveness of families and peer groups (Boer and Abubakar, 2014; Miranda and Gaudreau, 2011). Armies around the world march to music with the principal goal of enhancing cohesion and morale (McNeill, 1995). Solitary listening makes other contributions to well-being, allowing young adults to carve out personal space and motivate persistence on challenging tasks, and enabling elderly adults to experience intense emotions or feelings of transcendence (Groarke and Hogan, 2016).

The efficacy of music in stress reduction is leading to the increased use of music in medical contexts to reduce or replace medication (e.g., Pittman and Kridli, 2011). Finally, music therapy interventions are being used to foster social engagement in children with autism spectrum disorders (Thompson et al., 2014), to alleviate depression in adults (Aalbers et al., 2017), and to enhance well-being in other clinical populations.

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