

Musicality in Infancy

Sandra E. Trehub

University of Toronto Mississauga, Mississauga, Canada

Abstract

The present review summarizes the available evidence on musicality, or music-related abilities, in infants (birth to 3 years). In the early months of life, infants are responsive to the pitch and temporal patterns of music. Their perceptual skills are similar, in many respects, to those of adults, presumably because of the nature of the human auditory system. Adult-infant differences, where evident, are attributable to infants' unfamiliarity with the musical conventions of their culture. Musical enculturation proceeds more rapidly for temporal than for pitch processing. Musical exposure, especially the singing of caregivers, is prevalent in infancy. Caregivers' music-making for infants has consequences for their emotional and social regulation and for their subsequent self-regulation abilities. By the end of their first year, most infants have become music-makers as well as music listeners. They move spontaneously to music, and their patterns of "dancing" undergo considerable change in the subsequent months and years. Early dancing is influenced by the familiarity of the music, and later dancing may include aspects of caregivers' dance movements. Although the onset of singing occurs considerably later than the onset of dance, early singing is remarkably accurate in terms of its pitch range, pitch contours, rhythmic patterning, and fluency, especially when infants sing in their familiar home environment.

Keywords: musicality, infants, perception, production, pitch, rhythm, dance

Introduction

Musicality refers to the uniquely human constellation of skills underlying our ability to perceive, appreciate, and produce music (Buren et al., 2021; Trehub et al., 2018). My goal, in this brief review, is to present evidence consistent with infants' possession of such skills. For the present purposes, infancy encompasses the period from birth to 3 years of age. I will summarize the relevant research in four broad realms: (1) laboratory findings on infants' perception, memory, and learning, (2) descriptive and laboratory studies on the nature of infants' exposure to music, (3) the emotional and social consequences of such exposure, as revealed in the laboratory

Sandra E. Trehub <https://orcid.org/0000-0002-7940-1258>

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and, finally, (4) infants as budding music-makers based on descriptive studies in the home environment and parent reports. This review focuses primarily on the first year, especially with respect to research on perception, memory, and learning. The research on music production encompasses a broader age range because of developmental changes in the motor skills affecting the emergence of behaviours related to singing and dancing. Taken together, the evidence attests to infants' inherently musical nature and the relative ease with which they acquire the musical skills relevant to their culture.

Perception

Infants can perceive the smallest musically relevant pitch and timing differences (Cabrera & Lau, 2022; Lau et al., 2017; Trehub & Degé, 2016). Presumably, they have the requisite perceptual skills for acquiring the music of any known culture, as reflected in the available cross-cultural descriptions of music (e.g., Brown & Jordania, 2013; Savage et al., 2015). In general, however, infants focus on the global patterning of music, especially the melodic contours (pattern of rising and falling pitches) and rhythms (temporal grouping of notes) rather than individual pitches and durations (Chang & Trehub, 1977a, 1977b; Kragness, Johnson, et al., 2022; Plantinga & Trainor, 2005; Trehub & Hannon, 2006; Trehub et al., 1984, 1987) even though they may notice finer details such as the absolute pitch level of songs (e.g., Volkova et al., 2006). For example, when infants are familiarized briefly with a melody, hearing a limited number of repetitions, they respond to a transposition that changes all pitches but preserves the pitch relations as functionally equivalent to the original melody (Chang & Trehub, 1977a; Trehub et al., 1984, 1987). Although infants readily differentiate contrasting temporal groupings of pitches (Chang & Trehub, 1977b), they perceive the identity of a musical sequence across changes in tempo (Trehub & Thorpe, 1989) and singing style (Kragness, Johnson, et al., 2022). In those respects, they are much like adults, focusing primarily on pitch and timing relations and secondarily on specific pitches and durations (Trehub & Hannon, 2006).

Memory

Their long-term memory for melodies is remarkable, especially for material heard in a familiar environment like their own home. For example, if a recorded melody is played at home for 5 or 10 minutes daily for 1 or 2 weeks while 5- or 6-month-old infants are awake and alert, they subsequently recognize the melody in the laboratory, distinguishing it from a novel melody (Mehr et al., 2016; Plantinga & Trainor, 2005; Volkova et al., 2006). They remember more details if the recording played at home is vocal rather than instrumental. Although they remember the vocal and instrumental melodies, they remember the pitch level at which they heard the vocal rendition (Volkova et al., 2006) but not the instrumental rendition (Plantinga

& Trainor, 2005). Several months later, they remember a song heard repeatedly at 5 months of age even though they had no opportunity to hear it in the intervening period (Mehr et al., 2016).

Learning

Infants' perception of musical structure is culture-general in the early months of life, stemming from the nature of their auditory system rather than their musical exposure or learning. As a result, researchers sometimes encounter unexpected findings such as young infants detecting subtle pitch or rhythmic changes in musical patterns that adults fail to detect (Hannon & Trehub, 2005a; Trehub et al., 1999). In one instance, Western 6-month-olds detected subtle temporal changes in the context of foreign metrical patterns (i.e., Balkan music with non-isochronous metrical structure), but Western adults did not (Hannon & Trehub, 2005a). In another, infants more readily detected subtle pitch changes in the context of scales with unequal intervals than in scales with equal intervals; adults detected subtle pitch changes only in the context of the familiar (major) scale, failing to do so in the context of unfamiliar scales with equal intervals or unequal intervals (Trehub et al., 1999). Infants seem to be more flexible listeners than adults, presumably because of their ignorance of local musical conventions (Stewart & Walsh, 2005; Trehub & Hannon, 2006). Adults' entrenched knowledge of such conventions interferes with their perception of foreign or atypical pitch and timing structures. One consequence of adults' attunement to familiar auditory structures, whether in music or speech, is reduced perceptual flexibility.

By 12 months of age, Western infants exhibit some attunement to Western metrical structure, which is a surprisingly early achievement. Specifically, they exhibit difficulty detecting changes in the context of non-Western metrical structures (Hannon & Trehub, 2005b) despite being able to do so at 6 months of age (Hannon & Trehub, 2005a). In that respect, they are becoming more like adults. Unfortunately, there are no comparable studies of non-Western infants that compare their learning of non-Western and Western musical structures. In fact, studies of infant music perception have focused largely on Western infants – an important omission that should be rectified by future researchers.

Attunement to culture-specific pitch patterns is considerably more protracted than the attunement to rhythmic patterns. For example, sensitivity to key structure (i.e., the notes that belong in a key) is apparent by 4 or 5 years of age, at which time preschoolers remain insensitive to various aspects of harmony (Corrigall & Trainor, 2014; Trainor & Trehub, 1992, 1994).

Musical Exposure in Infancy

Infants' exposure to auditory patterns mainly involves their primary caregivers' speech, which may sound somewhat like music to their ears. Caregivers' speech to infants is melodious, with numerous musical elements such as enhanced rhythmicity and emotional expressiveness, simple, repeated pitch patterns, extended vowels, and expanded pitch contours, in stark contrast to typical adult-directed speech (Bergeson & Trehub, 2007; Fernald, 1992). Differences between infant- and adult-directed speech have been documented in several urban, rural, and small-scale societies, and these differences (i.e., whether the speech is infant- or adult-directed) are readily identified, even by listeners who are unfamiliar with the languages (Hilton et al., 2022).

Songs for infants seem to be present and readily identified (as songs for infants) in much of the world (Mehr et al., 2018), but the subtleties and consequences of sung performances for infants have received little attention outside of Western contexts. In general, songs sung to Western infants are higher in pitch, slower in tempo, and more emotionally expressive than performances of the same songs in the infant's absence (Trainor, 1996; Trehub et al., 1997). Fully expressive versions of these performances for infants depend not only on infants' presence but also on their visibility. When an opaque curtain is placed between a mother and an infant so that they cannot see one another, caregivers are unable to generate the full range of expressiveness that is evident in their usual songs for infants (Trehub et al., 2016).

Individual differences in caregivers' singing style are magnified across cultures, presumably because of substantial differences in caregiving practices. In many cultures, mothers or primary caregivers maintain almost constant physical contact with infants, holding and carrying them throughout the day and sleeping with them at night (LeVine, 1988). In such high-contact cultures, vocalizations to infants, whether speech or song, are primarily soothing (Trehub & Trainor, 1998). Western urban environments involve much less physical contact between caregiver and infant but much more face-to-face contact. In such contexts, vocalizations, whether speech or song, are generally playful or lively.

Caregivers' singing is not merely an auditory experience for infants. The experience is multimodal, whether it involves the body contact and movement of caregivers in many non-Western cultures or the facial expressions and visible motion (head nodding, body sway) of typical Western caregivers (Trehub & Russo, 2020). In face-to-face contexts, mothers smile almost continuously while singing to 6-month-old infants, in contrast to intermittent smiling while talking to infants, with these visible aspects of singing having distinctive consequences for infants (Trehub et al., 2016). In other words, there are bi-directional influences in infant-directed singing contexts.

Caregivers' songs for infants are like rituals in many respects. Although caregivers generally know many children's songs, they typically sing a few of those

songs repeatedly (Trehub et al., 1997), often singing them at the same pitch level and tempo on different occasions (Bergeson & Trehub, 2002).

Infants' Responsiveness to Infant-directed Singing

Infants exhibit considerably greater engagement for infant-directed singing than for infant-directed speech, especially when the materials are familiar and multimodal (Nakata & Trehub, 2004). Caregivers' familiar, highly predictable sung performances provide an important source of pleasure, comfort, and belonging for infants. Such songs also have social consequences beyond the mother-infant dyad. For example, infants are more responsive to strangers who sing a song from the mother's repertoire than if they sing another infant-directed song (Cirelli & Trehub, 2018; Mehr et al., 2016).

Caregivers' Songs as Mood Regulators

Because infants are notoriously poor at emotional self-regulation, caregivers strive to develop and maintain a repertoire of skills for ameliorating infant distress. Investigators have examined the efficacy of infant-directed singing in infant mood regulation. In one study, calm, contented infants were placed in a dimly lit room with no toys or people in sight (Corbeil et al., 2016). Half of the infants heard a recording of an unfamiliar children's song in an unfamiliar language (Turkish). The other half heard a rhythmic recitation of the same song by the same performer. The question of interest was how long it would take for infants to become discontent and start crying. In fact, infants listened for more than twice as long to the sung version (an average of 9 minutes) than to the recited version (an average of 4 minutes) before initiating sustained crying.

For those initially contented infants, singing delayed the onset of distress. It is even more important to understand the potential efficacy of songs for ameliorating infant distress. To address that question, infants were subjected to a well-known stress-inducing intervention, which is known as the still-face procedure (Cirelli & Trehub, 2020; Trehub et al., 2015). After caregivers and infants sat across from one another and played for 2 minutes, caregivers became unresponsive and immobile while continuing to gaze directly at infants. This "still-face" episode, which elicits distress in most infants, was followed by a resumption of interaction during which caregivers attempted to reduce infant distress by responsive touch and vocalization. Caregivers were required to restrict their vocalizations to singing on some trials and to speech on others. Singing proved to be considerably more effective than speech in reducing infant distress (negative vocalizations and facial expressions) and arousal levels (measured physiologically) in 8- and 10-month-old infants (Cirelli & Trehub, 2020; Trehub et al., 2015). Moreover, familiar songs were substantially more effective than unfamiliar songs (i.e., familiar to caregivers but not to infants) in accelerating infants' recovery from elevated distress and arousal levels (Cirelli &

Trehub, 2020). For non-distressed infants, familiar songs elicit more attention and engagement than unfamiliar songs, even when the singing voice and singing style are unfamiliar (Kragness, Johnson et al., 2022).

Familiar Songs and Prosocial Behaviour

Several studies have shown that synchronous or coordinated music-making or movement increases cooperation and positive feelings among adult participants (e.g., Wiltermuth & Heath, 2009). That also seems to be the case for infants. For example, 14-month-old infants offer more help to strangers who bounce synchronously (to music) with them than to those who bounce asynchronously (Cirelli et al., 2014). They also offer more help to strangers who sing a familiar song (one from their mother's repertoire) rather than an unfamiliar song (Cirelli & Trehub, 2018).

Singing has salutary effects on singers as well as listeners. For example, singing in a soothing style reduces arousal levels in mothers as well as infants. By contrast, singing in a playful manner results in more mutual engagement and reciprocal eye contact (Cirelli et al., 2020).

Infant Music-Making: Dance

Infants begin moving rhythmically to rhythmic music sometime between 5 and 10 months of age. Approximately 50% of infants are dancing (i.e., behaviour that parents identify as dancing) by 6 months of age, 75% by 9 months of age, and 90% by 12 months of age. Such dancing does not depend on a social partner. Infants are as likely to move rhythmically to music during solitary play as in the presence of others. Once they begin dancing, however, they dance more and more. Although parents sometimes dance with or for infants, imitated elements in infants' dance are not evident before 12 months of age (Kim & Schachner, 2022).

In a case study of a 19-month-old girl, a parent video-recorded her child dancing at home to musical recordings provided by the researchers, which consisted of two children's songs (one familiar, one unfamiliar) and two adult songs (one familiar, one unfamiliar), each presented at three different tempos (Cirelli & Trehub, 2019). This 19-month-old danced and smiled more to familiar music than to unfamiliar music. Although her movements were not synchronized with the music, they were faster for faster music, which may stem from enhanced excitement rather than from greater coordination of her movements with the music. Preschoolers also dance and smile more to familiar than to unfamiliar music (Kragness, Ullah, et al., 2022). Some dance elements exhibited by the 19-month-old, such as head-bobbing, were likely learned from her father, who exhibited head-banging to Metallica music (Cirelli & Trehub, 2019).

Infant Music-Making: Singing

There is enormous variability in the onset of singing, with children occasionally singing before they speak but most producing recognizable songs by 2 or 3 years of age (Gudmundsdottir, 2020; Gudmundsdottir & Trehub, 2018). That timetable diverges substantially from numerous descriptions of preschoolers using a highly compressed pitch range and producing unrecognizable songs (e.g., Davidson, 1985; Flowers & Dunne-Sousa, 1990). It is notable, however, that singing proficiency is enhanced when infants and preschoolers sing at home or in a context designed to maximize their comfort (e.g., Gudmundsdottir, 2020; Gudmundsdottir & Trehub, 2018).

Once infants become independent singers, they have a potent tool of emotional self-regulation at their disposal. Solo singing is commonly evident during solitary play. In some cases, infants sing to themselves at bedtime (Sole, 2017), easing the often-challenging separation from family members and promoting a calm transition to sleep.

Conclusion

The available evidence is consistent with the view that infants are inherently or naturally musical. Initially they are drawn to live, vocal music delivered multimodally by their primary caregiver. Exposure to music in this manner shapes infants' budding musical taste, cements bonds with their caregivers, and promotes social interaction with others. In a relatively short span of time, infants come to know what they like, and they clearly like what they know – the familiar songs sung repeatedly by their primary caregiver. Those songs play a critical role in the parent-infant relationship, also influencing infant socialization more broadly. Others who sing parents' familiar songs readily gain infants' trust and confidence.

Infant music-making occurs, first, as a rhythmic movement to music, with more rhythmic movement observed in the context of familiar music, and such rudimentary dancing often accompanied by smiling. The demonstrably positive impact of caregivers' singing on infants and on caregivers is increasingly prompting interventions aimed at enhancing infant, parent, and dyadic outcomes.

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