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SINGING ACQUISITION IN THE FIRST YEARS OF LIFE

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Introduction

The majority of research in singing ability and singing skill acquisition is conducted with school age children five years or older. Despite the lack of data from early childhood before the age of five, studies with school-age children have been used as the basis for singing acquisition theories (Rutkowski, 1990, 1998; Welch, 1998, 2006; Welch, Sergeant, & White, 1998). Other theories on singing development have been drafted with references to rather small samples of infants and toddlers (Davidson, McKernon, & Gardner, 1981; McKernon, 1979) or case studies (Dowling, 1984, 1988). The literature that describes infants and toddlers as capable singers (Honig, 1995; Kreutzer, 2001; Moog, 1976; Stadler-Elmer, 2012a) has been either ignored or taken with precaution as those ideas contradict established theories on early singing acquisition such as the "contour scheme theory" (Davidson et al., 1981), a developmental model that portrays singing skills in toddlerhood as rudimentary and far from culturally correct singing (Davidson et al., 1981; Dowling, 1984, 1988; McKernon, 1979). Recent studies have found evidence of widespread high-level singing skills in typically developing two- and three-year-old children (Gudmundsdottir, 2018; Gudmundsdottir & Trehub, 2018), corroborating the view of toddlers as capable singers. This new evidence suggests that singing skills in early childhood may have been underestimated in some previous studies, resulting in misleading models of singing development.

In this chapter, early singing acquisition beginning at birth will be primarily viewed as a combination of two models of learning, that is, a) vocal learning from the perspective of social learning theory (Bandura, 1971) and b) complex skill acquisition (Ackerman, 1988). Newborns, infants and toddlers will be viewed as learners of vocal repertoire, both speech and song in a social context in a similar way as young songbirds (Goldstein & Schwade, 2010). The young infant learns to use the voice and develops a vocal repertoire in a species-specific, culturally meaningful manner through observing, hearing, imitating and gradually adjusting vocal sound through turn taking with an adult (Goldstein & Schwade, 2008). The research literature on vocalizations, language acquisition and auditory perception in early childhood will be reviewed from the perspective of the infant as a vocal learner acquiring singing in the interactive model of social learning and complex skill learning.[1]

Singing Skill as Social Learning and Complex Skill Acquisition

As an infant is learning to sing, the amount of adult feedback in one-on-one singing dialogues will have a major impact on the acquisition process. More importantly, the quality and consistency of the feedback will determine the precision the infant or toddler can reach in the singing skill acquisition. It is obvious that an infant or toddler who has an enthusiastic adult singing partner will enjoy communicative singing and this singing is likely to contribute to bonding, cognitive growth and emotional well-being of the individual (Trehub & Gudmundsdottir, 2019). However, an infant with a musically skilled adult partner who sings with consistent precision of intervals will more likely be coached into attending to exact pitches and intervals of melodies. In such cases, it is possible to consider the vocal learning of songs as switching from the approximate melodic contour to a complex skill acquisition where relative pitch and interval precision in the reproduction of melodies becomes important. From the neurological point of view of pitch processing, what occurs is a switch from the coarse mode of linguistic pitch processing sufficient for language processing to the fine-tuned processing necessary for perceiving and producing musical pitch (Zatorre & Baum, 2012).

Infants as Vocal Learners

Viewing infants as vocal learners means that all vocalizations need to be considered as a part of singing acquisition in early infancy, not only the vocalises that adults would consider as music to their ears. Infants are continually making sense of ambient auditory information and honing the skills needed to reproduce what they hear in their immediate environment. Therefore, teasing apart what can be considered pre-singing and what is pre-speech in infant vocalizations may not be useful. In the past, researchers of early singing and spontaneous singing have been concerned with distinguishing between the different modes of vocal behavior, suggesting that there may be a clear difference between "speech-babble" and "song-babble" in children's vocalizations (Moog, 1976; Papoušek & Papoušek, 1981; Reigado, Rocha, & Rodrigues, 2011; Ries, 1987). However, there is some singing in speech and some speech in singing, especially in the context of very early childhood. For example, infant directed speech by adults has been described in terms of musical qualities (Malloch, 1999; Papoušek & Papoušek, 1981), and similarly prelinguistic babbling in infants has been regarded as musical in nature and described as having a musical syntax (Holahan, 1987) and a musical rhythm (Malloch & Trevarthen, 2009).

Vocal Learning and Interrelatedness of Speech and Singing

All vocal experiments and exercises in early childhood can be interpreted as being of either musical or linguistic origin. Language and speech sounds can be practiced in a repetitive manner that sounds more like music than speech. Vocal exercises in early childhood tend to flow between speaking and singing modes, suggesting that the young child is exploring these modes concurrently. Although young children do explore with vocalizations that are free flowing with little or no syllabic content, such "pure" vocalises are less common than vocalizing with syllables in toddlerhood. Most singing-like vocalizations by toddlers are produced on syllables (Barrett, 2011; Björkvold, 1989, 1992; Moog, 1976; Stadler Elmer, 2012a; Young, 2002). Longitudinal studies of toddlers' free and spontaneous singing suggest that they rarely produce song-like material without words or word-like syllables (Whiteman, 2001).

Syllabic singing in childhood can be interpreted as pre-singing or invented songs (Barrett, 2011; Davies, 1986; Whiteman, 2001; Young, 2002). Syllabic singing can also be viewed as a playful practice of linguistic sounds found in the ambient language environment. Learning the

specific sounds and enunciations particular to each language culture requires an immense amount of practice and children may instinctively discover that these sounds can be practiced through vocal exercises that, to an adult, sound like singing. This is not to suggest that the purpose of all syllabic singing is merely to practice linguistic sounds. Young children explore both singing and speech through their vocalizations. Furthermore, the practice of song singing involves the incorporation of linguistic sounds, phonetics and syllables. Therefore, it is sensible, even unavoidable to consider language acquisition when studying singing acquisition. Some believe that speech prosody preceded singing in the development of humans (Patel, 2010) and others suggest that singing preceded language (Welch, 2006). This may not be a fruitful debate in itself, as Hanus Papoušek suggested, musical qualities in both song and speech are intimately related and this interrelationship is perhaps more interesting as a topic of research than the differences between them (Papoušek, 1996a).

Acquisition of Language and Music

Singing and language acquisition occur simultaneously and there are numerous parallels in the acquisition of both skills (Chen-Hafteck, 1997). In fact, the ambient language can affect the pitch in both the speaking and singing of toddlers (Mang, 2001). Because singing and speaking share the same production mechanisms, the two systems of music and linguistic skill can be assumed to rest upon the same learning capacities early in life (McMullen & Saffran, 2004). However, there may be some differences in the perception of pitch in speech and music that are apparent later in life (Zatorre & Baum, 2012), and presumably in pitch production of both modes as well. Therefore, there may be a need for increasing differentiation between singing and speaking with more experience and practice.[2]

Perception of Vocal Sounds

Perception of sounds needs to develop before and concurrently with the ability to produce and imitate vocal sounds (linguistic or musical) present in the surrounding environment. In the first year of life infants become increasingly more tuned in to their sound environment. Infants begin by perceiving language as sound information before they recognize words and they are sensitive to the emotion and melodic patterns in speech before they attribute meaning to individual words (Werker & Tees, 1999). Infants can discriminate patterns in speech and derive affective qualities such as approving and disapproving patterns. Fourmonth-old infants are more interested in positive approving speech patterns than negative disapproving patterns (Papoušek, Bornstein, Nuzzo, Papoušek, & Symmes, 1990). At five months infants are capable of recognizing patterns in their own language from a foreign language, although they are not capable of discriminating between two foreign languages (Nazzi, Jusczyk, & Johnson, 2000). Between six and 12 months, infants increasingly become better at perceiving phonetic information in their own language (Kuhl et al., 2006).

Infants prefer listening to a playful and happy sounding speech than to a lullaby (Corbeil, Trehub, & Peretz, 2013). In fact, infants as young as five months old are highly responsive to vocal affect (emotion) in their own and foreign languages, indicating that infants focus on other aspects of speech sounds than merely vowels and consonants (Fernald, 1993). At six months, infants demonstrate more sustained attention to their mothers' singing than speaking (Nakata & Trehub, 2004). After six months infants become increasingly interested in novel stimuli and begin to demonstrate more interest in other voices than their mother's singing voice (de l'Etoile, 2006).

Research on linguistic stimuli suggests that eight-month-old infants are capable of processing speech sounds and demonstrate an understanding of linguistic structures long before they can

produce these sounds themselves or vocally demonstrate their understanding of linguistic structure (Aslin, Saffran, & Newport, 1998). Infants also increase their understanding of melodic structure in the first year. Infants seem to recognize melodies based on melodic contour rather than interval sizes and they recognize melodies as the same, even after key transposition, in a similar way as adults do (Trehub, Bull, & Thorpe, 1984).

To summarize, there is ample evidence that very young infants are perceptive and discriminative listeners of their sound environment and they seem to actively engage in learning the patterns and rules that govern the linguistic and musical structures they encounter. The perception of details in vocal sounds is an important prerequisite for fine tuning one's own production of vocal expressions through deliberate practice or playful explorations.

Early Vocalizations

Newborn infants arrive in to the world with a burst of their own vocal sound and seem capable of using crying as a medium to respond to external circumstances already within the first hours of life (Cecchini, Lai, & Langher, 2007). From an acoustical perspective, early infant crying is continuous with speech-babble (Kent & Murray, 1982). The infant crying is a vocal mode of communication and very early on the infant crying is affected by the context and the social situation (Acebo & Thoman, 1992). This means that infants do not cry at random and their crying is somewhat controlled by the infant, for example infants cry more when left alone than when they are carried (Hunziker & Barr, 1986), or when someone is present (Cecchini et al., 2007).

Infants communicate not only through crying but also through other types of vocalizations. Infants are, from the very beginning, capable of producing different types of vocalizations ranging from crying to euphoric cooing in response to their immediate environment and these vocalizations can be categorized as either positive or negative (Keller, Schölmerich, & Eibl-Eibesfeldt, 1988). From two weeks of age, and possibly earlier than that, positive vocalizations occur most frequently during eye-contact with a caregiver (Keller & Schölmerich, 1987). Crying and cooing precede speech-babble which is seen as continuous with the speech phenomena proper to initial speech (Blake & de Boysson-bardies, 1992; de Boysson-bardies, Sagart, & Durand, 1984). The idea of singing acquisition as vocal social learning allows the classification of crying and other vocal utterances as pre-singing as well as pre-speech.

Acquisition of Vowels and Speech Intonation

The development and formation of vowels are equally important for singing acquisition as for language acquisition. Although the acquisition of vowels is mostly studied in the context of language, it is useful to consider this development in order to understand the progression of vocal production in early life. The increased ability to control vowel formation has a direct impact on the ability to produce song-like vocalizations. Infants from three to five months produce more vowels sounding like the vowels they are exposed to in their ambient language than other controlled vowel types from a foreign language (Kuhl & Meltzoff, 1996; Lee, Davis, & MacNeilage, 2010). This is also the case with 10 to 18-month-old infants (Rvachew, Mattock, Polka, & Ménard, 2006). The contention is that infants imitate sounds they are familiar with and those sounds become the target for production (Kent & Bauer, 1985; Kuhl & Meltzoff, 1996). However, studies across languages reveal common patterns in speech babble (Blake & de Boysson-bardies, 1992) and others suggest that there are more common trends than differences in babbling sounds across languages during the first two years of life (Kern, Davis, & Zink, 2009). Studies find that infants' ability to control speech intonation is detectable around the same time they are capable of producing single word utterances (Snow & Balog, 2002). The ability to control the

voice in terms of vocal pitches has obvious implications for singing acquisition, especially for reproducing contour preserving renditions of known melodies or melodic phrases. The few studies that have looked at the concurrent development of linguistic pitch and melodic pitch production in particular suggest that these two domains interact through development in early childhood (Chen-Hafteck, 1998; Mang, 2001).

Vocal Pitch Production

As infants mature, their attempts to control the content of their vocal productions become increasingly more apparent and researchers report engagement in solitary play with vocal sounds around four months (Ries, 1987). Infants as young as three- to six-months old may attempt to imitate single pitches they hear (Kessen, Levine, & Wendrich, 1979; Michel, 1973), and attempt to join their mothers' singing by vocalizing with sustained tones that resemble singing more than speaking (Michel, 1973). A study on musical elements in the vocalizations of infants aged two- to eight-months suggested that there were signs of influence of ambient musical material in vocalizations of infants growing up in a musically enriched environment from three to four-months before birth (Tafuri & Villa, 2002). Infants' vocalizations generally increase during the first year of life and they tend to vocalize more when engaged by an adult, for example, in response to infant directed singing (de l'Etoile, 2006). It is possible that infants respond to singing with more singing-like sounds and to speaking with more speech-like sounds (Papoušek, 1996a; Ries, 1987). Nevertheless, the classification of singing versus speaking may not be meaningful at this point in development as it is quite possible that the infant perceives speech as singing, especially the infant directed speech infants are exposed to (Malloch, 1999; Trehub, Hill, & Kamenetsky, 1997) and therefore, infants may respond to melodic speech patterns with song-like vocalizations. Also, it is important to keep in mind that the interpretation of what is singing and what is not, always lies with the adult listener, and the adults' perception may not have any basis in the infants' intent. It has wisely been pointed out that adults' interpretations of what constitutes singing in early vocalizations is highly subjective (Chen-Hafteck, 1997; Dowling, 1988).

Early Singing

Observations of spontaneous singing in day care centers suggest that children between one and two years are relatively quiet in such settings in comparison to two- and three-year-olds (Young, 2002). After the second birthday there is a notable increase in singing of standard songs and self-invented songs (Barrett, 2011; Björkvold, 1989, 1992; Whiteman, 2001; Young, 2002). There are large individual differences in the observed onset of early singing behavior in childhood. Although, there is a tendency to generalize knowledge based on average abilities in order to establish developmental stages, as is done with language development, it is well known that individual differences in language acquisition are considerable (Fenson et al., 1994). For example, 16-month-old infants can have an active vocabulary ranging from three to over 600 words (Caselli et al., 1995).

In two case studies where the researchers were fathers observing their children's singing development, there was a considerable difference in the timing of the onset of what they described as first singing. The girl's father observes her first singing at 17–18 months (Forrester, 2010), while the boy's father observes his first singing at 25–26 months (de Vries, 2005). Both singing behaviors are described as pre-singing in the sense that they were not singing complete songs, but they were reproducing melodic and rhythmic phrases that resembled standard songs in their environment. Other case studies report singing proficiency in young toddlers. Stadler Elmer described a 14 month-old boy's singing of recognizable phrases from standard songs (Stadler Elmer, 2012a)

and a girl's singing at 20 months (Stadler Elmer, 2012b). These children were repeating (practicing) phrases from a standard song with considerable skill in terms of stability of pitches and melodic contour. Stadler Elmer furthermore described the apparent awareness of musical rules such as in the 20-month-old girl's use of stress patterns and phrasing that added to the overall convincing performance of the song.

Singing-like vocalizations have been reported in infants as young as nine months (Honig, 1995; McGraw, 2017; Papoušek, 1996b). It seems that singing is observed early in infants with families where much attention is given to musical parenting. A study with mothers who were early childhood music educators found that these mothers commonly observed singing-like vocalizations in their own infants between nine months and the first birthday (McGraw, 2017). In a case study, researchers observed differences in children's singing acquisition in families that differed in terms of musical background, suggesting that the acquisition of singing skills were enhanced in more musically engaged families (Kelley & Sutton-Smith, 1987).

Singing on Syllables and Word Sounds

As noted above, toddlers between the age of three and five rarely produce singing without any word-like syllables (Whiteman, 2001; Young, 2002). Interestingly, observations demonstrate that two- and three-year-olds use word sounds as an anchor to secure the musical elements of songs (Mang, 2005). It is important to consider that young children acquiring language, most likely hearing words predominantly as sounds and not as distinct lexical items (Forrester & Borthwick-Hunter, 2015; Gudmundsdottir & Trehub, 2018). Word sounds are made up of vowels and consonants that in effect function as the percussive element of speech or singing. When linguistic sounds (e.g., "ba" or "doo") are regarded as percussive elements in the context of a sung melody, the musical qualities of the word sounds become apparent.

Because consonants function as a percussive element in vocal music, the words or syllables that go with melodies are likely attached in memory to melody or melodic contour in a similar way as rhythm is inseparable from melody in memory (Dowling, Barbey, & Adams, 1999). Therefore, it is understandable why toddlers are likely to claim they cannot remember a song if they do not remember the words to the song, even when the melody is obviously known to the child and she is able to reproduce the melody on nonsense syllables, filling in a forgotten second verse of a song (Mang, 2005).

Gestures and Song Learning

When young children spontaneously begin rehearsing songs that interest them they seem to give just as much attention to accompanying gestures as they do to other aspects of the songs. This seems to be a sensible and effective strategy for learning and memorizing songs. Gestures are in fact effective aids for learning and memory in general (Goldin-Meadow & Wagner, 2005). Furthermore, studies with older children have demonstrated that gestures help increase pitch accuracy in children's singing (Liao, 2008; Liao & Davidson, 2007). The role of gestures in the learning of song singing may be to kinesthetically internalize the structure of a song during the song learning process. Mothers do instinctively use hand and head gestures that mark the structure of songs they sing to their infants (Longhi, 2009), and both mothers and infants use gestures in musical interactions through musical vocalizations and singing (Malloch, 1999). In general, movements and gestures seem to accompany vocalises and singing-like behavior of toddlers and young children who typically sing and chant to their own rhythmic movements (Barrett, 2011; Björkvold, 1989, 1992; Young, 2002).

The Alleged Intent in Early Singing Behavior

Research on singing behavior and singing acquisition concerning the vocalizations of infants/toddlers is frequently analyzed with regard to adult-based criteria of what constitutes correct singing. The vocalizations are compared to musical elements of the ambient culture in order to find similarities and convincing attempts at reproducing standard musical material or songs in particular (Davidson, 1985; Davidson et al., 1981; Davies, 1986, 1992; Dowling, 1984; McKernon, 1979; Moog, 1976; Moorhead & Pond, 1941/1978; Stadler Elmer, 2012a; Young, 2002). However, the focus on musicological content of early vocalizations may undermine the intent of young children's singing behaviors. Alternative perspectives on early singing suggest that young children explore auditory material in the environment with their voices for their own purposes, that may have little to do with adult conceptions of culturally correct singing. Children's singing may not always be intended as music in the adult sense, and spontaneous singing in early childhood should be considered as a mode of communication, social interaction (Björkvold, 1989, 1992; Knudsen, 2008) and self-exploration (Knudsen, 2008), rather than as imperfect attempts at adult like singing. After a three-year longitudinal study on spontaneous singing in an early childhood setting, Whiteman (2001) suggested that future research should focus on the social agency of children when their musical development is investigated. He stated that research that strives for a "unidirectional model of musical development" may not be fruitful for the understanding of musicality and musical behavior in early childhood (Whiteman, 2001, p. 22).

The Multimodality of Song Singing

When researchers of early song singing focus on pitch accuracy, interval precision and stable tonal centers, they may be missing the point of what the act of singing a song means to a child. Furthermore, a young child may consider many different aspects of the song other than pitch- and interval accuracy. The imprecision of pitch in a given performance does not necessarily mean that a child is incapable of producing the correct pitches and intervals required for adults to deem the singing musically correct. However, for a young child the interval precision may be much less important than the social context and other aspects of the song singing.

If we consider the complex structure of a song and the multimodality of song singing, there are many other elements to consider than pitch intervals. The rhythmic structure and overall form of a song are important elements, as well as the expressions and phrase structure that children absorb and incorporate into their own reproductions of songs (e.g., Björkvold, 1989/1992; Mang, 2005; Stadler Elmer, 2012a; Young, 2002). Furthermore, singing a song can mean to a young child having a particular feeling or being in a mood that goes with a song, such as a happy song or an interpretative song about characters or objects. The word-sounds (percussive syllables) that accompany most children's songs seem important to children, and they even make up their own songs or play with fractions and phrases of standard songs. And last, but not least, the gestures that accompany songs may seem just as important to a toddler as any other aspect of a song. Considering how multifaceted song singing is, one can suggest that melodic contour is more than sufficient in terms of pitch precision for a socially successful and recognizable song performance. In fact, adults can easily recognize toddlers' contour preserving singing of familiar songs with foreign linguistic content (Gudmundsdottir & Trehub, 2018).

Individual Differences in Singing Acquisition

There are large individual differences in singing skills in the general population (Dalla Bella, Giguère, & Peretz, 2007), and wide differences are reported between individuals in childhood (Flowers &

Dunne-Sousa, 1990; Leighton & Lamont, 2006). Some suggest that singing accuracy is typically achieved as late as 11–12 years (Rutkowski & Miller, 2003; Welch, 2006; Welch et al., 2011). Other reports suggest that some individuals are capable of culturally accurate singing near their second birthday (Moog, 1976) and even earlier (McGraw, 2017; Stadler Elmer, 2012a, 2012b).

The large differences reported in singing skills and singing accuracy in terms of culturally accurate reproductions of melodies and songs are much more extensive than the differences normally reported in the onset of language. In this context, it may be useful to consider that what we usually refer to as culturally correct reproductions of songs in Western societies requires the high precision of pitch production that is not necessary for song recognition. In order to recognize a melody, a version that preserves the rhythm and contour of the melody and the words (word sounds) need not be recognizable (Gudmundsdottir & Trehub, 2018). In fact, most adults who are occasional singers do not necessarily reproduce songs with the highest precision of pitch but rather approximate the melodic contour (e.g., Pfordresher & Brown, 2007). However, as previously noted, the absence of pitch accuracy in singing does not mean that the ability to produce accurate pitches is not present. Pitch accurate performances of songs require that the singer is aware of the importance of pitches and interval precision, which requires deliberate practicing of that cognitive and physical skill. Most people may have the ability to reproduce pitch-accurate renditions of songs and melodies (Dalla Bella et al., 2007), and this ability may be present very early in childhood in many individuals (Honig, 1995; McGraw, 2017; Moog, 1976; Stadler Elmer, 2012a). Still, it is only through deliberate practice that this ability is transformed into the skill of "singing in tune". This transformation may possibly occur at any time in life, although it is not known if there are critical periods for this skill acquisition. Singing skills can be improved through deliberate practice in two-year-olds (de Vries, 2005), three-year-olds (Jersild & Bienstock, 1931; Smith, 1963), and later in childhood (Barlow & Howard, 2005; Roberts & Davies, 1975; Welch et al., 2011). A recent study demonstrates that adults are also responsive to training and can improve their singing accuracy after a short period of training (Neokleous, 2015). Even those who have been diagnosed with congenital amusia (Peretz et al., 2002) can improve their singing through training (Anderson, Himonides, Wise, Welch, & Stewart, 2012). Previous studies have shown that simple measures can improve occasional adult singers' pitch accuracy, such as by asking them to sing in a slower tempo (Dalla Bella et al., 2007) or by giving them a matching human vocal model to imitate (Lévêque, Giovanni, & Schön, 2012). Therefore, it seems that singing skills do not simply unfold through normal biological and cognitive development but rather depend on the musical opportunities and social interactions individuals have throughout their lives.

It seems that "in tune" singing is a skill that many individuals are capable of developing very early in life. However, without reinforcement and deliberate practice of singing skills, it seems that many individuals may not reach their potential ability of precise singing that would be considered "culturally correct" or "in tune" singing. In infancy and early childhood, there may be a critical period that allows individuals to achieve high precision and confidence in their use of a singing voice for correctly reproducing vocal music of the ambient culture. Acquiring precise singing skills in early childhood presumably requires encouragement through constant feedback from a skilled adult. In early childhood language acquisition, the amount and quality of feedback infants receive determines their vocabulary size and linguistic skill acquisition is well documented (Bates, Dale, & Thal, 1995; Goldstein & Schwade, 2008). This has not been explored sufficiently in early childhood acquisition of singing. Singing acquisition has been regarded as a gradually unfolding ability with age through normal development but with little regard to the effect of the stimulating environment on singing skill acquisition. Future research should take into account the interaction between the social context and the complex skill development in the context of early development singing skills.

Notes

1 Note that *Volume 1 Development* of this *Routledge Companion to Interdisciplinary Studies in Singing* includes the related chapters on infant development of singing: Chapter 2 by Stephanie Stadler-Elmer "From canonical babbling to early singing"; Chapter 13 by Simone Falk & Christine Tsang "The role and functions of infant-directed singing in early development"; Chapter 14 by Eugenia Costa-Giomi & Lucia Bennetti "Home music environment and singing development in infancy"; Chapter 16 by Leslie Phillmore & Christine Tsang on "Vocal Communication in Birds and Humans – Beyond Song and Speech", Chapter 19 by Sandra Trehub and Frank Russo "Infant-directed singing from a dynamic multimodal perspective: evolutionary origins, cross-cultural variation, and relation to infant-directed speech"; and Chapter 20 by Anna Rita Addessi on "Before singing: The role of reflexivity during vocal interactions with caregivers in diaper change daily routine". Chapter 8 by Beatriz Raposo entitled "Singing and speech as comparable phenomena: A dynamicist approach" is also relevant.

2 A hypothesis of interaction between two models of singing acquisition, a model of social-vocal learning and a model of singing as a complex skill acquisition, is presented in the Introduction of this Volume by Gudmundsdottir, Beynon, and Ludke, developed further in Chapter 1 by Gudmundsdottir, and again in further detail in the concluding chapter of this Volume.

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