Babies come equipped with exquisite sensitivity to the musical features that are common across cultures. They are remarkably skilled listeners, their memory for music is adult-like, and they are keenly interested in music. Intuitively, mothers in all parts of the world cater to these interests and inclinations by providing informal musical mentoring. They do so selflessly, motivated by love and a desire to communicate with their preverbal infants. These notions about infants and mothers may seem like wild speculations, but they are based on findings from systematic studies of infant music perception and musical interactions between mothers and infants. This article outlines the evidence for the musical nature of infants and mothers and considers the implications of this knowledge.

The Listening Skills of Adults and Infants

One way of appreciating infants' musical proficiency is to compare their music-listening skills with those of adults. Adults, even those without musical training, are proficient music listeners (Dowling, 1999). After hearing an unfamiliar melody, they remember its pitch contour and rhythm (i.e., a rough gloss of the tune), but they forget precise details such as pitch distances between notes (i.e., musical intervals), specific pitch levels, and note durations. For melodies heard repeatedly over months (e.g., popular songs) or years (e.g., "Happy Birthday"), their memory is much more precise. For example, adults readily detect errors in amateur performances of sung or instrumental music, and they often notice errors in professional performances.

Along with adults' excellent memory for familiar musical pieces is a generalized or abstract conception of those pieces. For example, their recognition of a familiar tune does not depend on a specific pitch level, a specific tempo (or speed), or a specific instrument (e.g., a piano, flute, or voice). What matters are the relations between notes, which define the tune as "Yankee Doodle" rather than "Happy Birthday," "Twinkle, Twinkle, Little Star," or anything else. For many years, scholars believed that previous experience with different renditions of a tune taught us which features are critical to the identity of that tune (e.g., pitch relations and rhythm) and which are not (e.g., exact pitches and note durations). However, research with infant listeners overturned traditional views about music listening and added substance to the claim that music has biological foundations (Trehub, 2000, 2001).

Our knowledge about infants' musical skills would be minimal were it not for the innovative test procedures in current use. In one procedure, 6-month-old infants learn to turn toward a loudspeaker whenever they hear a change in the background melody, and are rewarded with visual treats whenever they do so (Trehub, Thorpe, & Morrongiello, 1987). If infants respond consistently to a particular change, it tells us not only that they noticed the change, but also that they remembered what the original melody sounded like. Another procedure allows researchers to learn about infants' musical preferences by measuring signs of interest and attentiveness while they listen to different musical selections (Trainor, 1996).

at a glance

- Infants prefer the musical qualities of infant-directed speech to adult-directed speech. Babies respond better to infant-directed sign language than to adult-directed signing.
- Maternal singing captures infant attention better than maternal speech.
- Mothers produce playful or soothing renditions of familiar songs to regulate their infants' states, and possibly their own.
- Infants' ability to grasp musical patterns is adult-like, and may have biological origins.
Well before infants understand anything about language, they can recognize a recently heard melody or auditory pattern (i.e., sequence of pitches), even when it is presented at a different pitch level (Chang & Trehub, 1977a; Trehub, Thorpe, & Morrongiello, 1987) or tempo (Chang & Trehub, 1977b; Trehub & Thorpe, 1989). Infants’ attention to musical detail is truly impressive. After mere minutes of listening to a melody, they detect subtle changes in pitch (Trainor & Trehub, 1992; Trehub, Bull, & Thorpe, 1984) or rhythm (Trehub & Thorpe, 1989). What surprised everyone, however, was infants’ especially keen memory for melodies that sound conventional or ordinary to adults. For example, infants remember extraordinary detail from melodies with consonant, or pleasant-sounding, intervals (e.g., perfect fourths or fifths) and those with regular timing (i.e., a steady beat). By contrast, they remember little from melodies with dissonant intervals or irregular timing (Schellenberg & Trehub, 1996; Trehub, 2000). In this respect, they are very much like adults.

I am not suggesting that 6- or 8-month-old infants have learned the musical conventions of their cultures. Instead, nature provides them with the ability to appreciate the music of any culture (Schellenberg & Trehub, 1999; Trehub, 2000, 2001). The implication is that music everywhere, especially folk or popular music, reflects the capabilities and constraints of the human auditory system.

Beyond the perceptual parallels between infants and adults are interesting aesthetic parallels. In general, adults prefer music with consonant intervals to music with dissonant intervals. How interesting it is that infants, in their own way, make comparable judgments! For example, 4-month-olds are more fretful and restless when they listen to dissonant versions of European folk melodies than to the original consonant versions (Zentner & Kagan, 1996). Similarly, 6-month-olds prefer intact Mozart minuets to modified versions that substitute dissonant intervals for many of the consonant intervals (Trainor & Heinmiller, 1998).

Music in Mothers’ Speech: Babies’ Reactions

It is reasonable to wonder whether these music-listening skills are useful to infants. As it happens, mothers regularly produce music or musical sounds for their babies. They talk a great deal to infants, and their sing-song speech is repetitive, rhythmic, and dominated by flowing pitch contours (Fernald, 1991). Moreover, caregivers across cultures use similar intonation contours in similar contexts — for example, rising contours to attract infants’ attention; smooth, falling contours to soothe infants; and abrupt, flat contours to discourage undesirable behavior (Fernald, 1991; Papousek, 1992). In short, vocal, non-verbal aspects of mothers’ speech are emotionally interpretable (see Fernald, 1991).

Deaf mothers achieve comparable expressive goals through very different means. Their signed messages to infants are more rhythmic, repetitive, and emotionally expressive than are their signed messages to adults (Masataka, 1992). Just as infant-directed speech has parallels with music, so infant-directed signing has parallels with dance. In other words, verbal and signed communications to infants provide similar emotional information.

In general, mothers use a small set of intonation patterns or tunes when talking to their pre-verbal infants, and they fill such tunes with an assortment of verbal phrases (Bergeson, 2002). For example, they pose numerous questions, most of which end with a rising pitch: “Do you want to eat now?” “Should I change your diaper?” “Are you my special baby?” “Should we ride in the car?” Fine-grained analyses of maternal questions and statements reveal distinctive pitch patterns on the part of every mother (Bergeson, 2002). In effect, distinctive voice quality, tunes, and facial features provide multiple cues to the mother’s identity in light or darkness.

How do babies respond to their mothers’ “spoken music”? Newborns and older infants are more attentive and responsive to the sounds of infant-directed speech than to those of adult-directed speech (Cooper & Aslin, 1990; Fernald, 1985; Werker & McLeod, 1989). Essentially, they prefer happy-sounding speech to neutral-sounding speech (Singh, Morgan, & Best, 2002). Similarly, infants show greater attention and more positive affect to signed infant-directed messages than to signed adult-directed messages, whether or not they have experience with sign language (Masataka, 1996, 1998).

Maternal Singing: Babies’ Reactions

Maternal vocal interactions with infants are not limited to speech or playful noises (e.g., clicks, raspberries). Mothers throughout the world sing regularly to infants in the course of child care (Trehub & Trainor, 1998). Historical accounts indicate that caregivers, whether mothers, fathers, grandparents, siblings, or nannies, have always engaged in such singing. Maternal singing to babies differs from typical informal singing in its greater emotional expressiveness, higher pitch level, and slower tempo (Trainor et al., 1997; Trehub et al., 1997). Although fathers sing less frequently to infants than mothers do, their singing is also marked by heightened emotionality (O’Neill, Trainor, & Trehub, 2001; Trehub et al., 1997). Even preschoolers sing more expressively than usual when their infant sibling is in view (Trehub, Uytk, & Henderson, 1994). The presence of a baby seems to influence the emotions of caregivers or bystanders, one consequence of which is highly expressive singing.

Most mothers have a small repertoire of songs that they sing repeatedly to their infants. One might expect mothers to vary these renditions, but they produce highly similar performances. For example, when mothers sing their favorite
nursery song to infants on different occasions, they maintain the same pitch level and tempo (Bergeson & Trehub, 2002). Such monotony would likely bore the adult listener. For the infant, however, stable performances provide a source of security — a familiar voice, a familiar performance style, and a familiar song. As one would expect, mothers adjust their performances to respond to their infants’ changing states, producing playful or soothing renditions, as appropriate. In other words, mothers tailor their performances to the needs of their young listeners.

Singing and speech are important means by which mothers share emotions with their pre-verbal infants. Such emotion-sharing can be accomplished even with infants’ limited range of social-emotional skills. Infants are sensitive to socially significant visual and auditory stimuli. For example, they are attracted to faces (Johnson, Diurawiec, Ellis, & Morton, 1991) and to voices (Ecklund-Flores & Turkevitz, 1996) from the earliest days of life. They are also precocious social learners, as reflected in their recognition of mother’s face (Bushnell, Sai, & Mullin, 1989) and voice (DeCasper & Fifer, 1980) soon after birth. Before infants can understand specific emotional meanings, they succeed in mimicking mothers’ emotions by a process of emotional contagion (Hatfield, Cacioppo, & Rapson, 1994). Just as infants cry upon hearing the crying of other infants (Hoffman, 1978), they attain positive affective states simply by hearing a mother’s expressions of positive emotion.

Even as newborns, babies are more attentive to singing in the “maternal” style than to typical informal singing (Masataka, 1999), and this preference persists during subsequent months (Trainor, 1996). No doubt, vocal cues to positive affect underlie this preference, as they do for infant-directed speech (Singh et al., 2002). In everyday life, maternal singing provides visual, tactile, and movement stimulation in addition to auditory stimulation. Videotaped (i.e., audio-visual) versions of maternal singing generate exceptional interest, even greater than that shown for videotaped episodes of maternal speaking (Nakata & Trehub, 2000). Infants’ engagement during the singing episodes is evident from their prolonged regard of the mother’s on-screen image and from dramatic reductions in their body movements. Videotaped singing performances of unfamiliar singers (the mothers of other infants) are also effective in maintaining infants’ attention (Nakata & Trehub, 2001).

Maternal speech readily captures infant attention, but maternal singing is more effective in maintaining attention. Maternal singing also reduces infant arousal (Sherfield, Trehub, & Nakata, 2002). The success of singing in regulating mood and arousal may account for its prevalence in child care settings across cultures and historical periods (Trehub & Trainor, 1998). Mothers’ use of music to manage infant moods has parallels in the therapeutic use of music for regulating emotion in disabled or sick children and adults (Bunt & Pavlicevic, 2001) and to adolescents’ self-regulation of moods by music-listening (Sloboda & O’Neill, 2001).

Maternal singing may well provide benefits for the singer as well as the listener. Throughout history, informal singing has been used to ease the burden of manual labor (Keil, 1979), relieve the pressures of daily life (Cong-Huyen-Tong-Nu, 1979), foster closeness between singer and listener (Pantaleoni, 1985), and provide a safe outlet for negative feelings (Merriam, 1964). Caring for infants involves stresses as well as pleasures. The privacy of mother-infant interactions and the pre-verbal status of the infant make it possible for the mother to say or sing what she could not express in other contexts. Releasing pent-up feelings may increase the mother’s feelings of closeness to her confidence. Soothing singing likely calms mothers as well as infants, and playful singing likely rouses them both. In this way, maternal singing can regulate maternal as well as infant emotions.

Implications for Infant/Family Practice

If singing to a baby is beneficial to mother and child, surely practitioners who work with infants, toddlers, and their families should urge every mother to sing to her infant. Surely they should encourage mothers to produce highly expressive performances. Or should they? The available research offers descriptions of what most mothers do when interacting with their infants, not prescriptions for what mothers should do. Moreover, deliberate, planned performances are unlikely to have the emotional richness of spontaneous performances, which are motivated by sensitivity to the infant’s changing needs. Just as sensitive mothers adjust their communications to the needs of infants, so sensitive practitioners must fine-tune their interventions to the unique needs of each family.

Commercial Recordings and Music Lessons

Media reports about infants’ musical abilities and potential have convinced many mothers that “good” (i.e., professional) recordings are preferable to their own mediocre singing. Such recorded materials, interesting as they may be, are designed to attract the adults who buy them. They are no match for maternal performances, which feature interesting sights and movements as well as sounds. Moreover, commercial recordings lack the familiar voice and emotive qualities that are so engaging to the infant listener, and they are not tailored to the preferences of individual infants, as mothers’ performances are. No one would suggest replacing maternal verbal interactions with recorded monologues or dialogues by professional actors. By the same token, professional singers are no substitute for live, maternal singing.

The recent media frenzy surrounding controversial claims that music training increases brain power has also fuelled unparalleled interest in music programs for moms and tots. Although music programs for older children may be highly valuable, such programs are by no means necessary for mothers and infants. However, parent-centered programs can connect mothers or fathers with other parents, encourage playful inter-
actions with infants, musical or otherwise, and provide parents with a repertoire of enjoyable musical activities. By contrast, instructor-centered programs often take the joy out of music by their authoritative (or authoritarian) pronouncements on the “right” music, the “right” activities, and the “correct” developmental timetable of musical exposure and training.

Conclusions
Infants’ precocious listening skills, musical memories, and responsiveness to music attest to their musical natures. Mothers complement these skills by providing extraordinary musical mentoring from the earliest days of life. Unlike musical mentoring by professionals, maternal mentoring is intuitive and selfless, guided by love and concern for infants rather than profit or musical goals. If infants are musical, then surely mothers are, too.

REFERENCES