Musical affect regulation in infancy

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Adolescents and adults commonly use music for various forms of affect regulation, including relaxation, revitalization, distraction, and elicitation of pleasant memories. Mothers throughout the world also sing to their infants, with affect regulation as the principal goal. To date, the study of maternal singing has focused largely on its acoustic features and its consequences for infant attention. We describe recent laboratory research that explores the consequences of singing for infant affect regulation. Such work reveals that listening to recordings of play songs can maintain 6- to 9-month-old infants in a relatively contented or neutral state considerably longer than recordings of infant-directed or adult-directed speech. When 10-month-old infants fuss or cry and are highly aroused, mothers’ multimodal singing is more effective than maternal speech at inducing recovery from such distress. Moreover, play songs are more effective than lullabies at reducing arousal in Western infants. We explore the implications of these findings along with possible practical applications.

Keywords: infants; mothers; music; singing; affect regulation

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The use of music listening for affect regulation (i.e., self-regulation) is widespread in adolescence and adulthood, with varied goals such as relaxation or revitalization, prolonging positive moods, discharging negative emotions, evoking pleasant memories, and distraction from challenging circumstances.¹⁻⁵ Musical selections in such circumstances tend to be congruent with listeners’ initial mood rather than their target mood, except when the goal is distraction.³,⁶ Infants, who have limited affect-regulation skills at their disposal, can usually count on caregivers to provide music listening experiences that fulfill comparable functions and also facilitate social bonding.⁷⁻⁹

Singing to infants: cross-cultural perspectives

Adults throughout the world sing to their infants for purposes of affect regulation.⁷⁻⁹ Their success in modulating infant affect, by whatever means, is considered critical not only for the immediate consequences (e.g., increasing pleasure, decreasing discomfort, promoting sleep) but also for children’s subsequent development of self-regulation skills and social competence.¹⁰⁻¹³ To date, however, research on maternal singing has focused largely on its acoustic features¹⁴⁻¹⁸ and its effect on infant attention¹⁹,²⁰ rather than affect.

In agrarian societies in the developing world, where concerns about infant safety and survival are paramount, mothers maintain almost constant physical contact with infants, who are carried in slings throughout the day and sleep with mothers at night.²¹,²² Mothers in such situations typically sing lullabies or soothing songs, which are in line with cultural ideals of calm, contented infants. Play songs tend to be introduced in the toddler phase or thereafter.⁹ Infants’ musical experience is multimodal in that they hear the singing while feeling contact comfort and movement.

Caregivers in the developed world commonly have the luxury of focusing on the quality of the dyadic relationship and on providing a stimulating environment for their infants.²³ They promote these goals through animated play, including the singing of play songs.⁹,¹⁸,²⁴ Such singing is also multimodal,
with mothers smiling as they sing,\textsuperscript{25} often with distinctive actions.\textsuperscript{24} In other words, singing is almost invariably heard and seen, with touch and movement included on many occasions.

Maternal singing, especially play songs, is highly expressive as well as individually distinctive,\textsuperscript{14–18,26} with expressiveness influenced by visual feedback from infants. For example, maternal vocal expressiveness is heightened when infants are present rather than absent\textsuperscript{16–18} and face to face rather than obscured from view.\textsuperscript{25}

**Infant-directed singing: consequences for infant attention**

As noted, the consequences of maternal singing have been evaluated primarily for attention regulation rather than affect regulation. Infants who are exposed to audio samples of infant-directed and non-infant-directed singing by unfamiliar singers listen longer to the infant-directed versions,\textsuperscript{20} even as newborns.\textsuperscript{19} When the listening choices consist of infant-directed speech and singing (audio only), also involving unfamiliar voices, they listen longer to the version that sounds happier, whether speech or singing.\textsuperscript{27} For example, infants listen longer to exuberant infant-directed speech than to hummed lullabies, equally long to infant-directed speech and play songs, and longer to play songs than to adult-directed speech. When contented infants experience live maternal singing rather than recordings, the consequence is arousal modulation,\textsuperscript{28} which raises the possibility that maternal singing could have salutary effects on the arousal of fretful infants.

In general, mothers smile more when they sing than when they speak, which may account for infants’ greater visual attention to silent videos of infant-directed singing than to comparable videos of speech.\textsuperscript{25} Infants also exhibit prolonged attention to audiovisual samples of playful maternal singing relative to playful maternal speech.\textsuperscript{29}

Acoustic analyses of infant-directed speech reveal more features in common with singing than with conventional or adult-directed speech.\textsuperscript{27} Nevertheless, the two vocal forms differ in a number of respects, with infant-directed singing being less variable than infant-directed speech in pitch, dynamics, and timing. Although audio samples of infant-directed speech and singing have comparable efficacy in attracting infant attention,\textsuperscript{27} they might have differential efficacy in sustaining infant attention over a longer time span and delaying the onset of negative affect.

**Infant-directed singing: sustaining attention and delaying distress**

Corbeil et al.\textsuperscript{30} addressed this question by exposing 6- to 9-month-old infants to one of three audio recordings: (1) a rhythmic Turkish play song sung in a lively, infant-directed manner; (2) the words of the Turkish song spoken in an infant-directed manner, with the spoken version having greater variability in pitch, dynamics, and timing than the sung version; and (3) the same words spoken in a neutral or adult-directed manner, with smaller pitch and dynamic range than the version spoken in an infant-directed style.\textsuperscript{30}

Infants sat in a dimly lit room with their parents out of view. The designated recording played continuously until infants met a criterion of distress (i.e., fussiness) based on visual signals alone (e.g., grinning, cry face, restlessness). On average, when listening to infant-directed singing, infants took almost 9 min to meet the distress criterion, roughly twice as long as when listening to infant- or adult-directed speech (Fig. 1). The findings were replicated in a follow-up experiment in which infants listened to infant-directed speech and singing samples in their native language (French). In short, simply listening to recordings of infant-directed singing has

![Figure 1. Infants’ mean listening time (min) to audio samples of infant-directed (ID) singing, infant-directed speech, and adult-directed (AD) speech before meeting a distress criterion. Error bars are standard errors. Infants listened significantly longer to ID singing than to both speech registers, which did not differ from one another.](image)
demonstrable affect-regulatory consequences, as reflected in its ability to prolong positive or neutral affect and delay visible signs of distress. It is possible, indeed likely, that familiar songs sung by familiar singers would have even greater success in sustaining infants’ attention.

**Maternal singing: alleviating distress**

A question of greater theoretical and practical significance is whether infant-directed singing can reduce the high arousal levels of distressed infants. Maternal touch is known to be highly efficacious in increasing infants’ positive affect and reducing their negative affect.\(^\text{31,32}\) Moreover, the manner of touch (e.g., tickling, patting, stroking) differs as a function of infant needs and caregiving goals.\(^\text{33}\) There is much less understanding of the consequences of mothers’ vocal behavior in the context of multimodal interaction.

Infant affect regulation has been studied extensively in the laboratory with stress-inducing perturbations such as the still-face procedure.\(^\text{34,35}\) This perturbation involves mothers becoming unresponsive—motionless and expressionless—after freely interacting with infants, which puts infants’ self-regulation strategies on display. Infant reactions during the still-face manipulation have been linked to parenting quality\(^\text{36}\) and to subsequent indices of child adaptation, including attachment to mother\(^\text{37}\) and behavior problems.\(^\text{38}\) The resumption of “normal” interaction in the final phase of the still-face procedure provides an opportunity to explore the factors that facilitate infants’ recovery from distress. In general, residual distress from the still-face phase remains evident in the reunion phase, delaying infants’ recovery.\(^\text{35}\)

Studies using the still-face procedure have focused largely on infants’ self-regulation strategies (when mothers are unresponsive) as a function of factors such as infant age, gender, risk status, and temperament, with some attention accorded to differences in dyadic interaction between the initial and final interaction.\(^\text{34,35,39}\) To date, however, there has been no attempt to manipulate the nature of maternal vocal behavior during the resumption of interaction or the so-called reunion phase.

Ghazban\(^\text{40,41}\) compared the efficacy of maternal speech and singing for reducing the distress of 10-month-old infants in the context of the still-face procedure (see Fig. 2 for a schematic depiction of the procedure). Each of four trials consisted of the following sequence. In an initial 60-s play phase, mothers interacted freely with infants (vocalization, touch, and movement). Subsequently, mothers became unresponsive, looking directly at the infant but remaining silent and motionless and maintaining a neutral facial expression for 15 seconds. In the final reunion phase, which lasted 90 s, mothers resumed full interaction except for vocalizations being restricted to speech for half of the trials and to singing for the other half. The procedure was videotaped to permit subsequent coding of infant and maternal behavior (e.g., infant negative vocal and facial expression, maternal facial expression and touch), and infant skin conductance was monitored continuously as an index of infant arousal. Increases and decreases in skin conductance correspond to increases and decreases in arousal.

As expected, mothers’ emotional withdrawal during the still-face period led to infant discontent and increased skin conductance levels (i.e., arousal levels) in line with previous research.\(^\text{34,35,42}\) Arousal continued to increase during the initial part of the reunion phase, indicating a protracted process of recovery. The findings of greatest interest, however, were the substantially higher skin conductance levels (i.e., higher arousal levels) and longer recovery time for reunion episodes involving maternal speech rather than those involving maternal singing. As can be seen in Figure 3, arousal was comparably elevated during the first 30 s of the singing and speech episodes. As the reunion progressed beyond 30 s, arousal increased dramatically during the speech reunions, but it began a downward trajectory during the singing reunions. In fact, the most pronounced difference in infant arousal was evident toward the end of the reunion phase (i.e., 60–90 s), which highlighted the greater efficacy of maternal singing than maternal speech in ameliorating the arousal and distress of 10-month-old infants.

In line with the physiological data, infants exhibited significantly more negative facial and vocal expressiveness during speech episodes than during singing episodes as well as greater visual fixation on their mothers during singing than during speech episodes. Mothers also engaged in more affectionate touch during speech than during singing episodes, perhaps prompted by infants’ negative emotional displays.\(^\text{43}\) However, affectionate touch proved to be relatively ineffectual in reversing infants’ distress in this situation.
Mothers interacted with infants during an initial play phase, which was followed by the stress induction (still-face) phase and, finally, by the resumption of interaction with speech or singing in the reunion phase.

What accounts for the greater efficacy of maternal singing than maternal speech in ameliorating infants’ distress? Several factors may be implicated. One is the rhythmicity of singing, which may be especially potent in its ability to capture infants’ attention and distract them from their woes. Most mothers sang lively play songs rather than lullabies—a choice congruent with the desired end state rather than infants’ current state. In effect, mothers elected to distract their fretful infants with rousing songs rather than to soothe them with lullabies.

In addition, mothers often accompanied their rhythmic singing with rhythmic head and arm movements, sometimes moving their infants to the beat of the songs. Infants are sensitive not only to rhythmic patterns but also to patterns of movement when moved by others. The importance of rhythmicity was confirmed in a second experiment that compared maternal play songs and lullabies, instead of the previous speech and singing comparison. Infants recovered their composure more rapidly in the context of play songs rather than lullabies. Although maternal lullabies were less effective than play songs in lowering infants’ arousal levels, they were considerably more effective than maternal speech. It is clear, then, that aspects of singing, over and above its lively, rhythmic character, contributed to arousal reduction. The relative efficacy of lullabies and play songs for distress and arousal reduction may also depend on the age of infants. For example, it is conceivable that lullabies would be more effective than play songs for very young infants.

Another potentially relevant factor is infants’ greater familiarity with the form and content of mothers’ songs relative to those of speech. In general, mothers know many songs, but they sing a small subset repeatedly—play songs for the most part—performing them in a nearly identical manner on different occasions. Hearing well-known songs performed in a predictable manner would
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Figure 3. Standard scores (z scores) for skin conductance during play, still-face, and reunion phases. Scores for the 90-s reunion phase are shown for each 30-s period. Data from Ghazban.⁴⁰,⁴⁷

provide infants with welcome relief from the experience of the still-face episode, in which mothers behaved in unpredictable and seemingly insensitive ways. The lesser efficacy of lullabies could stem, at least in part, from their lesser familiarity (e.g., sung primarily at bedtime).

It is possible that the still-face procedure was somewhat stressful for mothers as well as infants. Mothers watched their infants become upset as a result of their own actions and then had difficulty restoring infants’ equanimity, all of this occurring while the cameras kept rolling. Singing songs to infants would have been easier than talking to them in the sense of having prescribed tunes and texts that are known and loved by infants. The act of singing may have reduced maternal arousal levels as well as those of infants, perhaps affecting the infants through emotional contagion or automatic mimicry.⁴⁸

Maternal singing for distress reduction: a glimpse at possible applications

The success of maternal singing with mildly distressed infants⁴⁰,⁴¹,⁴⁷ suggests potential applications for adults who are at risk for parenting difficulties because of their own circumstances or because of infants’ serious health challenges. Crying, the clearest and most common signal of infant distress, typically prompts caregiving interactions aimed at remedying the situation. The adequacy of parents’ responsiveness in such circumstances has implications for infants’ emotional development.⁴⁹ For parents with serious personality or adjustment difficulties, infant crying may generate negative attributions, insensitive responding,⁵⁰ and, in extreme cases, intense anger or frustration culminating in infant abuse.⁵¹,⁵² Even adults who have no history of personal difficulties sometimes react to infant crying in less than optimal ways. For example, childless university students whose anger is aroused when listening to infant crying report child-blaming attributions in contrast to listeners whose sympathy is aroused.⁵³

It would be naive to think that singing in itself could transform insensitive parents into sensitive ones. In conjunction with professional support and other interventions, however, singing may well enhance infants’ and caregivers’ well-being.

Neonatal intensive care units (NICUs) are high-stress environments because of the fragility of the patients, the anxieties of their parents, and the need for frequent medical interventions. Live singing provided by music therapists has favorable implications for a number of health indicators.⁵⁴ There are indications that maternal singing has comparable effects for NICU infants,⁵⁵ and it may well have additional benefits for parents.

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Conflicts of interest

The authors declare no conflicts of interest.

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