MOTHERS' SINGING TO INFANTS AND PRESCHOOL CHILDREN

by

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Abstract

Mothers were recorded singing the same song of their choice to their infants and preschool children. In Experiment 1, naive adult listeners accurately identified the infant-directed versions out of each pair of mothers' songs. Pitch and tempo also were measured--pitch was higher for the infant-directed versions but tempo and intensity did not differ across contexts. In Experiment 2 naive listeners judged which version out of each pair sounded more "loving" and more articulate. The preschooler-directed songs were rated as more clearly articulated than the infant-directed versions; there were no differences in "loving" tone of voice. However, the percentage of infant-directed versions rated as more "loving" in Experiment 2 was highly correlated with percentage of correct identifications in Experiment 1.

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Mothers' Singing to Infants and Preschool Children

Mothers speak differently to their infants than they do to adults, the former speech register variously known as motherese, baby talk, or infant-directed speech (Ferguson, 1964; Fernald & Simon, 1984; Garnica, 1977; Snow, 1977). The age of the child affects the nature of maternal speech (Snow, 1972; Stern, Spieker, Barnett, & MacKain, 1983), reflecting, perhaps, different communicative intentions--"social regulatory" versus "informational" (Fernald, 1991; Garnica, 1977; Warren-Leubecker & Bohannon, 1984)--and listener capabilities (Fernald, 1991; Stern et al., 1983, Trainor, 1996). Parental singing also differs noticeably in an infants' presence or absence (Trehub, Unyk, Kamenetsky, Hill, Trainor, Henderson, & Saraza, 1997; Trehub, Unyk, & Trainor, 1993b). There has been no indication, however, whether the age of the child listener affects the nature of such singing. Accordingly, the current investigation aimed to compare maternal singing to preverbal (infant) and verbal (preschool) listeners.

The differences between infant-directed and adult-directed speech are numerous. Mothers increase their pitch, expand their pitch range, produce smooth, simple, and highly exaggerated pitch contours, decrease their tempo, articulate poorly, use a "sing-song" rhythm, repeat sounds, and elongate their vowels (Ferguson, 1964; Fernald & Simon, 1984; Garnica, 1977; Snow, 1977). Moreover, similar changes in mothers' speech to infants have been found in a number of languages, including Mandarin, French, Italian, German, Japanese, Swedish, and Russian (Fernald & Simon, 1984; Fernald, Taeschner, Dunn, Papousek, de Boysson-Bardies, & Fukui, 1989; Grieser & Kuhl, 1988; Kuhl et al., 1997; but see also Bernstein Ratner & Pye, 1984; Ingram, 1995). Comparable changes are evident in fathers' speech (Jacobson, Boersma, Fields, & Olson, 1983). Changes such as these (higher pitch, increased pitch range, slower tempo) have been associated with happiness or affection (Fônagy & Magdics, 1963; Scherer, 1981). In fact, Tartter (1980) found that smiling raises the speaker's pitch (fundamental as well as formant frequencies).

These alterations have notable consequences. For example, infants in the early days and months of life show attentional "preferences" for infant-directed speech over adult-directed speech (Cooper & Aslin, 1990; Fernald, 1985), fundamental frequency contours playing a critical role in such preferences (Fernald & Kuhl, 1987). Affective as well as attentional preferences for female infant-directed speech are also apparent (Fernald, 1984; Werker & McLeod, 1989). Comparable preferences for male infant-directed speech, even for infants as young as 7 weeks of age, imply that high pitch in itself cannot be the principal determinant of infant preferences (Pegg, Werker & McLeod, 1992; Werker & McLeod, 1989). Nevertheless, infants may be sensitive to relative pitch changes, favoring the infant-directed versions of male and female speech because of their higher pitch. Preferences for infant-directed over adult-directed speech in unfamiliar languages (Fernald, 1993) rule out familiarity with the sound patterns of a particular language as the basis for infant preferences. Fernald (1989) and others (Papousek, Bornstein, Nuzzo, Papousek, & Symmes, 1990; Stern, Spieker, & MacKain, 1982) have suggested, instead, that the melody (i.e., pitch contour) may be the defining feature of infant-directed speech.

In an attempt to identify age-related changes in mothers' speech to infants, Stern et al. (1983) recorded maternal speech when their infants were newborns and subsequently when they were 4, 12, and 24 months of age. Pitch highs, pitch changes, and sound repetitions increased from birth to 4 months of age, decreasing thereafter until 24 months. Mothers talked longest and utterance length was greatest for 24-month-olds, but pauses between utterances were greatest for newborns. Stern et al. (1983) interpreted these differences in terms of changing infant needs and caregiving concerns. For example, maternal concerns about overstimulating newborns may generate long pauses between utterances. By contrast, face-to-face contact reaches a maximum at 4 months of age, when the majority of features of infant-directed speech have the most extreme values. According to Stern et al. (1983), mothers use various speech maneuvers to gain and hold infants' attention. From 12 to 24 months, when infants become object-oriented and increasingly acquire language skills, mothers talk more and

use longer utterances. In so doing, they support infants' exploratory and communication attempts.

Age-related changes in maternal speech articulation are also evident. Mothers pronounce vowels and consonants more distinctly to children who are beginning to talk compared to younger or older children (Bernstein Ratner, 1984; Malsheen, 1980). Specifically, consonants are articulated very distinctly at about 12 months of age (Malsheen, 1980). Vowels are articulated more distinctly to children with a mean length of utterance (MLU) of 2.5-4.0 words than to prelinguistic infants or children with MLUs of 1.0 (Bernstein Ratner, 1984). Kuhl et al. (1997), for example, documented the use of exaggerated acoustic values in mothers' spoken vowels to their 2- to 5-month-old infants in the United States, Sweden, and Russia. Mothers also stress important or new information in their speech to 14-month-olds by means of higher pitch, greater intensity, or placement of words in utterance-final position (Fernald & Mazzie, 1991).

Maternal speech may be responsive not only to children's linguistic capabilities but also to the social context. For example, mothers who assist their children in the performance of specific tasks show the characteristic increase in pitch height and pitch range when talking to 2-year-olds but not to 5-year-olds (Garnica, 1977). By contrast, Warren-Leubecker and Bohannon (1984) failed to find comparable differences in pitch (but not in pitch range) in mothers' speech to 2- and 5-year-olds during spontaneous play. According to Fernald (1991), the speech to 2-year-olds served "social regulatory" functions (e.g., attempting to influence children's mood or social responsiveness), whereas the speech to 5-year-olds had social regulatory goals in one case (Warren-Leubecker & Bohannon, 1984) and "informational" goals (e.g., attempting to instruct children or guide them in the performance of a task) in the other (Garnica, 1977). Although informational speech would be reserved for older children or those with more advanced language, social regulatory speech would be used over a wider range of linguistic ability. Nevertheless, mothers use more social regulatory speech with infants than with children 3-4 years of age, which is reflected primarily in their higher pitch level in the

former situation (Fernald & Dorado, 1990). In fact, maternal pitch range reaches a high at 4 months, decreasing subsequently until 24 months of age (Stern et al., 1983). Perhaps maternal pitch range continues to decrease until children reach some threshold of communicative competence (e.g., 3-5 years of age). At that time, it may not be as necessary to highlight linguistic units or use other distinctive vocal devices to attract and direct children's attention as it is with less able children. Instead, conventional informational speech may serve those functions as successfully as high-pitched, social regulatory speech for younger children.

If mothers are aware of their children's abilities, as the above studies imply, then the child's differential responsiveness to aspects of the speech signal may shape maternal speech style. For example, infants are sensitive to pitch contours in both speech and music (Fernald, 1991, 1992; Papousek et al., 1990; Trehub, Bull, & Thorpe, 1984; Trehub, Thorpe, & Morrongiello, 1987), to the rhythmic organization of tone sequences (Thorpe & Trehub, 1989; Thorpe, Trehub, Morrongiello, & Bull, 1988; Trehub & Thorpe, 1989), and to phrase boundaries in speech and music (Jusczyk & Krumhansl, 1993; Kemler Nelson, Hirsh-Pasek, Jusczyk, & Cassidy, 1989; Krumhansl & Jusczyk, 1990).

Not only do mothers change their speech style for infants, but they also change their style of singing. Performances of songs in an infant's presence involve a more emotionally engaging voice quality (Trehub et al., 1997) or a more "loving" tone of voice (Trainor, 1996) compared to performances of the same material in an infant's absence. Mothers also produce exaggerated performances--more rhythmic versions of playsongs and less rhythmic versions of lullabies--when they sing directly to their infants (Trainor, 1996). Infant-directed playsongs are typically characterized by increased duration and intensity of their stressed syllables, a higher pitch level, slower tempo, more variable pitch, and increased intensity range relative to non-infant-directed playsongs (Trehub & Trainor, in press). These features of songs to infants closely parallel those observed in speech to infants.

Trehub, Unyk, and Trainor (1993b) recorded North American and Indian mothers singing in English and Hindi, respectively, in the presence and in the absence of their infants

(same song in both contexts). On average, mothers sang more slowly and showed more gliding between pitch levels (more typical of speech than of music) when the infant was present than when the infant was absent. Adult listeners readily identified the infant-directed versions, even in an unfamiliar language, lending support to the notion of cross-cultural similarities in infant-directed singing (Trehub, Unyk, & Trainor, 1993a), as in speech (e.g., Fernald, 1993; Fernald et al., 1989; Grieser & Kuhl, 1988). Even when English-speaking mothers and fathers were instructed to reproduce their infant-directed singing, the infant-present versions were still distinguishable from infant-absent versions, although accuracy was greater with mothers' than with fathers' songs (Trehub et al., 1997).

If parents sing in a unique style for their infants, does this imply that the babies notice and prefer this style? Trainor (1996) found that infants attended longer to infant-directed than to non-infant-directed performances of songs. Moreover, Trehub and Henderson (1994) found that infants preferred lullabies over playsongs and adults' songs, and mothers' singing over fathers' singing.

Although the findings on infant-directed singing are consistent with those on infant-directed speech, it is unclear whether mothers produce comparable age-related changes in singing style. We know that mothers change the style and content of their speech to children of different ages (Garnica, 1977; Snow, 1972; Stern et al., 1983), but the altered content may be at least partially responsible for the altered speech style. To date, however, no study has equated the content of maternal utterances across different contexts, perhaps because the resulting speech would be unnatural. Because songs are often sung to children of different ages, however, comparisons of maternal performance style across listener age are feasible.

Differences as a function of listener age might be less marked for singing compared to speech for a number of reasons. Singing has a larger social regulatory component (Fernald, 1991) than speech does. In fact, singing can be considered to be primarily social regulatory rather than informational, a factor that should reduce variations across listener age. Recall that speech differences between toddlers and preschoolers are greater when informational

components supplement the social regulatory components (Fernald, 1991; Garnica, 1977; Warren-Leubecker & Bohannon, 1984). Indeed, the singing situation could be considered analogous to free play contexts in which age-related differences in mothers' speech are minimized (Warren-Leubecker & Bohannon, 1984). Moreover, a mother's singing style would likely reflect her feelings as well as her social goals. Although her caregiving goals might differ somewhat for her infant and preschooler, her feelings would likely have similar valence (presumably positive). Finally, songs are more constrained than speech in the sense that the melody, rhythm, and words are essentially "given" for songs but not for speech.

Nevertheless, it is conceivable that mothers' singing style would differ for children with different linguistic abilities (i.e., their potential for understanding the words or informational components of songs) and social regulatory needs. For example, differences between infant-directed and preschooler-directed songs might reflect state optimization versus pedagogical goals. Although mothers likely sing to influence infants' and preschoolers' mood by means of soothing or playful songs, they might add informational emphasis to the versions for preschoolers, highlighting elements like words, numbers, or letters of the alphabet. Within the constraints of song form, these different goals in infant-directed and preschooler-directed songs could be accomplished, in principle, with a number of performance devices. To maintain attention and positive affect, mothers might increase their pitch, decrease their tempo, increase their intensity range or elongate their vowels, suggested by maternal adjustments in speech and song to infants and young children (Ferguson, 1964; Fernald & Simon, 1984; Garnica, 1977; Snow, 1977; Stern et al., 1983; Trainor, 1996). To the extent that these goals are similar for infants and preschoolers, differences in the use of these devices might be minimal or absent. For preschoolers, however, mothers might emphasize the words or other linguistic components of songs by singing with clearer articulation, as they do in speech (Bernstein Ratner, 1984; Fernald & Mazzie, 1991; Malsheen, 1980).

We recorded and compared mothers' performances of the same songs to their infants and their preschool children. First, we examined the ability of naive adult listeners to identify

the infant-directed versions. Second, we measured a number of acoustic features of the performances such as pitch, tempo, intensity (loudness), phrase duration, and vowel elongation. Third, naive listeners provided ratings of various features such as tone of voice and articulation.

Experiment 1

Method

Participants. The mothers ($N = 18$), who were recruited from the community, had an infant 6 to 11 months of age ($M = 8;6$ months) and a preschooler 2;10 years to 3;11 years of age ($M = 3;3$ years), approximately 2 1/2 years older than the infant. The adult listeners, consisting of 31 women and 35 men, 19 to 66 years of age ($M = 27.5$ years), participated as volunteers or for partial course credit. The latter participants had on average 3.3 years of musical training (77.7% with little or no musical training).

Stimuli and Apparatus. Digital recordings of the mothers were made in an IAC sound-attenuating booth by means of a SHURE 5155D microphone, a Denon PMA-680R stereo amplifier, and SoundScope software on a Radius 81/110 computer. Identical portions of two recordings from each mother were selected according to the following criteria: (a) as close as possible to the beginning of the song, and (b) little noise or extraneous cues to the age of the child listener (e.g., child vocalizations). Although some noise remained in a few of the excerpts, it provided no unique cues to the age of the listener, as judged by two independent, skilled listeners. The stimuli for adult listeners consisted of 18 pairs of singing samples (one pair from each mother) in random order (total of 36 songs). The order of infant-directed and preschool-directed songs within each mother was counterbalanced. The stimuli were presented to adult participants over Sony CD550 headphones through a Power Macintosh 8100/100 computer connected to a NAD 3225PE stereo amplifier.

Procedure. Mothers were instructed to sing a song that they normally sang to both of their children at home. The order of singing to the infant or preschooler was counterbalanced across mothers. To reduce the mother's self-consciousness, the mother was alone with one of

Table 1. Incidence of maternal songs

Song Title	Number of mothers
Twinkle, Twinkle, Little Star*	5
A,B,C Song*	2
Itsy Bitsy Spider*	2
Baa, Baa Black Sheep*	1
Skinna-Marink*	1
The Cuckoo Song	1
Jesus Loves Me	1
Take Me Out to the Ball Game	1
The Little Green Frog	1
The Barney Song	1
The Grand Old Duke of York	1
Do, Re, Mi (from <u>The Sound of Music</u>)	1

* Songs also performed in Trehub et al. (1997)

her children in the recording booth. Each mother was encouraged to select the most comfortable of the following arrangements: (a) sitting on a chair with her child on her lap or (b) sitting on a blanket on the floor. Adult listeners were tested individually. They listened to successive paired excerpts of mothers' songs (infant-directed and preschool-directed), judging, for each mother, which of the two versions had been sung to an infant. They were also asked to list the basis for their judgments.

Results and Discussion

The songs sung by each of the mothers are listed in Table 1. As can be seen in Table 1, the variety of sung material was limited. For example, 5 of the 18 mothers sang "Twinkle, Twinkle, Little Star," 2 sang "The ABC Song," and 1 sang "Baa, Baa Black Sheep," all of

which share the same tune. In a previous study of parental singing (Trehub et al., 1997), 26.7% of mothers sang this tune when asked to sing a song of their choice in the presence and absence of their infants. In fact, five different songs in the present study were also sung in the previous study. The parallels in song selection confirm the local repertoire of songs for infants as well as their use with preschoolers.

Of the 66 participants who attempted to identify the infant-directed version, 5 were excluded because of experimenter error ($n = 3$) or for mentioning the use of noise as their principal judgment criterion ($n = 2$). Adults identified the infant-directed version on 61.84% of trials ($SD = 11.45$), which significantly exceeded chance values ($M = 50\%$), $t(60) = 42.177$, $p < .0001$. Correct identification of infant-directed songs for individual mothers ranged from 27% to 84%.

Comparisons of intensity (loudness), tempo, phrase duration, and vowel elongation across singing contexts failed to reveal differences between infant and preschooler versions, as can be seen in Table 2. Pitch was initially measured by means of SoundScope software, but the presence of some mothers who sang too softly or in a whisper-like tone precluded reliable pitch measurements in these instances. Because pitch was audible, even in the latter instance, an alternative procedure was used. The initial pitch in each recording was independently matched to notes on an electric keyboard by two skilled listeners, who had no information about the context of the recordings (inter-rater reliability = 97.2%). The initial pitch of mothers' performances to infants and preschoolers is shown in Figure 1. The mean initial pitch of songs to infants and preschoolers was 219.90 and 210.15, respectively. The initial pitch level of mothers' songs to infants corresponds closely to the measured level of 220.03 in a previous study (Trehub et al., 1997).

To facilitate the analysis of subtle pitch differences across contexts, measurements were converted to pitch intervals (following Campbell & Greated, 1987) by taking the ratio of the fundamental frequency of the infant-directed version and the preschool-directed version and applying the following formula: $12 * \log_2 (\text{infant } F_0 / \text{preschool } F_0)$. The obtained differences

Table 2. Acoustic measures of maternal songs

Acoustic Measure	Infant		Preschooler	
	Mean	S.D.	Mean	S.D.
Pitch (Hz) *	219.90	52.78	210.15	51.66
Intensity (volts per syllable)	0.20	0.12	0.20	0.14
Tempo (beats per minute)	118.00	23.62	117.44	22.61
Phrase duration (sec)	7.08	1.62	7.21	1.60
Total length of vowels (sec)	4.44	1.41	4.53	1.33

* $p = .0002$

($M = .806$, $SD = .730$) significantly exceeded the expected differences ($M = 0$), $t = 4.69$, $p = .0002$, indicating that the initial pitch of infant-directed songs was significantly higher than that of preschooler-directed songs. As can be seen in Figure 1, each mother's pitch in the infant-directed context was equal to or higher than her pitch in the preschooler-directed context.

Why might the infant-directed songs have a higher pitch level than the preschooler-directed songs? Perhaps mothers have to work harder to gain and hold the attention of infants compared to preschoolers. Mothers' higher pitch may also reflect greater emotional engagement (Trainor, 1996; Trehub et al., 1997) or more positive affect (Fônagy & Magdics, 1963; Scherer, 1981; Tartter, 1980) with infants relative to preschoolers, contrary to our predictions. When singing to preschoolers, moreover, mothers may have pedagogical as well as social goals. In fact, mothers typically sang songs that their preschoolers knew either in part or completely. Some preschoolers even sang along with their mothers for a verse or two.

Experiment 2

To evaluate the possibility that mothers were more emotionally engaged with their infants than with their preschool children, we had adult listeners judge which of the two

Figure 1. Individual mothers' pitch levels for infant- and preschooler-directed songs. The subscript numbers refer to the note octave. The pitches correspond to the following frequencies: D₃ = 146.83 Hz, G₃ = 196.00 Hz, C₄ = 261.63 Hz, F₄ = 349.23 Hz, A₄ = 440 Hz.

versions was sung with a more "loving" tone of voice, a quality that had previously distinguished infant-present from infant-absent versions of mothers' songs (Trainor, 1996). Also, to assess whether mothers altered their articulation for more linguistically skilled children, as would be expected in speaking contexts (Bernstein Ratner, 1984; Fernald & Mazzei, 1991; Malsheen, 1980), we had these adult listeners judge which of the two versions had their words pronounced more clearly.

Method

Participants. The adult listeners ($N = 22$), consisting of 15 women and 7 men, 23 to 44 years of age ($M = 35.0$ years), were college and community volunteers, who had, on average, 1.9 years of musical training (90.9% with little or no musical training).

Stimuli and Apparatus. The stimuli consisted of the same 18 counterbalanced pairs of singing samples (one pair from each mother) from Experiment 1 presented in random order

(total of 36 songs). Adult participants listened to these materials over Sony CD550 headphones through a Radius 81/110 computer connected to a Denon PMA-680R stereo amplifier.

Procedure. Adult listeners, who were tested individually, judged which of the two versions was sung with clearer articulation of the words and in a more loving tone of voice.

Results and Discussion

Listeners rated preschooler-directed versions of the mothers' songs as more clearly articulated than the infant-directed versions in 59.85% of all comparisons ($SD = 13.05$), which significantly exceeded the expected value ($M = 50\%$), $t(21) = 3.54$, $p = .0019$. The two versions did not differ, however, on ratings of loving tone of voice, which provided no indication of greater maternal emotional engagement with infants relative to preschoolers. Nevertheless, the percentage of infant-directed versions judged by adult listeners as more loving than preschooler-directed versions (for each mother) was highly correlated with correct identification of the infant-directed versions, $r = .755$, $p < .0001$.

It is clear, then, that mothers enunciate the words more clearly in preschooler-directed performances of songs than in the infant-directed performances. For preschoolers who can understand the words and who may even know the songs, it is reasonable for mothers to produce clearly articulated versions. For infants who are primarily soothed or entertained by these performances, however, the words would obviously be secondary. Thus, mothers produce distinctive versions for their infants and preschoolers, using different devices for each—more precise articulation for preschoolers and higher pitch for infants. Clear presentation of words may hold the attention of preschoolers just as high pitch does for infants.

The high correlation between ratings of "loving" tone of voice in the present experiment and identification accuracy in Experiment 1 may indicate that naive listeners in the latter experiment expected the infant-directed versions to sound more loving than the preschool-directed versions. In other words, tone of voice influenced the judgments of naive listeners even though mothers did not use it differentially across contexts.

General Discussion

The results of the present study confirmed that mothers used somewhat different styles of singing for infants and preschooler. They sang at a higher pitch level for infants than for preschoolers, but their tempo and intensity level was comparable across contexts (Experiment 1). They also pronounced their words more clearly for preschoolers than for infants (Experiment 2). Despite these subtle differences, naive adult listeners identified the infant-directed versions at better than chance levels. In previous comparisons of mothers' singing in infant-present and infant-absent contexts, mothers sang more slowly, with more emotional engagement, and at a higher pitch level in the infant's presence (Trainor, 1996; Trehub et al., 1997; Trehub, Trainor, & Unyk, 1993b). The absence of intensity, tempo, phrase duration, vowel elongation, and tone of voice differences in the present study indicates that these adjustments are not directed specifically to infants but to children in general. For example, the mother's tone of voice may reflect similar, positive feelings for both of her children. Moreover, mothers may use similar means to optimize the attention of their infant and preschooler.

How can we interpret the higher pitch for infant than for preschool listeners? High pitch as a signal of affection (e.g., Fônagy & Magdics, 1963; Scherer, 1981; Trainor, 1996; Trehub et al., 1997) does not provide an appropriate explanation of infant-preschooler differences in view of the similarities in "loving" tone of voice, a more direct measure of affection. Although mothers may have been smiling more when interacting with infants, which resulted in higher pitch, there is no basis for arguing that mothers would smile more to infants than to preschoolers. Perhaps the attention-getting function of high pitch (Fernald, 1991; Stern et al., 1983) is more relevant for prelinguistic listeners than for older children. Mothers' use of more careful articulation with preschoolers may serve attention-holding as well as pedagogical goals. In any case, the differences in articulation parallel those observed in speech contexts (Ferguson, 1964; Fernald & Simon, 1984; Garnica, 1977; Snow, 1977), indicating, perhaps, that mothers are modeling the songs for their preschoolers.

Although the ratings of articulation did not allow access to the relative accentuation of consonants and vowels, it is likely that judgments of clearer articulation arose from more distinct pronunciation of consonants. Mothers typically accentuate their vowels to infants (Kuhl et al., 1997), a practice that likely has emotive goals. Moreover, the characteristic elongation of vowels (Fernald & Simon, 1984; Garnica, 1977) may contribute a flowing quality to the sung performances. By contrast, clear production of consonants in speech (e.g., Bernstein Ratner, 1984; Malsheen, 1980) and in song likely has informational, even instructional, goals. Songs to infants are mainly about feeling, for example, feeling content, safe, or happy. Songs for preschoolers are not only about feeling but also about objects and events in the world. In other words, songs for preschoolers have denotative as well as connotative meanings.

Although some researchers have hypothesized that the meaning of infant-directed speech is principally in its melody (Fernald, 1989; Papousek et al., 1990; Stern, Spieker, & MacKain, 1982), this type of meaning (i.e., melody) was constrained by the predetermined tunes of songs and the use of same songs for both children. One could say that mothers fine-tuned their performances by means of higher pitch for infants and clearer articulation for preschoolers. To the extent that the "meaning" of mothers' performances was in the melody (Fernald, 1989), this meaning was similar for infants and preschoolers, as reflected in common pitch contours (typically simple), rhythm, tempo, and tone of voice. Presumably, these features conveyed positive affect and a playful or soothing quality. Moreover, all mothers sang songs in a major key, which is generally associated with positive affect for children (Kastner & Crowder, 1990; Dolgin & Adelson, 1990).

Maternal speech to infants and preschoolers seems to be characterized by much greater stylistic variation than is the case for maternal singing. For example, the pitch differences between maternal speech to infants and to adults is approximately 3-4 semitones (Fernald et al., 1989) compared to 1-2 semitones between the mothers' songs to their infants and preschoolers. Recall, however, that in speech to children of different ages, content and

structural differences generally co-occur with stylistic differences. In the present study, however, mothers were asked to sing a song that they usually sing to both of their children. In all likelihood, the repertoire of songs for their infants and preschoolers differs. If mothers' entire repertoire had been sampled or if mothers had been free to choose different songs for each listener, greater differences might have become apparent. Perhaps there are situations in which mothers use similar speech patterns for their infants and preschoolers as in stereotyped greetings ("Good morning, Sunshine!") or praise ("That's a good girl!"). Even in functionally similar contexts (free play) with speech content uncontrolled, pitch range was the only feature that distinguished maternal speech to 2- and 5-year-olds, and the differences were relatively small (Warren-Leubecker & Bohannon, 1984). Perhaps highly stereotyped messages to infants and preschoolers would obliterate most of the age-related differences in caregivers' usual speech.

In summary, mothers' sung performances were at a high pitch level for infants and the lyrics were more clearly articulated for preschoolers. These differences, however subtle, made it possible for naive listeners to distinguish the infant-directed from the preschooler-directed versions. Moreover, these differences likely reflect fine-tuning to the children's abilities and needs.

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