

Lullabies and Simplicity: A Cross-Cultural Perspective

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Pairs of folk lullabies and comparison songs from different cultures were presented to adult listeners, who were required to choose the simpler song in each pair. Adults judged the lullaby excerpts as simpler whether presented with original field recordings, low-pass filtered versions that made the words unintelligible or excerpts synthesised with a uniform (piano) timbre. Structural analyses of the songs failed to reveal musical features that differentiated lullabies from other songs. Nevertheless, such analyses revealed melodic features that predicted adults' identification of lullabies.

Singing is a universal form of expression and an important vehicle for enculturation (Dowling and Harwood, 1986; Nettl, 1983). Exposure to this mode of expression begins early in life with lullabies and play songs. In fact, the widespread practice of singing to infants is suggestive of universal functions relevant to caretaking.

Although the act of singing is universal, the structure of songs across cultures seems highly varied, with little evidence of musical universals (Harwood, 1976). Even if some similar melodic and rhythmic features could be identified across cultures, the manner in which they are perceived and interpreted is likely to differ (Blacking, 1977; Meyer, 1960).

Unlike adults, infants have had relatively limited exposure to the musical style of their culture and are therefore unlikely to perceive musical structures in culture-specific ways. In the domain of speech perception, young infants exhibit behaviour that is relatively free of cultural influence. For example, although adults have difficulty distinguishing certain foreign speech sounds, 6-month-olds and younger infants seem to differentiate foreign and native-language sounds with equal ease (Trehub, 1976; Werker and Tees, 1984; Werker and Lalonde, 1988). If infants approached musical forms in a similar (*i.e.* culture-free) manner, they would be better served by music emphasising universal features and de-emphasising culture-specific features.

Songs in general vary in style and structure cross-culturally but lullabies in particular may share common features because of their more uniform function and audience. Indeed, infant-directed (ID) speech exhibits similarities in form across a wide variety of tonal and non-tonal languages (Ferguson, 1964; Fernald, Taeschner, Dunn, Papoušek, de Boysson-Bardies and Fukui, 1989; Grieser and Kuhl, 1988). When talking to prelinguistic infants, adults typically speak with higher pitch, wider pitch range, and use smooth, simple and highly modulated intonation contours (Fernald and Simon, 1984; Papoušek, Papoušek and Bornstein, 1985). They also use shorter phrases, longer pauses, a slower rate and more prosodic repetition (Fernald, 1984; Stern, Spieker and

MacKain, 1982; Papoušek, Papoušek and Haekel, 1987; Warren-Leubecker and Bohannon, 1984; Snow, 1977). These features jointly confer a *musical* quality to such speech.

The distinctive character of ID speech across several cultures (Ferguson, 1964; Fernald *et al.*, 1989) suggests a universal function for such speech (Ferguson, 1964; Blount and Padgug, 1977; Fernald and Simon, 1984; Sachs, Brown and Salerno, 1976; Watson-Gegeo and Gegeo, 1986). One prominent notion is that ID speech is highly salient for infants, facilitating the capture and maintenance of infant attention (Fernald, 1984). Indeed, when ID and adult-directed (AD) speech are both made available, infants exhibit a consistent preference for ID speech (Cooper and Aslin, 1990; Fernald, 1985; Fernald and Kuhl, 1987; Werker and McLeod, 1989).

The contours of ID speech do not embody the abrupt pitch transitions that characterise AD speech. Instead they are relatively simple and distinct, being separated from one another by substantial pauses (Fernald and Simon, 1984). One can consider them to display *good Gestalten* in comparison to adult speech, which presumably facilitates their encoding by infant listeners. ID speech may be a vehicle for conveying affective meaning to prelinguistic infants (Fernald, in press; Werker and McLeod, 1989). Caretakers use high, rising contours to arouse infants (Stern *et al.*, 1982) and low, falling contours to soothe them (Papoušek and Papoušek, 1981; Fernald, in press). Moreover, infants listening to ID speech are judged to be more pleasant, friendly, likeable and cuddly than those listening to AD speech (Werker and McLeod, 1989).

One could refer to lullabies, which are also intimate, aural communications between caregivers and infants, as ID music or song. Such music might well share some of the features of ID speech such as higher pitch, wider pitch range, smooth, simple contours, and greater repetition but this issue has not been investigated to date. If ID music did exemplify some of the salient characteristics of ID speech, its potential impact on infants could be substantial.

That various musical or music-like elements are discernible to infant listeners has only recently become clear. For example, there is evidence that infants, on listening to a melody, can encode and retain global features, the contour being the most prominent of these (Trehub, Bull and Thorpe, 1984; Trehub, Thorpe and Morrongiello, 1985, 1987). Just as infants can recognise a pattern when it is transposed to new pitches (Trehub *et al.*, 1987), they can recognise it with different tempos (Trehub and Thorpe, 1989) or timbres (Trehub, Endman and Thorpe, 1990). Moreover, when a melody is structured according to Western musical conventions (*i.e.* what adults would consider typical), infants encode and retain it in greater detail than when the melody violates such structural constraints (Cohen, Thorpe and Trehub, 1987; Trehub, Thorpe and Trainor, 1990). Infants also group the elements of patterns on the basis of similarity (Demany, 1982; Thorpe, Trehub, Morrongiello and Bull, 1988; Thorpe and Trehub, 1989) and proximity (Trehub and Thorpe, 1989). In short, their musical pattern processing skills are qualitatively similar to those of adults (Trehub, 1987, 1990; Trehub and Trainor, 1990). This implies that infants would likely be capable of discerning the distinctive features of ID music, if such features were present.

As noted, the cross-cultural similarity of ID speech in the context of dissimilar AD speech has been well documented (e.g. Fernald *et al.*, 1989). Lullabies have also been documented in the folk music of many countries and the art music of all periods (*New Grove Dictionary of Music and Musicians*) but they have not been the focus of cross-cultural comparisons. Anthropologists have described some of the stories conveyed in lullaby lyrics, relating the story themes to the social context of the singer (e.g. Hawes, 1974; Sands and Sekaquaptewa, 1978; Spitz, 1979). However, they have tended to ignore information accessible to the infant listener, notably the musical form.

Adults seem unaware of the full range of their ID vocal modifications (Papoušek and Papoušek, 1987) but this speech is still distinguishable to other adults, even those from a different language and cultural background. There are recent suggestions that adults can also distinguish foreign ID from AD songs. Trehub, Unyk and Trainor (in press) examined this question with a sample of lullabies and adult songs from several different cultures and geographic locations. Each ID song was paired with a song similar in cultural origin, tempo, and musical style but one not intended for infant listeners. Western adults were asked to identify which song in each pair was intended for infants. They succeeded in identifying the lullabies above chance levels but their performance was far from perfect. What was notable, however, was the relative uniformity of performance across listeners, with some lullabies consistently identified and others consistently misidentified. Surprisingly, factors such as Western versus non-Western musical style, type of instrumental accompaniment and sex of the singer were unrelated to the ease of lullaby identification. Similarly, the listener's age, sex and years of musical training had no effect on performance. These findings imply that listeners have some notion, necessarily culture-free, about what a lullaby *should* sound like or what features it should embody.

The purpose of the present investigation was twofold. First, we sought to determine whether there are structural features that differentiate lullabies from other songs. Second, we attempted to identify features that underlie adults' assignment of songs (correctly or incorrectly) to the category of lullabies.

Experiment 1

A content analysis of participants' reported criteria for lullaby identification in Trehub *et al.*'s (in press) study revealed simplicity and repetitiveness as the most frequently cited features. Structural simplicity can occur on a number of levels. Songs may be simple in the information-theoretic sense of redundancy or repetitiveness. For example, a melody can be considered repetitive if it consists of a few pitches that are repeated frequently (Vitz, 1966; Crozier, 1974). Repetitiveness can also be defined in terms of the transitional probabilities of component pitches. Thus greater repetitiveness would be associated with frequent as opposed to infrequent repetition of sequences. There is evidence that children's songs contain considerable redundancy or repetitiveness in this latter sense (Pinkerton, 1956).

It is possible that ID songs, like ID speech, have simpler pitch contours than their AD counterpart. If so, ID songs might successfully engage infant

attention just as ID speech does (Fernald, 1985; Fernald and Kuhl, 1987; Werker and McLeod, 1989).

To evaluate whether lullabies are perceived as simpler than comparison songs from the same culture, listeners were presented with the taped excerpts from Trehub *et al.* (in press). Instead of judging which member of each pair was the ID song, listeners were asked to judge which was simpler. On the basis of the greater simplicity of ID over AD speech (*e.g.* Fernald, 1984) coupled with listeners' reported use of simplicity in ID song identification (Trehub *et al.*, in press), we expected lullabies to be rated as simpler.

Method

Subjects. The participants were 20 university students (10 female, 10 male), 18 to 49 years of age, about half (45 per cent) of whom had no formal training in music.

Materials. Recordings of 30 lullabies from various cultures and geographic regions (African, Asian, European and North American Indian) were used (see Discography). The majority (57 per cent) were solo vocal renditions of lullabies obtained from field recordings. For 28 of the lullabies, a matching adult song was chosen from the same collection. The matching songs were from the same culture, approximating the tempo, singing style, and orchestration of the lullaby as closely as possible. In some cases, the lullaby and comparison song were performed by the same singer. For two lullabies, a matching children's song was chosen because no available adult song met the aforementioned criteria. There were 14 pairs of songs that were Western European in origin or musical style (*e.g.* Norwegian, Czechoslovakian, Irish, Russian), a style more familiar to the listeners in this study. In nine of the 30 pairs of songs, there was instrumental accompaniment, with two pairs having instrumental music without voice. In five songs, the lullaby was unaccompanied and the adult song accompanied. Finally, the sex of the singer differed across song types in five pairs, the lullaby being sung at times by a male and at times by a female. None of the songs was sung in English.

There were two audiotapes, each of which included 20-second excerpts from the beginning of each pair of songs, with the order of presentation of the song pairs as well as the position of the lullaby in each pair (first or second) randomised. Each pair of excerpts on the tapes was preceded by an announcement of the trial and excerpt number (*e.g.* "Number 1a", "Number 1b"). A 12-second silence followed each pair.

Procedure. Participants were tested individually. They were randomly assigned to one of the two tapes, resulting in 10 participants for each tape. The test session was conducted in a quiet room (3.05 m × 3.66 m) with cassette tape deck (TEAC V-300), amplifier (Realistic SA10) and two speakers (Radio Shack NOVA-6). Participants were told that they would hear pairs of musical excerpts from around the world and that they were to indicate which excerpt in each pair was simpler. They were also asked to indicate how much simpler it was on a three-point scale, ranging from not much simpler (1) to very much simpler (3).

Results

Judgements of simplicity for each paired comparison were scored as 1 if the lullaby was chosen as simpler and 0 if the matching excerpt was chosen. The mean score averaged across the 30 excerpts for each participant was .60. Lullabies were rated as simple significantly more often than chance (0.5), $t(19) = 7.03$, $p < .0001$. A multiple regression analysis revealed that age, sex and musical training were unrelated to the perceived simplicity of lullabies.

Confidence ratings (3-point scale) were transformed into a 6-point scale. If participants chose the lullaby as simpler, they were assigned scores of 4, 5 or 6 corresponding to their original rating of 1 (not much simpler), 2 (somewhat simpler), and 3 (very much simpler), respectively. If they chose the matching song as simpler, they were assigned scores of 1, 2 or 3 if they had rated their chosen song as very much simpler, somewhat simpler, or not much simpler, respectively. In this way, the transformed scores reflected the relative simplicity of the lullaby in each pair. A mean score across comparisons was calculated for each listener. The mean of these scores (across listeners) was 3.78, which differed significantly from chance (3.5), $t(19) = 7.24$, $p < .0001$.

In the Trehub *et al.* (in press) study, four lullabies (Pygmy, Creek Indian, Czechoslovakian and Irish) had been identified correctly by more than 85 per cent of adult listeners. For convenience, these can be considered prototypical (*i.e.* readily recognisable) lullabies. On the other hand, four adult songs (from Chad, Ecuador, Samoa and the Ukraine) had been consistently misidentified as lullabies. The lullabies in these latter pairs can therefore be considered atypical. The simplicity judgements for these *typical* and *atypical* lullabies were subjected to further analysis. For each participant, the mean transformed simplicity score (1–6) was calculated for the *typical* and *atypical* lullabies. The mean simplicity score of the *typical* lullabies (4.09) was significantly greater than that of the *atypical* lullabies (3.28), $t(19) = 3.8$, $p < .001$, indicating that listeners perceived the *typical* lullabies as simpler than the *atypical*.

To determine the association between simplicity ratings (from the present experiment) and lullaby identification (from Trehub *et al.*, in press), a Pearson product-moment correlation was calculated between the proportion of listeners correctly identifying the lullaby in each of the 30 comparisons and the proportion rating each lullaby as simpler in the present experiment. Lullaby identification and simplicity were positively associated, $r = .48$, $p < .01$.

Discussion

Adult listeners rated the lullabies in this cross-cultural sample as simpler than the comparison songs. Moreover, judgements of lullaby identification and simplicity were related, implying that perceived simplicity plays a role in lullaby identification. These findings are in line with adults' self-reports of simplicity and repetitiveness as lullaby identification criteria (Trehub *et al.*, in press). However, lullabies were not uniformly perceived as simpler than their comparison songs. In fact, those that were consistently misidentified were notable exceptions. This implies that some lullabies may be more typical of the real or "imagined" category of lullabies and that such prototypicality is associated with simplicity (Trehub and Unyk, in press).

Experiment 2

ID speech is simpler than AD speech in its syntax, semantics and prosody but it is the prosody that is especially salient for prelinguistic infants (Fernald, 1984; 1985). Although the melodic simplicity of lullabies may have contributed to the findings of Experiment 1, simplicity of the lyrics could have played the principal role. Simpler lyrics of lullabies compared to adult songs could provide inadvertent cues to lullaby identity, even for foreign listeners. Thus short words and repetitive word sequences could provide suggestive information about the intended audience. As a consequence, the contribution of melody to simplicity judgements would be obscured. For example, some lullabies sung by the Yuma Indians of North America (Curtis, 1921) involve a simple verbal phrase alternating with repetitive nonsense syllables such as *loo loo loo* or *ma ma ma*. The use of repetitive untranslatable (nonsense) syllables and extended vowels is also prominent in Mohave (Devereux, 1948), Arapaho (Hilger, 1952), Chippewa (Hilger, 1951) and Hopi (Sands and Sekaquaptewa, 1978) lullabies. It is important to ascertain, then, whether lullabies would be perceived as simple independent of their lyrics. To do so, we filtered the 30 pairs of excerpts from Experiment 1 to eliminate the verbal content. Adult participants were then required to select the simpler excerpt from each pair of filtered songs.

Method

Subjects. There were 20 university students (13 female, 7 male), 18 to 29 years of age, 30 per cent of whom had no formal training in music.

Materials and Procedure. The 30 pairs of excerpts from the first tape of Experiment 1 were filtered so that frequencies above 500 Hz were eliminated. This resulted in songs with unintelligible (*i.e.* muffled) words but with the melody, rhythmic information and voice quality largely preserved. The test procedure was the same as in Experiment 1, participants being required to select the simpler song of each pair.

Results

As in Experiment 1, judgements of simplicity for each paired comparison were scored as 1 if the lullaby was chosen as simpler and 0 if the matching excerpt was chosen. The mean score averaged across the 30 excerpts for each subject was .55, which was significantly greater than that expected by chance (.5), $t(19) = 2.32$, $p < .04$. Confidence ratings were transformed to a 6-point scale as in Experiment 1. The average transformed simplicity score across comparisons and listeners was 3.65, which significantly exceeded chance levels (3.5), $t(19) = 2.81$, $p < .02$. A comparison of the *typical* and *atypical* lullabies revealed a transformed simplicity score of 4.06 for the *typical* lullabies, which significantly exceeded the rated simplicity of the *atypical* lullabies (3.56), $t(19) = 2.17$, $p < .05$.

Discussion

Even with words eliminated, the lullabies in this cross-cultural sample were perceived as simpler than the comparison songs. Furthermore, the greater simplicity of the so-called *good* lullabies was preserved. These findings

indicate that the perceived simplicity of lullabies is influenced, in part, by features that are unaffected by the filtering process. It is likely that these features include melodic form and some aspects of voice quality.

Experiment 3

Adults rated lullabies as simpler than other songs both in the original version (Experiment 1) and in the filtered version that obscured the words (Experiment 2). Since much of the vocal quality remained intact in the filtered version, it is possible that vocal quality as opposed to melodic structure was principally implicated in the simplicity judgements. To clarify this issue, we assessed the simplicity of lullabies and comparison songs with synthesised versions that incorporated a uniform (piano) timbre. These synthesised versions were considerably simpler than the original and filtered versions of Experiments 1 and 2 because they presented the melody line only.

Method

Subjects. There were 20 university students (15 females, 5 males), 18 to 49 years of age, about half (45 per cent) of whom had no formal training in music.

Materials. Tapes 1 and 2 from Experiment 1 were used as the basis for creating two additional tapes of paired excerpts of lullaby/non-lullaby comparisons. The melody lines from the 20-second paired excerpts on these tapes were transcribed (by E.G.S.) and then performed in real time (also by E.G.S.) on a touch-sensitive Casio HT-6000 keyboard connected through MIDI to a Yamaha TX-816FM tone generator set at a piano timbre. The pitches and durations of tones as well as the tempo were matched as closely as possible to the original recordings. These paired excerpts were recorded onto two tapes, preserving the order of the excerpts from Tapes 1 and 2 in Experiment 1. Two of the 30 paired excerpts from the original tapes were omitted because the melodic form of these songs could not be captured with a single melody line.

Procedure. The procedure was the same as in Experiment 1. Listeners were randomly assigned to either Tape 1 or Tape 2.

Results

As in Experiment 1, judgements of simplicity for each paired comparison were scored as 1 if the lullaby was chosen as simpler and 0 if the matching excerpt was chosen. The mean score averaged across the 28 excerpts for each subject was .56, which was significantly greater than chance (.54), $t(19) = 3.07$, $p < .01$. An analysis of variance indicated that performance differences between Experiments 1, 2 and 3 were not significant.

A 6-point scale was created from transformed confidence ratings, as in Experiment 1. The averaged scores across comparisons and listeners was 3.7, which significantly exceeded the scores expected by chance (3.5), $t(19) = 3.69$, $p < .003$. The mean transformed simplicity score for the *typical* lullabies was 4.18, which significantly exceeded that for the *atypical* lullabies (3.31), $t(19) = 3.97$, $p < .001$.

Discussion

Even with lyrics and voice quality removed from the songs, listeners continued to rate the lullabies as simpler. This indicates that some structural features of the melody such as pitch range, contour and interval size must contribute to perceived simplicity and must therefore provide cues to the identity of lullabies.

Experiment 4

In Experiments 1 through 3, adult listeners judged lullabies from a wide variety of cultures as simpler than comparison songs from those cultures. The lullabies were considered simpler whether they were presented as originally recorded (Experiment 1), filtered so that the words were unintelligible (Experiment 2) or synthesised with uniform timbre (Experiment 3). Although these experiments confirmed the perceived simplicity of lullabies, they failed to identify the specific musical features contributing to lullaby identity. This was the focus of the present study.

Accordingly, we analysed the structure of 56 songs, specifically, the 28 lullabies and matching songs from Experiment 3. First, the complete recorded versions of these songs were transcribed into standard Western musical notation by a musician (E.G.S.). The transcription specified the pitches in the melody line, their durations and the phrase boundaries.

For the purposes of our structural analyses, simplicity was defined in the information-theoretic sense of variety in pitches (*i.e.* number of different pitches in the song) as well as variety in contour direction (*i.e.* average number of contour changes per minute). For example, after an ascending interval, a change in pitch direction could be either a descending interval or unison.

Other measures were derived from the literature on ID speech. To examine whether expanded contours prevail in lullabies as they do in ID speech (*e.g.* Fernald and Simon, 1984), the song range in semitones was calculated as was the average interval size (in semitones) between successive pitches (unison counted as zero). Similarly, to determine whether ID songs have higher pitch and shorter phrases than AD songs, we calculated the median pitch and mean length of phrase in all songs. The median pitch or pitch at which half the tones in the song were higher and half lower was tabulated. A median pitch of C₄ or middle C was arbitrarily assigned the number 28. Songs with a higher or lower median pitch were assigned numbers greater or lesser than 28 corresponding to the number of semitones above or below C₄. Thus songs with a median pitch of D₄ or G₃ would be assigned the numbers 30 and 23, respectively. The mean length of phrase was defined as the average number of tones per phrase. The rate of singing was also calculated as the average number of tones sung per minute.

Participants in Trehub *et al.*'s (in press) study had cited the soothing quality of the melody, over and above simplicity, as a lullaby cue. When ID speech is used for comforting infants, descending contours predominate in contrast to the ascending contours of arousing ID speech (Fernald, in press). On the assumption that lullabies would be soothing songs, we calculated the proportion of descending intervals.

Method

All calculations were performed on the written transcriptions of the melody line by one of the authors (A.U.). There were eight measures including median pitch, pitch range (lowest to highest pitch), rate of contour change (mean number of contour changes per minute), descending intervals (proportion), rate (average number of tones per minute), phrase length (average number of tones per phrase), average interval size and pitch variety (number of different pitches). Inter-rater reliability on these measures was ascertained by having eight undergraduate ethnomusicology students transcribe 16 songs from the cross-cultural sample. The songs included two lullaby/adult song pairs in which the lullabies had been consistently identified (Pygmy, Creek Indian) and two lullaby/adult song pairs in which the adult songs had been consistently misidentified (Samoan, Ukrainian) (Trehub *et al.*, in press). The transcribers were instructed to indicate phrase boundaries and the exact starting pitch of the songs. These ethnomusicology students were uninformed about the identity of the lullabies and comparison songs.

Average scores on each of the eight measures were calculated for the 16 transcriptions of the ethnomusicology students and compared to scores from the investigator's transcription. Differences between transcriptions (students' *v.* investigator's) were small, for the most part. Transcriptions differed by an average of one semitone in the case of pitch range, two semitones for median pitch and less than one semitone for average interval size. The number of different pitches differed by an average of 2.4, mean tones per phrase by 1.6 and proportion of descending intervals by .027. Finally, transcriptions differed in rate by an average of 3.8 tones per minute and in number of contour changes by 7.2 changes per minute.

Results

To determine whether the 28 lullabies in the cross-cultural sample differed from their matching songs, scores on the eight measures were compared but were not found to differ significantly, Hotelling's $T^2 = .436$, $p < .42$. These lullabies, then, were not structurally distinct from the other songs.

To determine whether the eight structural measures predicted adult listeners' lullaby judgements (as opposed to the actual status of songs), scores on the eight measures for the lullabies and matching songs were entered into a multiple regression analysis. The percentage of Trehub *et al.*'s (1991) listeners who correctly identified the lullaby in each of the 28 pairs of song excerpts was the dependent variable. The 16 independent variables were the scores on the eight structural measures for the lullabies and matching adult songs. The multiple regression analysis was executed with forced entry of all independent variables. Scores on these structural measures were predictive of the accuracy of lullaby identification, $F(16,28) = 2.67$, $p < .052$. To ascertain which structural variables were the strongest predictors of lullaby identification, a stepwise multiple regression analysis was executed. This analysis revealed that three structural variables accounted for 49 per cent of the variance in correct lullaby identification: the proportion of descending intervals in the lullaby (DL); the median pitch of the matching adult song (MPA) and the number of contour changes per minute in the lullaby (CCL). The resultant regression equation

% Correct Lullaby Identification = $92.4 + 1.35 (\text{DL}) - 2.26 (\text{MPA}) - .20 (\text{CCL})$
 indicates that the accuracy of lullaby identification was positively related to the proportion of descending intervals in the lullaby, negatively related to the median pitch of the matching adult song and negatively related to the number of contour changes per minute in the lullaby.

Discussion

The transcribed lullabies and matching adult songs did not differ on the structural measures, suggesting that lullabies are not characterised by features that distinguish ID from AD speech. A number of factors may be implicated in this outcome. The use of recordings as a source of songs obscured the actual context of performance. One wonders, then, whether the singers were providing functionally appropriate renditions of the lullabies or were merely complying with the researcher's request. In the latter case, particularly if no infant were present, the singer may have omitted critical lullaby features such as a soothing quality or slow tempo. The context of performance and resultant performing style may be even more important than the materials performed. For example, Hilger (1952) described Arapaho mothers' and grandmothers' occasional use of traditional dance songs as "lullabies" (p. 39). Similarly, Sands and Sekaquaptewa (1978) have distinguished soothing from admonishing lullabies, the former for co-operative infants and the latter for recalcitrant infants. In the case of ID speech, an infant's presence is known to be critical for the full range of vocal adjustments (Papoušek *et al.*, 1987). For ID song and lullabies in particular, the infant's presence and appropriate state may be essential.

The method of choosing comparison songs may have resulted in atypical adult songs. Recall that comparison songs were chosen to approximate the lullaby in tempo and singing style. This may have led to the inadvertent elimination of common adult songs that differed substantially from lullabies.

Nevertheless, some structural features of lullabies and adult songs were associated with the accuracy of lullaby identification. In line with the notion of lullabies as soothing or lulling songs, the proportion of descending intervals in lullabies was predictive of adults' correct identification. The greater the proportion of such descending intervals, the greater the likelihood that adults judged such songs as lullabies. This finding parallels the descending contours of soothing ID speech (Papoušek and Papoušek, 1981; Fernald, *in press*).

The lower the median pitch of the non-lullaby comparison, the more likely adults correctly rejected it as a lullaby. Again, this finding is consistent with the lower pitch of AD over ID speech (Fernald and Simon, 1984; Papoušek *et al.*, 1985) and, by extension, of AD over ID song. Finally, contour complexity was negatively associated with lullaby choices, songs incorporating fewer contour changes being more likely to be judged as lullabies.

Trehub *et al.* (1991) found that lullabies are perceptually distinct from adult songs and suggested that melodic form may provide distinguishing cues. Further support for their contention is provided by our finding that listeners identified lullabies more accurately if they contained more descending contours and fewer contour changes and if the matching songs had lower median

pitch. It is possible that the use of contextually appropriate lullabies (*i.e.* for purposes of lulling) and typical adult songs would exemplify these features to an even greater extent than the songs in the present sample.

Overall, the results of the four experiments indicate that adult listeners perceive lullabies or infant songs from different cultures as simpler than other songs from the same cultures. Moreover, they are highly confident about their judgements of simplicity. In addition, their classification of songs as lullabies seems to be influenced by melodic features that parallel some prosodic features of infant-directed speech.

These findings raise provocative questions for further research. For example, are functional lullabies (*i.e.* those actually sung to sleepy infants) structurally distinct from other songs or from the same songs sung in other contexts? How does an infant's presence influence the performance of a song, notably the melody, rhythm and voice timbre? To address questions such as these, we are currently recording informal singing to infants in different cultural communities locally and abroad. We are also analysing a large collection of North American Indian songs, which will permit greater representativeness of the lullabies and adult songs. If we succeed in identifying common structural features in these songs, we must then establish whether these features are salient for infant listeners. To this end, we are attempting to ascertain the musical preferences of infants and the structural features underlying such preferences.

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