

A Cross-Language Investigation of Infant Preference for Infant-Directed Communication

JANET F. WERKER AND JUDITH E. PEGG
The University of British Columbia

PETER J. MCLEOD
Acadia University, Nova Scotia

Virtually all the research to date on infant preference for infant-directed talk has been conducted with English-learning infants. This study was designed to test whether the preference for native infant-directed (ID) communication extends to a language group other than English, and whether infants' preference for ID communication extends to a nonnative language. English- and Cantonese-learning infants 4.5 and 9.0 months of age were tested on their preference for filmed displays of a Cantonese-speaking female addressing either her own infant (ID) or an adult (AD). Both groups of infants showed a robust attentional and affective preference for ID over AD in Cantonese. These results strengthen the claim that the special properties evident in ID communication may have universal attentional and affective significance.

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Caretakers modify their style of interaction when they speak to infants and young children. The vocal modifications include the use of a higher pitch (Fernald & Simon, 1984; Garnica, 1977), simple but broad pitch contours (Fernald, 1984; Jacobson, Boersma, Fields, & Olson, 1983), and longer pauses between utterances (Fernald, 1984). Nonvocal characteristics include exaggerated facial expressions, postural adjustments, and rhythmical body movements (Stern & Gibbon, 1979; Stern, Spieker, Barnett, & MacKain, 1983; Sullivan & Horowitz, 1983). The vocal modifications occur in the speech of parents and nonparents (Jacobson et al., 1983), familiar adults and strangers (Rheingold & Adams, 1980), and even preschool children (Shatz & Gelman, 1973). Although the precise characteristics of the vocal and nonvocal displays vary with the age of the infant being addressed (Stern et al., 1983) and the communicative context (Papousek, Papousek, & Bornstein, 1985; Stern, Spieker, & MacKain, 1982; Stern et al., 1983), the use of a special interactional style has been well-documented in the speech directed toward infants from birth to 24 months of age (McLeod, 1993).

There is considerable evidence that English-learning infants show an attentional and affective preference for infant-directed (ID) speech. The first convincing evidence of attentional preference was provided in a now classic study by Fernald (1985). Using a two-choice head-turn procedure, Fernald provided data showing that infants aged 4 months will selectively choose to listen to female ID over female adult-directed (AD) speech. Using other procedures, it has been shown that this attentional preference for female ID over female AD speech is evident in neonates (Cooper & Aslin, 1990), in infants 7 weeks of age (Pegg, Werker, & McLeod, 1992), in infants as old as 9 (Glen & Cunningham, 1983) and 18 months of age (Friedlander, 1968), and even in preschool children (McDonnell, Doherty, & Marshall, 1992). This preference is evident even when sine wave stimuli preserving the fundamental frequency contours of ID and AD vocalizations are used (Fernald & Kuhl, 1987), which suggests that the preference is a function of the prosody of the speech.

Only one study has directly assessed whether visual (as well as vocal) characteristics function to increase infant attention to ID speech. Werker and McLeod (1989) showed 4- and 9-month-old infants filmed displays of a male and a female speaking both ID and AD speech. To tease apart the relative contribution of face and voice, two control conditions were included. A robust attentional preference (longer looking time) for ID over AD speech

This research was supported by a grant to J. Werker from the SSHRC of Canada.

Correspondence and requests for reprints should be sent to Janet F. Werker, The University of British Columbia, Department of Psychology, 2136 West Mall, Vancouver, British Columbia V6T 1Z4, Canada.

was reported in infants of both ages when the original multimodal stimuli were presented. However, no attentional preference for ID over AD speech was found in the control condition when the vocal signals were presented with a neutral nodding face or when the ID and AD faces were accompanied by music rather than the original voices. Thus, in that study, the naturally occurring combination of face and voice was the most powerful stimulus for drawing and maintaining infant attention to ID stimuli.

Only a few studies have directly assessed whether infants show an affective preference for ID communication. Using filmed stimuli, Werker and McLeod (1989) assessed infant affective responsiveness by having two trained coders (blind to the experimental condition) rate each infant according to three affectively-based constructs scaled along a 9-point continuum. Filmed stimuli were used in the experimental conditions because previous research has shown that multimodal (face plus voice) stimuli are maximally effective in helping infants to perceive affect (Walker, 1982; Walker-Andrews & Lennon, 1991). Although infants of both 4 and 9 months showed an *attentional* preference for both male and female ID conditions, the results from the analysis of *affective* responsiveness revealed a preference for only the female ID over AD presentation. Post-hoc analyses revealed this affective preference for female ID to be significant when the vocal signals were presented with a neutral nodding face but not when the ID and AD facial stimuli were paired with music. Thus, the vocal aspects of ID stimuli were found to be more important than the facial characteristics in accounting for infant affective preference. As for attentional preference, however, the affective preference was strongest when face and voice were presented together as natural multimodal stimuli.¹

Two other studies have examined differential affective responsiveness to ID over AD speech. Both were designed to determine whether prelinguistic infants respond appropri-

ately to the affective messages conveyed in ID speech. Fernald (1993) reported that 4-month-old infants respond with more positive affect to praise and more negative affect to prohibitions when delivered in ID mode. Papousek, Bornstein, Nuzzo, Papousek, and Symmes (1990) showed that infants aged 4 months look longer to approving than to disapproving infant-directed vocalizations.

Similarities in the modifications made in speech directed to infants have been noted in many different language communities. Detailed acoustic studies have confirmed the presence of higher pitch, more exaggerated but simplified pitch contours, and longer pauses between utterances in such diverse languages as German (Fernald & Simon, 1984; Papousek, Papousek, & Haekel, 1987), Mandarin Chinese (Grieser & Kuhl, 1988; Papousek & Papousek, 1991); Xhosa (cited in Fernald, 1992b), Italian, French, Japanese, and both British and American English (Fernald et al., 1989). The elevated fundamental frequency (Fo) has been shown to be quite similar across studies with averages of above 250 Hz in short samples of highly engaging ID speech produced by females in English, German, Japanese, French, Italian, and Mandarin (Fernald et al., 1989; Grieser & Kuhl, 1988).

In addition to the profound similarities across cultures in the speech directed to infants, there are some differences as well (Heath, 1983; Ratner & Pye, 1984). In a study comparing Italian, German, Japanese, British English, and American English speech directed to infants of 10 to 12 months, it was found that although there were, in general, similarities in mean Fo, Fo range, and Fo variability, and there was a tendency for the mothers to use shorter utterances and longer pauses in ID speech, the modifications in Fo were less exaggerated in Japanese (Fernald et al., 1989) than in American English. In a more recent study of Japanese ID versus AD speech, it was reported that although overall Fo is higher in ID speech than in AD speech in Japanese, the increase in Fo is only evident when mothers need to make repeated bids in order to successfully elicit infant attention (Masataka, 1992a). Similarly, although studies of Mandarin-speaking mothers confirm the use of high Fo and Fo variability in speech directed to infants aged 2 to 4 months

¹ In a final experiment, Werker and McLeod (1989) showed that adults rate the same infant as more attractive, cuddly, and so forth when viewing female ID over all other three conditions suggesting that the behaviors infants display in response to ID multimodal communications make adults want to continue interacting with them.

(Grieser & Kuhl, 1988), comparative studies of Mandarin and English ID speech reveal the exaggeration of both of these characteristics to be more pronounced in English than in Mandarin ID speech (Papousek, Papousek, & Symmes, 1991). In a sample of 3 Quiche-speaking mothers, it was reported that the speech directed to adults is as high-pitched as that directed to infants (Ratner & Pye, 1984; the authors noted, however, that the Quiche mothers used other features of a "baby-talk" register such as whispering and quotative verbs). It has been reported that both the Kaluli of New Guinea (Schieffelin, 1979) and the Kwara'ae of the Malatia in the Solomon Islands (Watson-Gegeo & Gegeo, 1976) do not even address their infants directly. These mothers do, however, use a high-pitched voice to speak on behalf of the infant while facing their infant toward the addressee (Watson-Gegeo & Gegeo, 1976).

There is a paucity of cross-cultural research examining nonvocal behaviors that accompany ID speech. The few studies that have been done, however, report that the modifications in the facial and postural gestures accompanying ID speech are similar across cultures. For example, Papousek, Papousek, and Symmes (1991) report that the parental behaviors accompanying different types of ID speech are similar in Mandarin and in English. Interestingly the observed modifications in ID communication extend beyond spoken languages. For example, in American Sign Language, the facial gestures accompanying signed speech to infants are different than those accompanying signed speech to adults (Erting, 1987; Reilly, 1990); in Japanese Sign Language, mothers have been shown to slow down, repeat, and exaggerate their signing gestures when addressing their infants (Masataka, 1992b). Thus, although there are some differences in the precise form of the modifications used in addressing infants, there is reason to believe that in virtually all societies, the speech directed to or used in the vicinity of young infants is different from that directed to adults.

To date, no study has investigated the fundamental question of whether infants other than English-learning infants show a preference for ID over AD in their native language. If there are modifications in the communications direct-

ed to infants in nearly every culture, and if these modifications serve at least to attract attention and facilitate the establishment of affective relations, then infants in every language group should show a preference for their language-specific ID over AD communications. Thus, the first goal of this study was to examine whether a group of Cantonese-learning infants would show a preference for ID over AD in their native language.

In addition, no study to date has examined the basic question of whether infants show a preference for ID over AD speech when delivered in an unfamiliar language. To the extent that the modifications in ID speech and ID facial expressions are universal, or to the extent that there may be several different but equally effective language-specific ways to gain an infants' attention and draw an infant into a more optimal affective exchange, one would predict that infants would prefer ID over AD communication even in an unfamiliar language. On the other hand, the fact that there are differences between languages in the precise form of the modifications used in ID speech raises the possibility that the preference for ID communication may only be evident in response to familiar language input. This latter possibility is strengthened by the research showing that infants become "tuned" to the specific properties of their native language during the first year of life, with tuning first evident to the more global, prosodic features of the native language: the very features that are modified when addressing infants (for reviews, see Jusczyk, 1992; Werker & Pegg, 1992). Thus, it is not possible to make an a priori prediction as to whether infants will show a preference for ID over AD communication when delivered in an unfamiliar language. The answer to this question has important implications for both the issue of the universality of an ID interaction style and the issue of language-specific perceptual tuning across the first year of life.

This study was designed to assess whether Cantonese- and English-learning infants of two ages show affective and attentional preference for ID over AD multimodal stimuli as delivered by a Cantonese-speaking female. The Cantonese infants provide a test of whether the preference for native ID communication extends to a sample other than English infants.

The inclusion of English infants allows for a test of preference for ID over AD in a nonnative language.² Infants 4.5 and 9.0 months of age were tested to see if the preference for nonnative ID over AD stimuli changes across the first year of life. These ages are of particular interest because several authors have suggested that there may be a shift from "universal" affective to language-specific referential emphasis in the speech directed to infants between 4 and 9 months of age, and a concurrent shift in the characteristics of speech to which infants pay attention (Blount & Padgug, 1977; Freedle & Lewis, 1977; Papousek et al., 1985; Sherrod, Crawley, Peterson, & Bennett, 1978; Stern et al., 1983; Sullivan & Horowitz, 1983; also see Fernald, 1984, 1989 for a discussion of how the intonation contours of ID speech might facilitate entry into the referential function). Audio-video recordings were used as previous research has shown ID communication involves both facial and vocal modifications (Stern, Beebe, Jaffe, & Bennett, 1977; Stern et al., 1983; Sullivan & Horowitz, 1983). In addition, such multimodal stimuli have been shown to be maximally effective for revealing infant preferences (Werker & McLeod, 1989) and for helping infants to perceive affect (Walker-Andrews & Lennon, 1991).

Cantonese was chosen as the comparison language for a number of reasons. Cantonese is a tone language in which not only phones (consonants and vowels), but also syllabic tones signal a difference in meaning (Wang, 1991).³ The contours that signal differences in meaning are called *lexical tones*. Hence, in tone languages there are local lexical tone differences in addition to the global intonation contour of the utterance. In Cantonese, there are nine lexi-

cal tones: six occur on consonant-vowel (CV) syllables, and three occur on consonant-vowel-consonant (CVC) syllables. Three of the six CV tones are level tones that differ only in the height of the tone register.⁴ Two CV tones are classified as rising; one starts low and rises to a midlevel pitch and the other starts at midlevel and rises to a high level. The sixth CV tone is classified as a low-falling tone.

The characteristics of infant-directed speech may be different in tone than in stress languages. Although there is little research yet on Cantonese, there is evidence that the prosodic modifications in ID speech in another tone language, Mandarin, are similar to (Grieser & Kuhl, 1988) but less pronounced (Papousek et al., 1991) than those used in English. Lexical tone, however, is realized quite differently in Cantonese than in Mandarin. In Mandarin there are only four lexical tones, high-level, mid-rising, fall/rise, and high-falling, fewer than the nine described in Cantonese. Importantly, lexical tone and melody have been shown to interact quite differently in Cantonese and Mandarin singing, thus they might also interact quite differently in Cantonese and Mandarin ID speech. In an analysis of modern songs, Chan (1987) found that Cantonese songwriters take lexical tone into account when composing words and music. In over 90% of elements in the songs analyzed, lexical tone and melody were concordant (i.e., the musical notation would involve a rise in pitch in a low note at a syllable characterized as low-rising). However, in a similar analysis of six modern Mandarin songs, Chan found that either lexical tone or melody was violated in over 30% of the elements.⁵ This raises the very real possibility that lexical tone may be compromised in Mandarin ID speech in order to maximize an ID register, but that Cantonese-speaking mothers may maintain lexical tone (perhaps thus compromising prosodic emphasis) even when addressing their infants. In support, recent research reveals that lexical tone is indeed comprised in favor of global

²In the original study, another sample of English- and Cantonese-learning infants were also tested on their preference for ID versus AD as delivered by an English speaker. This English-speaker had an unusual voice, however, and even the English-learning infants failed to show a reliable preference for her ID interactions. Thus, these data were omitted from this article (and will be submitted separately), as it was impossible to interpret the data from the Cantonese infants listening to this English-speaker without an established preference by English infants listening to her ID speech.

³For example, in Cantonese, the syllable "si" can mean six entirely different things depending upon the tone contour (Wang, 1991).

⁴Some linguistics classify the highest of these as high-level, which is realized as high-falling in certain contexts, whereas others classify it as a high-falling tone that becomes level in certain contexts.

⁵Chan (1987) found similar differences between Cantonese and Mandarin in an analysis of imported songs that had been translated into Chinese.

intonation in Mandarin ID speech (Papousek & Hwang, 1991; see also Fernald, 1990), but no studies to date have specifically examined whether lexical tone is similarly compromised in Cantonese. Nevertheless, the studies of lexical tone and melody suggest that lexical tone might be more stable in Cantonese, and thus that the global intonation contour may be more readily compromised in Cantonese ID than in Mandarin ID speech. Thus, on the basis of the evidence to date, Cantonese seemed to be an ideal language for providing a strong test of the universality hypothesis of infant preference for ID communication.

The final reason for selecting Cantonese is logistical: There is a very large community of Cantonese-speakers in our metropolitan area from which to draw a sample. For these reasons, we decided to begin to test the question of the universality of infants' attraction to ID over AD stimuli by testing English- and Cantonese-learning infants viewing filmed presentations of a Cantonese speaker.

Following the research of Werker and McLeod (1989) mentioned earlier, attentional and affective preference were measured independently. Most of the previous work examining infant preference for ID over AD speech has been based on the results of measures of attention (as measured in looking time). Although measures of looking time may reveal infant attentional preferences, such measures do not necessarily reveal an affective preference (Werker, Pegg, & McLeod, 1990). An infant may show increased looking to a stimulus that has neutral or even negative affective valence if that stimulus captures and maintains their attention. For example, infants stare at looming figures (Yonas, 1981) and look longer to events that violate their expectations of the integrity of objects (Baillargeon, 1987; Spelke, 1991), but one would not want to conclude that either of those stimuli necessarily evokes a positive affective response from the infant. Similarly, an infant may choose not to look at a stimulus that does have positive affective valence. One example of such behavior might be the "coy" behavior observed in infants in interpersonal interactions, where an infant will sometimes turn his or her head away, avert the gaze, and break into a big smile. For these reasons, looking time was used as a measure of attention in this study, and affective preference

was coded from video records of infant behavioral responses.

METHOD

Subjects

The 40 subjects comprised 20 English-learning and 20 Cantonese-learning infants. Ten infants from each language-learning group were between 4.5 and 5.0 months of age ($M = 284.8$ days), and 10 were between 8.5 and 9.0 months of age ($M = 131.6$ days). An additional 11 English-learning infants had to be excluded from the sample: 4 due to fussiness, 3 due to equipment error, and 4 because the infant was off the video screen for more than 3 s in one trial. Two additional Cantonese-learning infants also had to be excluded, both due to fussiness. All infants were healthy and were reported to have been born within 2 weeks of expected due dates after normal pregnancies and deliveries.

The English-learning infants were recruited by visiting new mothers in the local hospitals and asking them if they would be interested in participating in studies of speech and language processing when their infants reached the appropriate age. Some Cantonese-learning infants were recruited similarly by a Cantonese-speaking student who visited new mothers in the local hospitals. In addition, recruiting advertisements were placed in local Chinese newspapers and radio and television stations, and posters and pamphlets were distributed at the Chinese Cultural Center and appropriate health clinics. Care was taken to include only those infants whose parents reported that Cantonese was spoken over 80% of the time in the home. In most cases, the parents were recent immigrants from Hong Kong.

Stimuli

The experimental stimuli consisted of audio-video recordings of a female native Cantonese speaker talking either to her own 4-month-old infant (ID condition) or to an adult Cantonese-speaking acquaintance (AD condition). Samples were selected from among five Cantonese mothers who volunteered to be recorded. The final samples were selected because they were of high audio quality, the mother was enface on the video camera during virtually all of the recording, and the mother provided highly animated and engaging samples of both ID and AD communications. An attempt was made to select samples of ID and AD that were as close as possible in duration while still ensuring that the samples ended at natural phrase boundaries. This resulted in an ID sample of 55 s and an AD sample of 50 s. The acoustic characteristics of the final samples selected are shown in Table 1. Sample facial images are shown in Figures 1 (ID) and 2 (AD).

In examining Table 1, it should be noted that the fundamental frequency values for the Cantonese female are within the range that has typically been reported in studies of ID versus AD speech in other languages. Means in the Grieser and Kuhl (1988) article were 199 Hz and 247 Hz for ID and AD speech, respectively. The variability in pitch, when examined by converting *SDs* to semitones,⁶ also yields values comparable to those previously reported and shows there to be much more variability in ID than AD speech.

⁶ The formula used for converting *SD* to semitones is: $12 \log_2 \{1 + SD/M - F_0\}$.

TABLE 1
Fundamental Frequency Means, Standard Deviations,
and Range in Semitones of Both ID and AD Speech
in the Cantonese and English Female Speech Samples

	M Fo	SD	Semitones
ID speech	255 Hz	91	5.3
AD speech	173 Hz	25	2.4



Figure 1. Sample image from the video of the Cantonese-speaking female in the ID condition.

Procedure and Apparatus

Testing was conducted in a 2.3 m × 2.7 m beige room with a few pictures on the walls. Lighting was provided by a 60-watt incandescent bulb in a shaded lamp behind and to the right of the parent/infant. The testing room was designed to be warm and attractive, much like the living room in a western home, in order to provide a more ecologically valid test of the hypothesis that ID communication modulates infant attention and affect.

During the experimental procedure, a parent held the infant on his or her lap. The infant faced a TV monitor at a distance of approximately 0.5 m. The parent wore headphones delivering music to mask the voices being presented to the infant. As a further control, the parent was instructed to focus his or her gaze on a picture on the wall at a 90° angle to the right of the TV monitor. The stimuli were presented on a 13" JVC color monitor placed flush with the edge of a table and linked to a JVC videocassette recorder (BR-1600U). A frontal view of the infant was filmed with a JVC, low-light color video camera (9X-N7UT). The videotapes were later scored by two highly trained coders who were blind to the infants' testing conditions. The sound was turned off during scoring to remove identifying information about the experimental condition.

Research Design

Each infant was presented with two trials of ID and two trials of AD displays in an alternating pattern for a total of four trials. Half the infants in each group were presented



Figure 2. Sample image from the video of the Cantonese-speaking female in the AD condition.

with ID speech in the first position and half with the reverse in order to counterbalance for possible order effects.

The videotapes were coded for infant attentional and affective responsiveness. Attentional responsiveness was coded by recording the proportion of time the infant looked at the monitor relative to the trial duration for each condition. Affective responsiveness was coded using the scale developed by Werker and McLeod (1989).⁷ Two trained coders assessed each infant with respect to three questions: (1) How much do you think the infant was trying to interact? (2) How interested do you think the infant was? and (3) What is your perception of the infant's emotional state? Each question was accompanied by a 9-point scale with construct-specific anchors. For the first two questions the anchors were (1) *not at all* and (9) *totally*, and for Question 3 they were (1) *experiencing negative or unpleasant feelings* (distress, stress, agitated) and (9) *experiencing positive or pleasant feelings* (happy, excited). The total score across these three questions as measured by the two raters was used as the measure of affective responsiveness.⁸

Mean scores from the original coders were used if the recorded values for looking time were within 2 s and if the scores for affective responsiveness were within 2 points on the 9-point scale. The scores of the primary raters fell within these criteria on 97% of the trials. When these criteria were not met, a third rater recoded the trial. In every case, the third rater's scores were within the accepted range of one or the other of the other two raters' scores. The mean

⁷ Reliability rating from the Werker and McLeod (1989) study using Cronbach, Gleser, Nanda, and Rajaratname's (1972) generalizability procedures yielded a $G = .92$ for rater and $G = .88$ for scales. The coders in this study were trained using the materials from the Werker & McLeod study.

⁸ The measure of affective response in the Werker & McLeod (1989) study was the mean score across the three questions, whereas it was the total score in this study.

of the third rater's score and of the original rater's score that was within the accepted range was then used as the final score.

All coders were trained by the same person (J.E.P.) who also served as the third rater whenever there was disagreement. One of the trained coders was a Cantonese-speaking student who was born in Hong Kong and spent the first 8 years of her life there. She was selected to ensure that at least one of the coders was sensitive to any potential culturally-specific affective display characteristics of the Cantonese-learning infants. The other coders were English-speakers born in Western Canada.

RESULTS

Data were analyzed in two separate 2 x 2 x 2 mixed analyses of variance (ANOVAs). In both analyses, baby language (English- vs. Cantonese-learning) and age (4.5 vs. 9.0 months) were between-subject factors, and communication style (ID vs. AD) was the within-subject repeated measures factor. In the first analysis, attentional responsiveness was assessed using percent of looking time as the dependent variable, and in the second analysis affective responsiveness was assessed using the cumulative affective score as the dependent variable.

Attentional Responsiveness

The mixed-model ANOVA using looking time as the dependent variable revealed a significant main effect for age, $F(1, 36) = 15.08, p < .001$, with younger subjects looking longer than older subjects. Most importantly, the within-subject factor, communication style, was also found to be significant, $F(1, 36) = 13.0, p < .001$, with subjects looking longer when presented with ID

than with AD presentations. No other main effects or interactions were significant. The pattern maintained for both Cantonese and English infants at each age group as is shown in Figure 3.

Affective Responsiveness

The 2 (baby language) x 2 (age) x 2 (communication style) mixed-model ANOVA of affective responsiveness revealed a significant main effect for communication style, $F(1, 36) = 21.15, p = 0001$. There were no other main effects and no interactions. The pattern maintained for Cantonese and English infants at each age group as shown in Figure 4.

GENERAL DISCUSSION

The study was designed to assess the generalizability of the finding that infants show a preference for ID over AD communication. Generalizability was assessed in two ways. First, because all previous research on preference for native ID over AD speech has assessed English-learning infants listening to English, we asked whether the preference for native ID over AD communication would extend to a sample of (non-English) Cantonese-learning infants presented with samples from their native language. Our results revealed that the Cantonese infants did indeed show a preference for ID over AD in their native language. This preference was evident in both attention (as measured by looking time) and affect.

Second, we asked whether the preference for ID over AD communication would extend to an

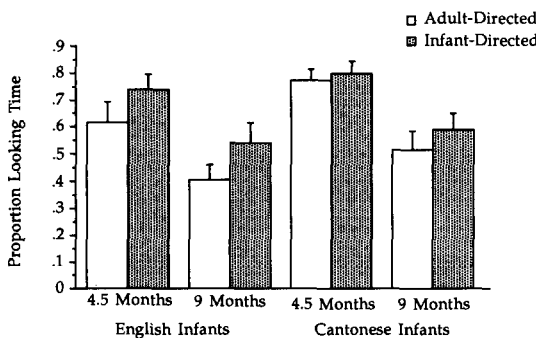


Figure 3. Mean looking time with standard error bars to ID versus AD displays as a function of age and baby language.

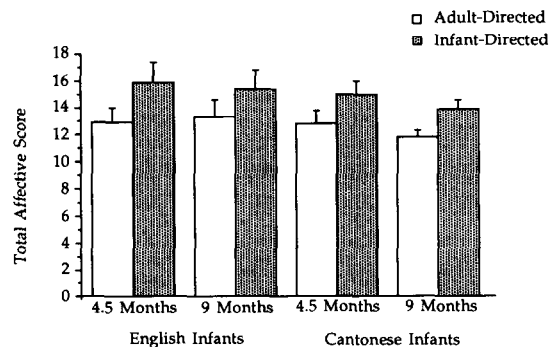


Figure 4. Mean total affect rating scores with standard error bars to ID versus AD displays as a function of age and baby language.

unfamiliar language. To answer this question, we assessed English-learning infants on their preference for Cantonese ID over AD communication. Again, our results revealed a strong preference for this nonnative ID over AD as evident in both attention and affect. The finding that English-learning infants looked longer and showed more affective responsiveness when presented with Cantonese ID over AD shows that the preference for ID over AD can extend to an unfamiliar language, thus providing the first support for the hypothesis that modifications in ID communication may function to attract and maintain infant attention and to facilitate affective exchanges even across very different languages.

There was no evidence in our results for an effect of specific language experience on the preference for ID communication. Baby language was not significant, nor did it interact with any other variables in either analysis. Similarly, there was no evidence in this study for an effect of age on the preference for ID over AD communication. In the analysis of attentional responsiveness, younger infants were shown to look longer overall than older infants, but age did not interact with either baby language or talk type. Thus, younger infants looked proportionately longer at both ID and AD displays than did older infants, but both age groups showed an equally robust attentional preference for ID over AD displays.

Taken together, these findings provide strong support for the hypothesis that infants prefer ID over AD communication even in an unfamiliar language. This is consistent with the notion that ID communication has universal appeal to infants over and above any specific differences between languages. This result is, we believe, compelling and even somewhat surprising in light of the growing number of studies showing language-specific influences on infant speech processing. Studies have shown that infants prefer (Moon, Cooper, & Fifer, 1993) and more efficiently process (Mehler et al., 1988) the native over a nonnative language within days after birth, that their perception of vowels begins to show an influence from the native language by 6-months of age (Kuhl, Williams, Lacerda, Stevens, & Lindblom, et al., 1992; Polka & Werker, 1994; Werker & Polka, 1993), that they prefer words and sentences obeying native language prosody

by 6 months of age (Jusczyk, Friederici, Wessels, Svenkerud, & Jusczyk, 1993), that they prefer native-language phonotactic rules (Jusczyk et al., 1993) and stress patterns (Jusczyk, Cutler, & Redanz, in press) by 9 to 10 months of age, and that they show language specificity in consonant discrimination by 10 months of age (Werker & Lalonde, 1988; Werker & Tees, 1984). It might be argued that these studies are not directly comparable to this research because only acoustic stimuli were used in these studies in contrast to the filmed, AV stimuli used in this study. However, Bahrick and Pickens (1988) showed that infants can classify bimodal, face-plus-voice native versus nonnative stimuli by 5 months of age revealing that tuning to the properties of the native language is evident even when facial information is included in the stimulus display. Thus, the finding of a robust preference for ID over AD even in an unfamiliar language at both 4 and 9 months of age is a result that reveals a socially relevant language-general bias that remains despite all the language-specific tuning that is taking place. The meaning of this preference, in light of all the other changes that are taking place, is worth consideration.

In earlier writings, several researchers have speculated as to the functional significance of ID communication. Three primary functional hypotheses have been suggested. First, it has been proposed that ID communication functions to attract and maintain infant attention. Fernald (1984, 1992a) and Gottlieb (1985) have suggested that the vocal characteristics of ID speech have special acoustic properties that match the attentional proclivities of the human infant and thus serve to attract and maintain infant attention. Several other authors have made similar suggestions but have also included the facial and other nonvocal behaviors that accompany ID speech as important in attracting infant attention (Papousek et al., 1984; Stern et al., 1983; Sullivan & Horowitz, 1983). Second, it has been proposed that ID speech and the accompanying nonvocal behaviors serve to facilitate the development of an affective relationship between the parent and infant (Ferguson, 1964; Fernald, 1984, 1992a; Papousek et al., 1985; Stern, 1985; Sullivan & Horowitz, 1983). Finally, it has been suggested that ID speech facilitates language acquisition (Snow & Ferguson, 1977). Support for this

hypothesis comes from studies showing that exaggeration of acoustic cues facilitates phonetic discrimination (Karzon, 1985) and parsing of syntactic structure (Kemler-Nelson, Hirsh-Pasek, Jusczyk, & Cassidy, 1989), and from studies showing that prosodic highlighting of the referent facilitates lexical acquisition (Fernald & McRoberts, 1991).

On the basis of the data presented in this article, we can conclude that there is at least some support for the hypotheses that ID communication serves attentional and affective functions irrespective of the particular language of input or of the match between the language to which the child is being exposed and the language/culture of the model. In other words, the attentional and affective functions seem to be of sufficient importance to continue to influence infant preferences well beyond the period that infants become sensitive to the structural properties of their native language. It should be noted, however, that because multimodal stimuli were used in this study, the possibility exists that cross-cultural similarities in the facial gestures accompanying ID speech contributed to our finding of infant preference. Further work examining cross-language preference for ID over AD speech in the absence of accompanying facial stimuli is required to address this question. In addition, it would be of interest to investigate in more detail cross-cultural similarities and differences in the facial expressions accompanying ID speech and in age-related changes in infants' recognition of culturally appropriate expression types.

Finally, this study does not address the question of whether the modifications in ID input serve universal linguistic functions. It is here that one might predict divergence between languages. That is, the specific differences that have been reported in the ID speech directed to infants in different languages may be very important, not for attentional or affective reasons, but in terms of their usefulness for facilitating the infants' entry into that language. It would thus be important, in future work, to assess not only attentional and affective preference for native and nonnative ID over AD communication, but to begin to assess the extent to which language specific differences in the modifications in ID input affect infants' discrimination, identification, and use of that specifically linguistic information.

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12 March 1993; Revised 28 July 1993 ■