Developmental trends in infant preferences for affective intent in mothers' speech

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Abstract

According to Kitamura & Burnham (2003), affective intent is modified in infant-directed (ID) speech such that mothers accentuate different emotional messages at different ages – 'comforting' at 3 months, 'approving' at 6 months, and 'directive' at 9 months. This study examined preferences for the three ID emotion types by infants aged 3, 6 and 9 months. After adults had rated utterances according to affective category, infants were tested with the 12 best exemplars using an auditory preference procedure. Results revealed that 3-month-olds preferred 'comforting' utterances; 6-month-olds preferred 'approving' to 'directive' ID utterances, and listened equally to 'approving' and 'comforting' utterances; and 9-month-olds showed no preference for any ID emotion type. Because it was possible that 9-month-olds were attending to segmental information, they were tested using low-pass filtered stimuli, and were found to prefer 'directive' to 'comforting' ID utterances, and listen equally to 'directive' and 'approving' utterances. It is concluded that during the first year, mothers' speech not only relies on contingent responsiveness but is also affected by their infant's age and state of development.

1. Introduction

During conversation humans exchange more than words, they also express their emotions, attitudes and intentions through the prosody of their speech. This is especially evident in the special register used by caregivers during interactions with young infants, namely infant-directed (ID) speech. It is well established that infants prefer ID to adult-directed (AD) speech at birth and older ages (Cooper & Aslin, 1990; Fernald, 1985; Hayashi, Tamekawa, & Kiritani, 2001; Werker & McLeod, 1989). Furthermore, ID speech appears to be a universal phenomenon (e.g., Fernald et al., 1989). Accordingly, three primary functions of ID speech have been outlined in the literature: (i) facilitation of language acquisition (Fernald & Mazzie, 1991; Hirsh-Pasek et al., 1987; Kemler Nelson, Hirsh-Pasek, Juscyzk, & Wright Cassidy, 1989), (ii) communication of affect and facilitation of social interaction (Fernald, 1989, 1993; Werker & McLeod, 1989), and (iii) engaging and maintaining infant attention (Fernald & Simon, 1984; Stern, Spieker, & MacKain, 1982).

With respect to the emotional function of ID speech, research has shown that infant preferences for ID speech are based on the heightened levels of positive emotion (Kitamura & Burnham, 1998; Panneton, Kitamura, Mattock, & Burnham, 2006; Singh, Morgan, & Best, 2002) rather than its pitch or fundamental frequency (F_0) qualities (Fernald & Kuhl, 1987). Indeed, infants show no preference for high- versus low-pitch ID speech when affect is matched but show a significant bias for ID speech containing high- over low- positive affect when mean pitch is matched (Kitamura & Burnham, 1998). Furthermore, this preference persists even when both speech samples are slowed by increasing their duration (Panneton et al., 2006). Infant preferences appear to be contingent on the affective salience in speech, and not just ID speech per se. Singh and colleagues (2002) showed that 6-month-olds listen longer to happy speech whether it is compared in ID or AD neutral speech (Singh et al., 2002).

Interestingly, infants not only prefer the emotional salience of ID speech, they also show contingent responsiveness to emotions portrayed in ID speech. In fact, English-learning 5-month-olds show appropriate affective responses to 'approving' and 'disapproving' ID speech whether presented in English, German, Japanese or Italian (Fernald, 1993). Moreover, 4 to 5.5-month-olds are more affectively responsive to video recordings of actors reciting ID not AD speech (Werker & McLeod, 1989). Thus infants appear to detect the difference between positive and neutral emotion and respond accordingly.

As we can see emotion is an integral feature of ID speech. Several lines of research converge on the fact that there is a set of distinct emotions mothers typically use when communicating with their infants. In an investigation of the influence of fundamental frequency (F_0) on meaning in maternal speech, Katz and colleagues (1996) identified three types of ID emotions: 'comfort', 'attention' and 'approval'. These 3 categories were commonly featured in adult to infant interactions, and were clearly distinct from one another according to the dynamic contour (rise, fall, and wave) and summary features (F_0 mean, F_0 SD and F_0 duration) of the utterances. Notably, when Moore, Spence and Katz (1997) examined 6-month-olds' ability to distinguish multiple exemplars of 'approving' and 'comforting' utterances, they found that infants categorized 'approving' and 'comforting' utterances even when they were low-pass filtered at 400 Hz to remove all segmental information. However, it seems only 6-month-olds can differentiate these ID emotion types, because 4-month-old infants could not do the task (Spence & Moore, 2003) unless the speech stimuli were paired with a female face (Spence, Chuang, & Sokolosky, 2004). Thus, although mothers produce distinct emotional messages in ID speech from birth, infants do not show the ability to categorize emotional speech until 6 months.

In addition to conveying positive emotion, mothers appear to produce specific age-related changes to the F_0 in ID speech over the first year. In fact, irrespective of language background, speech to newborns tends to be more 'gentle' and 'comforting' with mean-F_0 and pitch range more in accord with the levels found in AD speech (Kitamura, Thanavishuth, Burnham, & Luksaneeyanawin, 2002). Furthermore, between 9 and 12

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months F_0 patterns become language specific (Kitamura et al., 2002). Similarly, when Stern et al., (1983) compared speech to newborns, 4-, 12- and 24-month-olds, they found all measures of F_0 were highest in speech to 4-month-olds, lower in speech to 12-month-olds, and most restrained in speech to newborns.

Mothers also make modifications to affective intent in ID speech. Kitamura and Burnham (2003) used adults to rate low-pass filtered audio recordings of ID speech to newborns, 3, 6, 9 and 12 month-olds, and speech to another adult. They found that ID speech perceived as 'comforting' is most apparent at birth and decreases across age. ID speech perceived as 'expressing affection,' on the other hand, peaks at 6 months and is least evident at 9 months, while 'directive' type utterances are most evident at 9 months and least at birth (Kitamura & Burnham, 2003). They also found corresponding patterns of mean-F_0. When comforting qualities predominate in the first few months, ID speech has low mean-F_0, and is typically not aimed at gaining infant attention. Around 6 months of age, when mothers are most affectionate, mean-F_0 is at its highest. Conversely, at 9 months, when mothers are most directive and least affectionate, mean-F_0 has decreased, but not to the same level as in speech to newborns. From this, Kitamura and Burnham (2003) describe a model in which the patterns of F_0 and affective intent in ID speech vary according to infant age. The model states that mothers use a 'comforting' voice during the first few months; convey higher levels of affection around 6 months; and use ID speech to direct behavior/attract attention around 9 months.

Although it is known that infants' can categorize 'comforting' and 'attentional' utterances (Moore et al., 1997; Spence & Moore, 2003), it is not yet known which emotional messages are most attentionally salient. If infants encourage ID speech through contingent responsiveness, their preferences for ID emotion types should correspond to the affective intent that predominates in mother's speech at that infant age. This study aims to investigate the salience of mother's emotional messages and to test the Kitamura and Burnham (2003) model of affective intent by identifying developmental trends in infant preferences for the three types of ID emotions, 'approving,' 'comforting' and 'directive'. It is hypothesized that 3-month-olds will prefer 'comforting' to 'approving' and 'directive' utterances; 6-month-olds prefer 'approving' to 'comforting' and 'directive' utterances; and 9-month-olds prefer 'directive' to 'approving' and 'comforting' utterances.

2. Method and Results

This study investigates developmental trends in infant responses to three types of ID emotional intent: 'approving,' 'comforting' and 'directive'. Utterances were recorded and rated according to emotional category, category intensity, and level of positive emotion. Ratings were than collated and the best exemplars were identified for use in the infant study. Infant responses to ID emotion types were examined at three ages: 3, 6, and 9 months using an infant-controlled auditory preference method.

2.1 General Method

2.1.1 Participants

All infants were exposed to Australian English at home, and were tested at a time when they were expected to be alert and comfortable. At the time of testing, infants were reported to be healthy, without history of ear infection or hearing loss. A total of 96 infants were used in analysis, 24 in each experimental group. An additional 25 infants were excluded due to technical faults (12), inattentiveness (4) or fussiness/crying (9).

2.1.2 Speech stimulus materials

Utterances typical of each of the three types of ID emotions were recorded by a native Australian English female speaker with extensive experience talking to infants. The content of the utterances was: "Aren't you a clever thing" for 'approval', "It's OK now darling" for 'comforting' and "Look at the funny cat" for 'directive'. Each of the three utterances was recorded in all three ID emotion types. The scenarios used to aid production of the ID emotions were "imagine you are trying to calm your baby" for 'comforting', "imagine you love your baby very much and are trying to reward it for being good" for 'approving' and "imagine you are trying to show/direct your baby to do something" for 'directive'. Recordings were conducted in a sound attenuated room with a Rode NT2 studio microphone connected to a PC using a Mackie 12-channel mixer. Utterances were digitized with Cool Edit 2000 at a sampling rate of 16k Hz.

Mean-F_0, pitch range and the duration of the utterances were measured using Praat (Boersma & Weenick, 2005). A ratings study was conducted to determine the emotional category, intensity of emotion, and degree of positive affect of the utterances. Of the recorded utterances, 45 were pre-selected by the experimenter based on the level of pitch, and the experimenters' assessment of the strength of the ID emotion, that is, 5 exemplars x 3 ID emotion types x 3 sentence types. To enhance the sense of comfort, the duration of 'comforting' utterances were extended (x1.5) with Cool Edit 2000, as comforting utterances are slower in tempo (Trainor, Austin, & Desjardins, 2000) and longer in duration than directive utterances (Katz et al., 1996). The 45 utterances were low-pass filtered at 400 Hz and appended in three counterbalanced orders for rating. Utterances were played with Microsoft Windows Media Player and an Eridol (MA-10A) speaker to 30 first-year Psychology students (18 female, 12 male) from the University of Western Sydney (mean age=18.93 years; range=17-25 years).

Participants had to indicate which category best represented each utterance: 'approving/loving', 'comforting/soothing', 'directive/attentional' or 'none of the above.' They also had to indicate the intensity of the category on a scale of 1 (mildly) to 7 (extremely), and level of positive emotion on a scale of 1 (low) to 7 (very high). Participants were informed that utterances were low-pass filtered, and asked to listen to the 'tone' of the voice as they would not be able to understand the words. The participant's responses were then averaged according to (i) category, (ii) intensity and (iii) level of positive emotion. The values obtained for the 12 selected utterances are shown in Table 1, together with the measures of F_0 and duration of the utterances. The four best exemplars for each category (2 with content corresponding to the ID emotion type, and 2 with non-corresponding content) were used in the infant experiments.

2.1.3 Experimental materials

Movie files displaying each of the 3 types of ID emotions were paired with the same static image of a multicoloured bulls-eye. Each stimulus set was presented at an intensity of 60-65dB SPL (A). Silent flashing multi-coloured dots that progressed towards the centre of the screen were used as the attention-getting stimuli to draw the infant back to the screen between trials.

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Table 1. Ratings of affective category, category intensity, positive emotion and acoustic measures of duration, pitch range and mean-F_0 for stimuli used in the infant preference experiments. "Clever" refers to utterances that contain 'approving' content (Aren't you a clever thing?), "OK" refers to utterances that contain 'comforting' content (Its OK now, darling) and "Cat" refers to utterances that contain 'directive' content (Look at the funny cat!).

Utterance	Category	Intensity	Positive Emotion	Duration (Secs)	Range F_0 (Hz)	Mean F_0 (Hz)
Ok_1	Comfort	4.7	5	3.52	383	183
Ok_3	Comfort	4.9	4.9	3.23	250	192
Cat_4	Comfort	4.5	4.2	3.6	271	251
Clever_2	Comfort	4.9	3.5	3.25	157	185
Mean	**Comfort**	**4.8**	**4.4**	**3.4**	**265**	**203**
Clever_1	Approval	5.3	5.3	2.25	385	280
Clever_5	Approval	5.3	5.2	2.24	354	278
Cat_5	Approval	5.2	5.4	2.31	377	280
Ok_3	Approval	5.2	5.3	2.19	307	317
Mean	**Approval**	**5.3**	**5.3**	**2.25**	**356**	**289**
Cat_2	Directive	5.2	4.2	2.48	376	157
Cat_3	Directive	5	3.2	2.14	167	180
Clever_5	Directive	5.2	4	1.75	376	268
Ok_1	Directive	5.2	3.6	2.2	167	180
Mean	**Directive**	**5.2**	**3.8**	**2.1**	**272**	**196**

2.1.4 Procedure and apparatus

Infants were tested with a Serial Presentation Auditory Preference method, with test sequencing controlled by SerialPref software developed at MARCS Auditory Laboratories. Infants sat on their parent's lap in a sound-attenuated test room facing a video monitor placed slightly to the right of infant's midline. A camera placed directly in front of the infant was connected to a video monitor in the adjacent test room. The experimenter used the image on the video monitor to judge the infants head and eye movements. Each of the three ID stimulus sets ('comforting', 'approving', and 'attentional') alternated during a single session for a total of 18 trials. The order of presentation of the three ID stimulus sets was counterbalanced so that each category was heard in each position, i.e., first, second or third. In this way, one-third of infants in each experiment heard one of the three category orders: CAD, DCA, or ADC. Utterances within categories were ordered so that each successive utterance in the stimulus set represented a different word to the preceding utterance. For example, an utterance containing the word 'cat' may be preceded by an utterance containing 'clever' but followed by an utterance containing 'ok'. Trials began once the infant attended to the attention-getting stimuli on the screen for ≥2 seconds. Each trial lasted 25 seconds or until the infant looked away ≥1.5 seconds. The experimenter was blind to the order of trials for each infant.

2.1.5 Analysis

All data were analyzed using a (3) x 3 ANOVA with ID emotion type ('approving', 'comforting' and 'directive') as the within-participants variable and order (1, 2, 3) as the between-participants factor. Planned contrasts tested the difference between the ID emotion type of interest at each age, with each other ID emotion. The dependent variable was looking time averaged across the 6 trials for each type of ID emotion.

2.2 Experiment 1: 3-month-olds

This experiment tested 24 infants (10 female, 14 male) aged 3 months (M=12.9 weeks, range=11.7-15.9 weeks). It was expected that 3-month-olds would prefer 'comforting' to 'approving' and 'comforting' to 'directive' ID utterances.

2.2.1 Results and discussion

Figure 1 shows the mean looking times to the three ID emotion types. Planned contrasts compared average looking times to 'comforting' and 'approving', and 'comforting' and 'directive' utterances. The results revealed two significant effects for emotion types: 3-month-old infants preferred 'comforting' to 'approving' utterances $F(1,21) = 22.73$, $p < .01$, $\eta^2 = .520$, and 'comforting' to 'directive' utterances $F(1,21) = 28.87$, $p < .01$, $\eta^2 = .579$. There was no main effect for order. However, there was a significant order x 'comforting' versus 'approving' interaction $F(2,21) = 6.07$, $p < .01$, $\eta^2 = .366$. This interaction showed infants paid more attention to 'comforting' utterances when they were played first, and to 'approving' ID utterances when they were played first. There was no interaction between order and the 'comforting' versus 'directive' comparison. Thus, the results support the hypothesis that at 3 months, infants prefer the ID emotion that tends to be used most often in mothers' speech to 3-month-olds.

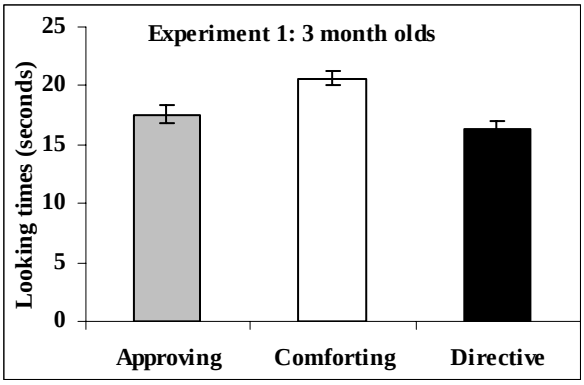

Figure 1. Mean looking time of 3-month-olds at ID emotions

2.3 Experiment 2: 6-month-olds

Twenty-four infants (14 female, 10 male) aged 6 months (M=26.6 weeks, range=24.7-28.6 weeks) were tested. It was expected that 6-month-olds would prefer 'approving' to 'comforting' and 'approving' to 'directive' ID utterances.

2.3.1 Results and discussion

Figure 2 shows mean looking times by 6-month-olds to the three ID emotion types. Planned contrasts tested the difference between average looking times at 'approving' versus 'comforting,' and 'approving' versus 'directive'. The results revealed there was no main effect for order, nor order x emotion type interaction for either contrast. However, there was a significant main effect for emotion type, showing infants listened longer to 'approving' than 'directive' utterances $F(1,21) = 8.537$, $p < .01$, $\eta^2 = .289$, and furthermore the second contrast revealed infants listened equally to 'approving' and 'comforting' utterances. It is interesting to find that infants maintain the preference for 'comforting' utterances at 6 months, still finding them as salient as 'approving' utterances.

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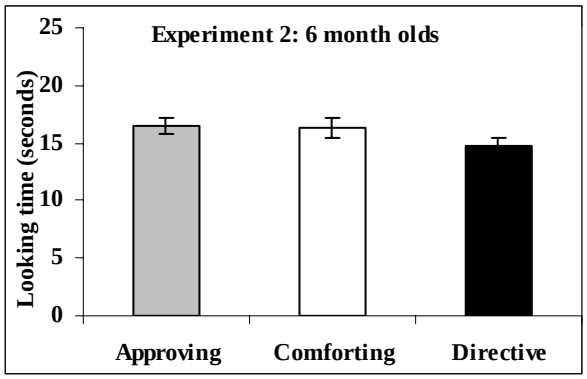

Figure 2. Mean looking times of 6-month-olds at ID emotions

2.4 Experiment 3: 9-month-olds

Twenty-four infants (12 female, 12 male) aged 9 months (M=39.79 weeks, range=38.29-41.29 weeks) were tested. It was expected that 9-month-olds would prefer 'directive' to 'approving,' and 'directive' to 'comforting' ID utterances.

2.4.1 Results and discussion

Figure 3 shows the mean looking times by 9-month-olds to the three emotion types. Planned contrasts compared looking times to 'directive' and 'approving' ID utterances in the first contrast, and 'directive' and 'comforting' in the second contrast. The results revealed infants looked equally to 'directive' and 'approving' utterances, and 'directive' and 'comforting' utterances. There was no main effect for order or order x ID utterance interaction for either contrast. The results from Experiment 3 revealed that 9-month-olds showed statistically equivalent looking to the three ID emotion types. Because it is around 9 months that infants begin attuning to consonant categories (Werker & Tees, 1984) and phonetic/phonotactic details (Jusczyk et al., 1993), it may be the case that infants' attention to available information distracted them from the emotional content offered in ID speech. To test this hypothesis, experiment 3 was replicated using the same stimuli albeit versions low-pass filtered at 400Hz to remove segmental content.

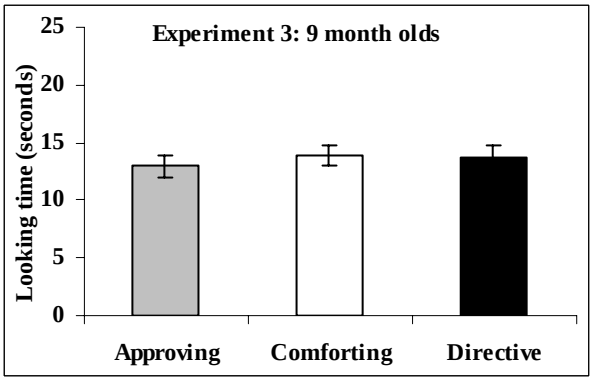

Figure 3. Mean looking times of 9-month-olds at ID emotions

2.5 Experiment 4: 9-month-olds (low-pass filtered)

Twenty-four infants (8 female, 16 male) aged 9 months (M=38.4 weeks, range=36.7- 40.3 weeks) were tested. It was expected that 9-month-olds would prefer 'directive' to 'approving' and 'directive' to 'comforting' ID utterances when the speech samples were low-pass filtered.

2.5.1 Results and discussion

Figure 4 shows the mean looking times of 9-month-olds to the low-pass filtered versions of the three ID emotion types. Planned contrasts compared looking times to 'directive' and 'approving' in one contrast, and 'directive' and 'comforting' in the other contrast. The results revealed a significant main effect for emotion type, showing that infants preferred 'directive' to 'comforting' ID utterances $F(1, 21) = 13.76$, $p < .01$, $\eta^2 = .396$. There was no difference in looking times between 'directive' and 'approving' utterances, no main effects for order and no interaction between order and either of the ID emotion type contrasts. As found in Experiment 2, where 6-month-olds preserved their preference for 'comforting' utterances shown at 3 months of age, this experiment showed 9-month-olds also maintain the preference for 'approving' utterances shown at 6 months of age. Presumably this is because of their prior familiarity with the 'approving' utterances at 6 months.

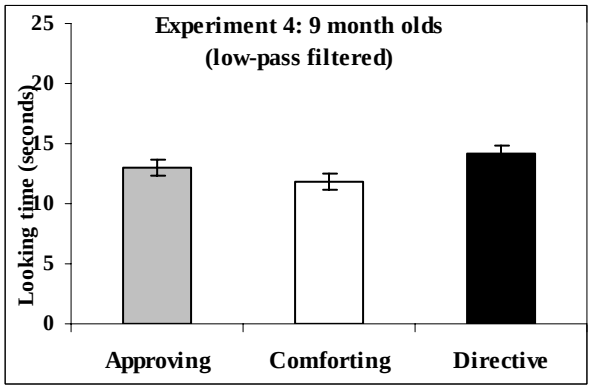

Figure 4. Mean looking times of 9-month-olds at low-pass filtered ID emotions

3. General Discussion

This study examined infants' selective attention to the ID affective intent in utterances which were 'comforting', 'approving', and 'directive,' and commonly found in mothers' speech. Based on descriptive evidence of the modifications made by mothers to affective intent in ID speech in the first 12 months, Kitamura and Burnham (2003) predicted that compared to the other types of ID utterances, 3-month-olds would prefer 'comforting' utterances, 6-month-olds would prefer 'approving' utterances, and 9-month-olds prefer 'directive' utterances. Critically the findings from this study support these predictions, of the three ID emotion types 3-month-olds preferred 'comforting', 6-month-olds preferred 'approving', and 9-month-olds preferred 'directive' ID utterances, but only when they were low-pass filtered to remove segmental information. Overall, these findings support the Kitamura and Burnham (2003) model of affective intent, as infants do indeed show contingent responses to the emotion types emphasized by mothers at 3, 6, and 9 months. Further, this study shows concordance with acoustic measures described in ID speech. Indeed, mean F_0 was low in ID utterances preferred by 3-month-olds ('comforting'), highest in ID utterances preferred by 6-month-olds ('approving')

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and decreased again in the ID emotion type preferred by 9-month-olds (‘directive’), demonstrating age trends similar to those identified by Kitamura and Burnham (2003).

In contrast to the findings of Spence and Moore (2003), we found that infants differentially respond to ‘approving’ and ‘comforting’ ID utterances well before 6 months even in the absence of a face (Spence et al., 2004). As expected, 3-month-olds preferred ‘comforting’ to ‘directive’ and ‘approving’ ID utterances because ‘comforting’ emotional messages predominate in speech to this age group (Kitamura & Burnham, 2003). Thus, as infants' physical and perceptual abilities continue to emerge; their preferences appear contingent on ID speech that maintains lower levels of arousal while still conveying positive affect. Other studies showing that infant’s aged 1.5 (Panneton, McIlreavy, Cooper, Ostroff, & Aslin, under review) and 4.5 months (Panneton et al., 2006) listen longer to slow than normal tempo speech support our findings, and provide evidence that slow speech could impart a ‘comforting’ message to young infants. Nevertheless, as identified in the Panneton et al., (2006) study, preferences for slow speech attenuate by the time infants reach 8 months as do preferences for speech with high positive affect. It might have been expected that 3-month-olds would prefer ‘approving’ to ‘directive’ ID speech. However, it may be the case that 3-month-olds are unable to distinguish between ‘approving’ and ‘directive’ ID utterances as they are not as readily available in maternal speech until infants reach 6 and 9 months respectively (Kitamura & Burnham, 2003).

As expected, 6-month-olds prefer ‘approving’ to ‘directive’ ID emotion types because ‘approving’ ID utterances predominate in speech to this age group (Kitamura & Burnham, 2003). Thus, as infants develop, and become more socially responsive and interested in their surroundings, their preference for ID speech is more contingent on the level of expressed affection in the maternal voice. Indeed, previous research has shown that 6-month-olds prefer happy speech to neutral speech (Singh et al., 2002), as well as preferring high- to low-affect ID speech (Kitamura & Burnham, 1998) even when it is slowed (Panneton et al., 2006). In this study 6-month-olds attended equally to ‘approving’ and ‘comforting’ as they did to ‘comforting’ and ‘directive’ ID speech. Thus, even though 6-month-olds can discriminate ‘approving’ and ‘comforting’ ID utterances (Moore et al., 1997), they do not selectively attend to ‘approving’ over ‘comforting’ utterances. Perhaps, 6-month-olds do not show clear preferences for ‘approving’ over ‘comforting’ utterances due to affirmative experiences with ‘comforting’ utterances in the previous months. Indeed, it seems that even though infants clearly show emerging preferences for ‘approving’ utterances, there may be a period of time before attentiveness to familiar ID emotion types, such as ‘comfort’ subsides.

In contrast to the findings for younger infants, when presented with full spectral versions of the ID utterances, 9-month-olds showed no systematic differences in their listening preferences for ‘directive’, ‘approving’ or ‘comforting’ ID utterances. However, once segmental information was removed 9-month-olds showed a clear preference for ‘directive’ over ‘comforting’ ID utterances, but listen equally to ‘directive’ and ‘approving’ ID utterances. Again, it appears that infant’s preference for a familiar emotion type has not yet disappeared even though they now find ‘directive’ ID utterances attentionally salient. That 9-month-olds only prefer ‘directive’ utterances once segmental information is removed reveals that, even though they can detect emotional information in ID speech, there appears to be a shift in infant attention, whereby they attend more to segmental than emotional information in speech. Indeed, by 9 months infants attend less to prosodic information than at 6 months, as they begin to integrate segmental and suprasegmental information (Morgan & Saffran, 1995). Moreover, at 9 months infants base their native language preferences on phonetic and phonotactic information, and not suprasegmental information as they do at 6 months (Jusczyk et al., 1993). Further evidence that infants find the emotionality of ID speech less attractive around 9 months was observed by Hayashi et al., (2001). They found that ID speech preferences showed a U-shaped function, such that 7 to 9-month-old infants pay equal attention to ID and AD speech. Interestingly, this was not the case with younger (4 to 6-months) and older (10 to 14-months) infants - both groups showing a preference for ID over AD speech (Hayashi et al., 2001). Perhaps if 12-month-old infants were tested with the three emotion types, it would enhance our understanding of infant preferences for emotions and identify whether ID emotion preferences follow the trends identified in ID speech preferences.

In accordance with previous research (Fernald, 1993; Katz et al., 1996; Kitamura & Burnham, 1998, 2003), this study demonstrates that ID speech carries distinctive emotional messages to pre-verbal infants. Furthermore, it reveals crucial information regarding infant ID speech preferences that has not been examined until now. Although this study shows that the preference procedure used here elicits differential responding to three ID emotion types, most variations of head-turn (e.g., Fernald, 1985) and infant-controlled habituation procedures (e.g., Moore et al., 1997; Spence & Moore, 2003) only compare two stimuli in each test session. It is possible that the inclusion of the third stimulus set subdued infant responses to one or two of the sets of utterances. In none of the experiments did infants show a first, second and third preference; instead infants showed a preference for one emotion relative to the others, or attended equally to two emotion types in comparison to a third. Therefore, a two-choice preference experiment may further clarify infant responses. It may be the case that with only two sets of stimuli, infants would show differential preferences to those emotional utterances they attended to equally in this study.

Werker and McLeod (1989) revealed that even though 7.5 to 9-month-olds were less responsive than younger infants (4 to 5.5-month-olds), they showed preferences for ID relative to AD speech when the speech stimuli were paired with an image of a woman’s face. The variations in infant responses found in our study may be attributable to the pairing of a static image of a coloured bulls-eye with each of the three ID emotion types. Pairing ID emotion types with a face may reveal subtle differences in infant preferences as it has been found that the inclusion of the image of a face assists infant speech discrimination (D'Entremont & Muir, 1999; Walker-Andrews & Lennon, 1991). It makes sense that a facial image may facilitate infants’ attention to vocal cues as though it were a naturalistic interaction and thus elicit fine-grain attentional preferences.

One of the most basic functions of ID speech may be that it provides a vehicle to convey a primitive form of meaning to the prelingual infant. These findings extend our understanding of the way infants perceive affective intent in ID speech by revealing distinct developmental trends in infant preferences for three ID emotion types. Between 3 and 6 months, infant preferences shift from ‘comforting’ emotions associated with low arousal, to ‘approving’ emotions that convey high levels of positive affect and arousal. In contrast, 9-month-olds show little preference for

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any commonly reported ID emotions when they contain segmental information, but show significant preferences for 'directive' emotions when they hear prosodic information alone. In summary, the age trends evident in the production of ID speech appear to be related to infant age and development. Indeed, infants contingently responded to those emotions that dominate in mothers ID speech at 3, 6 and 9 months as described by the Kitamura and Burnham (2003) model of affective intent.

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5. References

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