

Four-Month-Old Infants' Categorization of Infant-Directed Speech When Viewing

Female, Male, and Scrambled Faces

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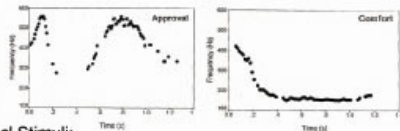
Abstract: The present study explored the impact of faces on 4-month-old infants' ($n=94$) categorization of infant-directed speech (IDS). Parents modify acoustic properties of IDS dependent on infants' affective states, providing infants opportunities to associate different caregiver vocal responses with different infant behaviors. When parents speak in an approving manner, utterances are higher in frequency and have ascending frequency contours. In contrast, comforting IDS has lower frequencies and falling frequency contours. Previous research showed no categorization of IDS approvals or comforts at 4 months of age when infants viewed a checkerboard while hearing IDS. But 4-month-olds categorized approving and comforting IDS passages when presented with a static, neutral female face (Spence & Moore, 2003; Spence, Chuang & Sokolsky, 2004). In the current study, 4-month-olds heard either approving or comforting IDS during an infant-controlled habituation procedure while viewing one of 3 visual stimuli: a female face, a male face, or a scrambled face. Faces were used to test the hypothesis that social context of faces impacts infants' processing of IDS. Infants were habituated to either approvals or comforts and then tested with two new exemplars from the habituation category followed by two exemplars from the novel category. Planned pairwise comparisons indicate that infants in the female face condition who were habituated to comforts increased attention to approving IDS, but not novel comforting IDS. Infants in both the male face and the scrambled face conditions failed to significantly recover looking to the novel IDS category at test. These findings have implications for understanding the role of faces in infants' processing of infant-directed speech.

Introduction:

- Infant-directed speech (IDS) may communicate speakers' affect to infants
 - Adults vary IDS as a function of context and intent (Fernald, 1992; Papousek et al., 1991; Stern et al., 1982)
- 4-month-olds do not categorize approving and comforting IDS while viewing a checkerboard (Moore, Spence, & Katz, 1997; Spence & Moore, 2003)
- But, when viewing a static female face, 4-month-olds categorize IDS (Spence, Chuang, & Sokolsky, 2004)
- Why does the face facilitate processing of IDS?
 - Faces provide a social setting for the discrimination of vocal affect (Walker-Andrews & Lennon, 1991; D'Entremont & Muir, 1999)
 - Faces recruit infant attention in social settings more than voices alone (D'Entremont & Muir, 1999)
 - 4.5-month-old infants discriminated approving and prohibiting utterances when viewing videos of a woman producing IDS (Castellanos, Shurman, & Bahrick, 2004)
- Hypothesis: Infants should categorize IDS while viewing either male or female faces, but will not categorize when the facial features are scrambled. It is the social context of the face and not perceptual information that facilitates categorization of IDS.

Methods:

- Participants:**
 - $N = 94$: 4-month-olds ($M = 127$ days old, $SD = 11.8$)
- Stimuli:**
 - Auditory stimuli:**
 - Infant-Directed Speech
 - 8 approving and 8 comforting utterances
 - Recordings of mothers speaking to their infants (Katz et al., 1996)
 - Mean F_0 :
 - Approvals: $M = 399.96$ Hz ($SD = 79.57$)
 - Comforts: $M = 221.04$ Hz ($SD = 31.20$)
 - Variation of mean F_0 range of individual stimuli:
 - Approvals: 17.70 – 279.93 Hz
 - Comforts: 17.46 – 76.33 Hz



Visual Stimuli:

- Each infant was presented a female, male or scrambled face contingent on visual attention



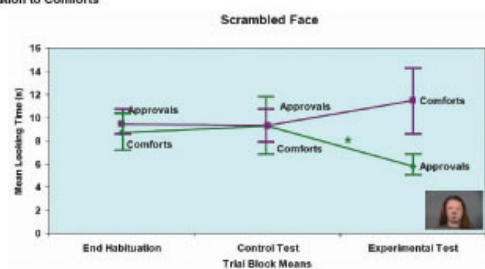
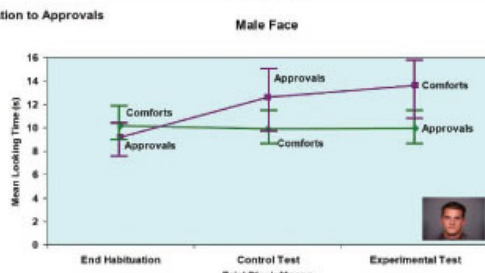
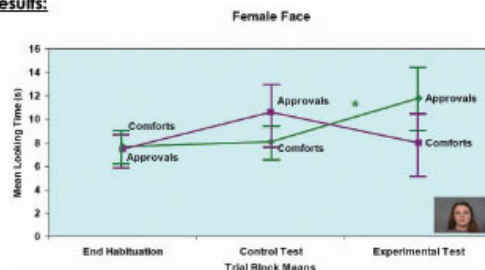
- DOVARDARPA Human ID project database (O'Toole, Hame, Snow, Hunt, Pappas, Ayyad & Abdi, 2005)

Methods continued:

- Procedure:**
 - Habituated to approvals or comforts
 - Habituation criterion: 3 consecutive trials decreased to 50% (Habt 2000; Cohen, Atkinson, & Chaput, 2000)
 - Four test trials:
 - Control test trials: 2 novel IDS utterances from habituation category
 - Experimental test trials: 2 novel utterances from different IDS category than habituation



Results:



Results continued:

- Pairwise comparisons:**
 - Female Comfort
 - Control versus Experimental test trials:
 - Mean difference = 3.717*, $SE = 1.646$, $p = .040$
 - Scrambled Comforts
 - End of Habituation versus Experimental test trials:
 - Mean difference = -2.871*, $SE = 1.234$, $p = .033$

	Trial Block	Trial Block Means					
		Female Face		Male Face		Scrambled Face	
Approvals	Last 3 Hab Trials	7.43	4.43	9.21	5.09	9.45	4.28
	Control Test (17.470)	10.61	7.60	12.58	10.64	8.30	5.06
	Exp. Test (23.470)	7.96	7.38	13.52	9.84	11.47	9.71
	N=	16		15		16	
Comforts	Last 3 Hab Trials	7.65	4.23	10.16	6.45	8.68	5.91
	Control Test (17.470)	8.08	4.67	9.92	6.66	8.27	8.77
	Exp. Test (23.470)	11.8	8.45	9.84	5.10	6.82	2.96
	N=	15		15		17	

Discussion:

- Female Face Condition**
 - Infants categorized IDS stimuli when they were habituated to comforts and tested with approvals
 - Infants habituated to approvals and tested with comforts did not categorize IDS
 - Asymmetrical categorization in female face condition may be due to variability of approval stimuli
 - More variation of mean F_0 range of individual stimuli for approvals than comforts. Comforts range from 17.46 – 76.33 Hz, and approvals from 17.70 – 279.93 Hz
 - Similar to asymmetrical categorization effects seen with dog and cat faces, where "dog" category is more diverse and includes much of the "cat" category (Quinn, Eimas & Rosenkrantz, 1993)
- Male Face**
 - No categorization in male face condition
 - Infants' lack of sufficient experience with male faces at 4 months limits abilities to form male facial prototypes (Ramsey, Langlois, & Marti, 2005)
- Scrambled Face**
 - As hypothesized, no categorization in scrambled face condition
 - Scrambled faces lack perceptual information specific to faces (Turati, Valenza, Leo & Simion, 2004)
- Results of female and scrambled face conditions support the hypothesis that IDS categorization at 4 months is facilitated by the social context of the face.
- Male face condition results add further support for infants' delay in processing of male faces stated by Ramsey, Langlois, & Marti, 2005.

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