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Infant responses to direction of parental gaze: A comparison of two still-face conditions

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Abstract

Six-month-old infants ($N = 43$) showed differences in the frequency of neutral/positive vocalizations produced when exposed to a standard (parent gazes at infant) versus modified still-face condition (parent gazes above infant). No significant differences in smiling, social gaze, negative affect, and fuss/cry vocalizations were observed. © 2002 Published by Elsevier Science Inc.

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The face-to-face/still-face paradigm (Tronick, Als, Adamson, Wise, & Brazelton, 1978) has been used for more than two decades as a method to better understand infant social development. This paradigm typically consists of an episode of face-to-face play between an infant and a parent, a still-face episode during which the parent remains unresponsive and maintains an expressionless face while facing the infant, and a final episode of face-to-face play. The responses of infants between 1 and 7 months of age to the still-face episode consistently include decreased smiling, increased grimacing and distress, increased crying, and decreased gazing at parent (Ellsworth, Muir, & Hains, 1993; Field, Stoller, Vega-Lahr, Scafidi, & Goldstein, 1986; Field, Vega-Lahr, Scafidi, & Goldstein, 1986; Gusella, Muir, & Tronick, 1988; Peláez-Nogueras, Field, Hossain, & Pickens, 1996; Stack & Muir, 1990; Toda & Fogel, 1993; Tronick et al., 1978; Weinberg & Tronick, 1996; Weinberg, Tronick, Cohn, & Olson, 1999).

Observations of infant behavior in response to manipulations of the still-face procedure have provided support for the notion that infant responses to the still-face condition are a result of violations of infant expectations, created by the presence of an en face adult who is not interacting with the infant. Research by Field and colleagues has demonstrated infant response

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to violations of expectancies in two ways. First, by demonstrating that infants of depressed mothers react less negatively to the still-face episode than children of non-depressed mothers (Field, 1984). Second, by demonstrating that infants respond more negatively to emotional separation created by the still-face condition than to physical separation from the parent (Field, Vega-Lahr et al., 1986). Additional research has indicated that relatively minor changes in parental behavior can impact how infants respond to the still-face episode. The presence of active facial expressions, a static happy face, and touch by the parent during the still-face episode have each been shown to reduce the negative impact of this episode (D'Entremont, Hains, & Muir, 1997; Gusella et al., 1988; Stack & Muir, 1990; Stack & Muir, 1992). The presence or absence of the parent's interactive voice during the still-face episode, however, has not been shown to alter still-face responses in 6-month-old infants (Gusella et al., 1988). Therefore, with the exception of vocalizations, it appears that the more similar the still-face condition is to the infants' expectations for interaction, the less negatively they respond.

Adult gaze direction is an important social indicator that has not been previously studied in the context of the non-interactive still-face condition. Eye contact serves as an indicator of adult's availability for interaction and shifts in eye orientation serve as an indicator of interesting objects and events in the surrounding environment. Infants demonstrate their understanding of eye orientation by 5 months of age (Caron, Caron, Roberts, & Brooks, 1997; D'Entremont et al., 1997; Lasky & Klein, 1979; Morales, Mundy, & Rojas, 1998; Symons, Hains, & Muir, 1998). The present study utilized various interactive (face-to-face) and non-interactive (still-face) contexts to examine 6-month-old infants' understanding of social contexts created by manipulating parental eye orientation. This study was designed to compare infant responses to two versions of the still-face situation, the standard still-face posture (gaze-at still-face) in which the parent looked directly at the infant while maintaining an expressionless face as well as a modified still-face posture (gaze-above still-face) in which the parent looked at a picture positioned above and behind the infant (Yale, Messinger, Cobo-Lewis, Oller, & Eilers, 1999).

The gaze-above still-face episode places parents in a posture that indicates disengagement while the gaze-at still-face posture remains one of engaged communicative partners. It is quite likely that most infants do not experience behavior in their everyday lives similar to that presented to them during the gaze-at still-face episode (with the possible exception of infants of depressed mothers). Therefore, the gaze-at still-face condition likely violates the infants' expectations for interaction with their parents to a greater extent than the gaze-above still-face condition. If infants respond to the contradictory nature of the gaze-at still-face, they would be expected to display less positive and more negative behaviors during the gaze-at still-face episode when compared to the gaze-above still-face episode.

Forty-three (23 females, 20 males) 6-month-old infants ($M = 26.6$ weeks, SD $= 0.8$ weeks) participated in the study with one parent (the mother for 42 of the infants and the father for one of the infants). The families of all of the infants were categorized as mid-SES based on a synthesis of the SES evaluations of Hollingshead (1978) and Nam and Powers (1983) as adapted by Eilers et al. (1993). Eighteen of the subjects were White Non-Hispanic, 15 were White Hispanic, 6 were African-American, 2 were Asian, and 2 were classified as Other. An additional 10 subjects were not included in the following analyses (2 due to technical problems, 1 due to repeated interruptions by a sibling, and 7 due to excessive crying which resulted in the early termination of the session).

The session consisted of four episodes, each 2 min long: a face-to-face episode, a still-face episode, a face-to-face episode, and a still-face episode. For the face-to-face episodes the parent was instructed to play with the infant as he or she would at home, using the language he or she would use with the infant at home. Two different still-face episodes were used and their order was counterbalanced with each infant receiving both still-face versions. For the gaze-at still-face the parent was instructed to sit back in the chair, place her hands in her lap, look directly at the infant, and maintain an expressionless face. For the gaze-above still-face the parent was instructed to sit back in the chair, place her hands in her lap, look at a picture located above and behind the infant, and maintain an expressionless face. Parents were instructed to place their hands in their laps to keep them from touching their infants during either of the still-face conditions. Infants were randomly assigned to one of the two groups. Infants in the At-Above group (18 infants) received the gaze-at still-face followed by the gaze-above still-face. Infants in the Above-At group (25 infants) received the gaze-above still-face followed by the gaze-at still-face.

The proportion of the total duration of infant smiling, negative affect, and social gaze, as well as the frequency of infant neutral/positive and fuss/cry vocalizations occurring within the face-to-face or still-face episodes were the measures of interest. Infant facial expressions were coded using Ekman and Friesen's (1978) Facial Action Coding System (FACS) as adapted for infants in Oster and Rosenstein's (in press) Baby FACS. The action units, defined by FACS and Baby FACS, were combined into more general categories of 'smile', 'negative affect', and 'neutral' based on the classifications developed by Camras, Oster, Campos, Miyake, and Bradshaw (1992). Infant gaze direction was coded as "social gaze" (infant's gaze directed at the parent's face or eyes) or "other" (infant's gaze directed away from the parent's face or eyes). Both facial expressions and social gaze were viewed in slow motion to determine the frame-accurate begin and end points of each coded action. The parent's portion of the monitor was covered to prevent observers from seeing which version of the still-face the parent was displaying. In addition, the sound was turned off while facial expressions and gaze direction were coded to prevent observers from hearing the infant's or the parent's vocalizations.

Infant vocalizations were classified affectively as neutral/positive or fuss/cry. Neutral/positive vocalizations were sounds that were not considered to be negative. Fuss/cry vocalizations were sounds that were considered negative, such as fuss or whine sounds, broken cry sounds, or wails. The coders listened only within the start and end times for each episode and, therefore, were not able to listen to instructions given to the parent between episodes. In addition, the monitor was covered (only the time code was left visible) to prevent the coders from making affective judgments using the facial expressions and posture of the infant or the parent. The occurrence of each vocalization was coded; however, frame accurate begin and end times were not identified resulting in frequency rather than total duration data for vocalizations.

Each modality was coded entirely by one observer. Sixteen percent of the infants were also coded by a second observer to determine reliability. Durational reliability was calculated to single frame accuracy using Cohen's κ for the categories of facial expression and gaze direction mentioned above. The observers demonstrated substantial agreement according to the criteria defined by Landis and Koch (1977) for both facial expression and gaze direction, 0.69 (88.31% agreement) and 0.78 (93.21% agreement), respectively. These reliability estimates are similar to those reported in previous studies (Kisilvesky et al., 1998; Toda & Fogel, 1993; Weinberg & Tronick, 1994; Weinberg & Tronick, 1996).

Durational reliability was not calculated for infant vocalizations because only frequency counts were obtained for this modality. The agreement between observers on frequency measures of vocalizations was determined using a combination of Pearson correlations and paired *t*-tests. The frequency counts determined by two independent observers were highly correlated for each vocalization type examined: neutral/positive vocalizations [$r(33) = .94$, $p < .001$], fuss/cry vocalizations [$r(33) = .99$, $p < .001$]. Additional paired *t*-tests indicated that the mean frequencies determined by each observer did not significantly differ for either of the vocalization types examined: neutral/positive vocalizations [$t(33) = 1.75$, $p = .09$], fuss/cry vocalizations [$t(33) = -1.63$, $p = .11$]. The correlational estimates of reliability are similar to those reported in previous studies (Ellsworth et al., 1993; Peláez-Nogueras et al., 1996).

The impact of the direction of the parent's gaze on the infant's response to the still-face was examined using a series of 2 (Episode: first still-face, second still-face) × 2 (Group: At-Above group, Above-At group) repeated measure ANOVAs (see Fig. 1). The presence of significant Group × Episode interactions would indicate differences in infants' responses to the two still-face conditions and were, therefore, the main focus of the analyses. The results indicated a significant Group × Episode interaction for only neutral/positive vocalizations [$F(1, 41) = 4.17$, $p < .05$]. Infants in the At-Above group showed a greater decrease from the first still-face episode to the second still-face episode in the frequency with which they produced neutral/positive vocalizations than infants in the Above-At group. Significant interactions were not found for social gaze [$F(1, 41) = 1.58$, $p = .22$], smiling [$F(1, 41) = 1.88$, $p = .18$], negative affect [$F(1, 41) = .02$, $p = .88$], and fuss/cry vocalizations [$F(1, 41) = .002$, $p = .97$]. In addition, significant main effects for Episode indicated that infants produced fewer smiles [$F(1, 41) = 19.12$, $p < .001$], fewer neutral/positive vocalizations [$F(1, 41) = 14.91$, $p < .001$], more negative affect [$F(1, 41) = 53.19$, $p < .001$], and more fuss/cry vocalizations [$F(1, 41) = 61.35$, $p < .001$] during the second still-face episode than during the first still-face episode. Only one significant main effect for Group was found. Infants in the At-Above group smiled more during the still-face episodes than infants in the Above-At group [$F(1, 41) = 5.20$, $p = .03$].

Supplementary analyses indicated that infants demonstrated the still-face effect described in previous research. When compared to the preceding face-to-face episode infants responded to each still-face episode with decreased smiling and social gaze as well as increased negative affect and fuss/cry vocalizations (see Fig. 1). In the present study infant production of neutral/positive vocalizations increased in response to the first still-face episode but did not differ in response to the second still-face episode. The few studies that have examined neutral/positive vocalizations separately from fuss and cry vocalizations have reported either a decrease (Peláez-Nogueras et al., 1996) or no change in response to the still-face episode (Tronick et al., 1978; Weinberg & Tronick, 1996; Weinberg et al., 1999).

This study indicated that infants responded to a modified still-face episode in which the parent gazed above them in a manner similar to the standard still-face episode in which the parent gazed directly at them. These two still-face conditions did not elicit differences in the extent to which infant displayed smiling, social gaze, negative affect, or fuss/cry vocalizations. Infants who received the gaze-at still-face condition first, however, showed a greater decrease in neutral/positive vocalizations in response to the second still-face condi-

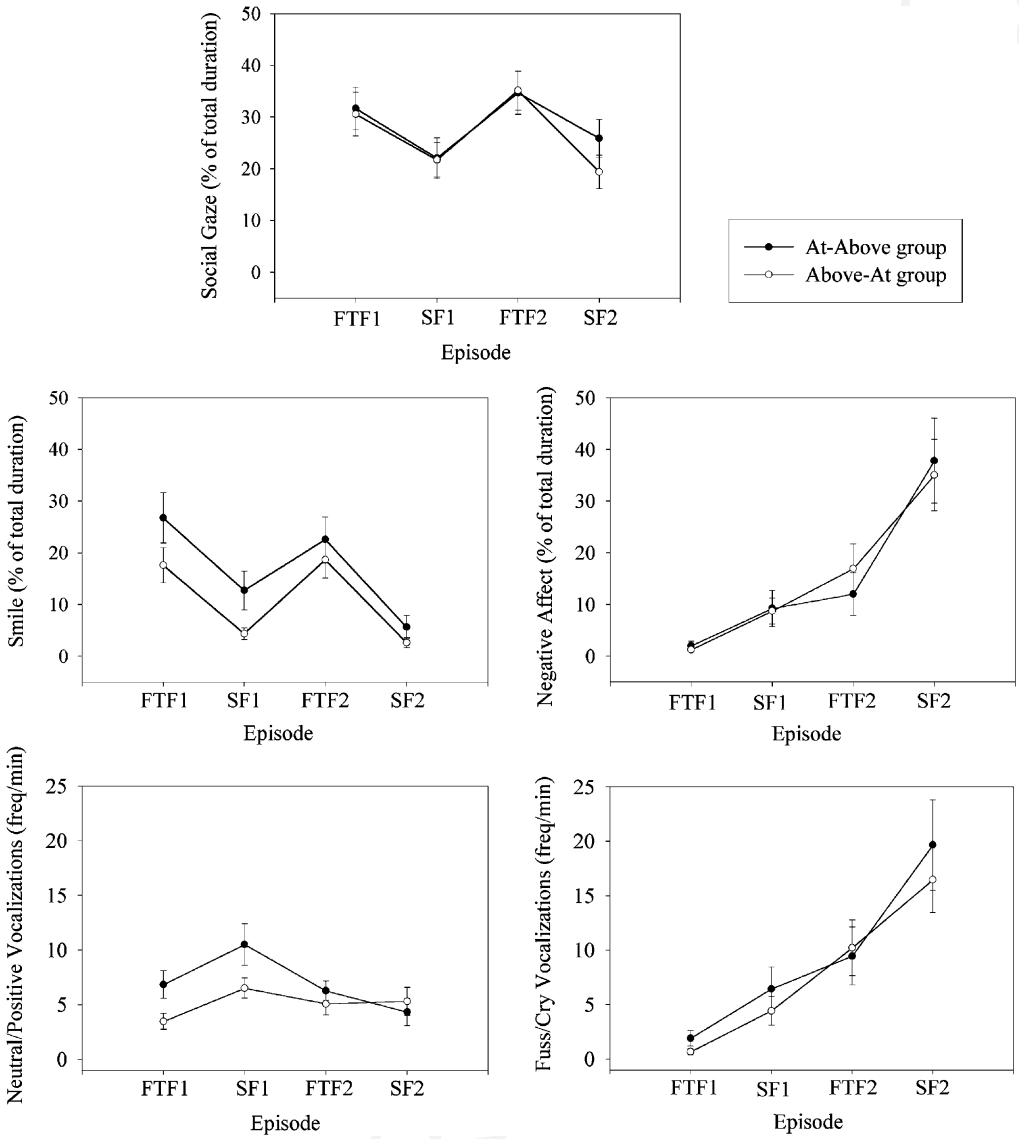

Fig. 1. Mean level of infant responses across episodes for both groups. Vertical lines represent standard errors of the means.

tion than infants who received the gaze-above still-face condition first. Neutral/positive vocalizations may be used by infants during the still-face episode as attempts to regain the parents' attention. Infants attempting to regain the attention of an en face parent may become more frustrated by the parent's lack of response than infants faced with a parent in a more disengaged posture. If this were the case, however, the increased negativity expressed by the infants in the At-Above group during the second still-face episode would have been expected to manifest itself in the other behaviors measured. The absence of group differ-

ences for other behaviors in response to the second still-face episode renders the difference in neutral/positive vocalizations difficult to interpret. Therefore, while this study provides some indication of differences in infant response to the gaze-at versus the gaze-above still-face conditions with neutral/positive vocalizations, these findings need to be interpreted with caution.

Previous studies have indicated that infants differentiate both horizontal shifts (Caron et al., 1997; Symons et al., 1998) and vertical shifts (Lasky & Klein, 1979) in eye contact by 5 months of age. These studies examined infant response to gaze shifts within an interactive context, demonstrating that by 5 months of age infants appear to have some understanding of the role of eye contact within interactive contexts. In the present study, however, when gaze shifts occurred in a non-interactive context, infants did not demonstrate a clear differentiation of the social contexts created by the gaze-at versus gaze-above still-face conditions. Adults perceive gazes directed at versus away from them as distinctly different during both interactive and non-interactive contexts. It is unknown when or how infants come to understand the social differences inherent in contexts based on the orientation of another's gaze.

There are several possible reasons for lack of sensitivity to gaze shifts utilized in the present study. First, it is possible that sensitivity to vertical shifts in gaze develops later than sensitivity to horizontal shifts in gaze. Symons et al. (1998) reported that while 5-month-old infants are sensitive to small horizontal shifts (infant's ear) in parental gaze, they are not sensitive to small vertical shifts (top of head or chin). While these shifts in gaze are much smaller than those used in the present study and by Lasky and Klein (1979), this research demonstrates the potential for developmental changes in an infants' ability to understand gaze shifts and their role in social interaction. Second, due to the unfamiliar and potentially unpleasant nature of the still-face condition, it is possible that during the still-face episode infants are responding affectively to the lack of interaction by the parent rather than cognitively to the distinct social contexts created by changes in eye orientation. Finally, changes in behavior due to parental gaze aversion may be small in comparison to the changes in behavior due to the lack of responding by the parent and, therefore, difficult to identify in small samples. Further research is necessary to more fully understand the developmental nature of the infant's understanding of gaze shifts within both interactive and non-interactive contexts.

In conclusion, infants demonstrated the typical still-face effect, responding to the still-face episodes with decreased social gaze, decreased smiling, increased negative affect, and increased fuss/cry vocalizations. With few exceptions, infants responded similarly to the lack of interaction common to both the gaze-at and gaze-above still-face conditions, illustrating that at 6 months of age infants may not fully understand the role of upward shifts in eye direction within non-interactive contexts. Additional research is necessary to provide a more complete understanding of the still-face effect and of infants' understanding of social contexts. In addition, cultural differences in the development of the social understanding of eye contact in non-interactive contexts also remain unknown.

Uncited reference

Hains and Muir (1996).

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