

## The effect of positive emotion on infants' gaze shift

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### Abstract

Infants often voluntarily glance at their social partner during their toy play, disengaging their gaze from a toy and selecting a caregiver as their new looking target. This study posed two research questions: Do positive emotions disengage infants' gaze from their point of fixation, and do positive emotions facilitate the selection of the caregiver as their next looking target? The rate of gaze shifts was calculated for neutral and positive emotional states during their toy play. Across all ages, infants exhibited more disengagement from their point of fixation in the positive state than in the neutral one. However, 6- and 9-month-old infants revealed no difference in selecting a caregiver or a physical object as their next looking target in the positive state, but 12-month-olds increased gazing at caregivers in the positive state. These results were discussed with regard to the role of positive emotions on the development of infants' initiating joint attention.

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When we come across something interesting or exciting, we often shift our attention to the people around us in an attempt to share the interesting object or event with them. We tend to use meaningful glances, facial expressions, verbal messages, or pointing gestures to attract their attention and direct it to the object or event that holds our interest. Similarly, infants often exhibit a voluntary attention shift toward their social partner during an exciting toy play, even if it means having to interrupt their play in order to look at them (Jones, Collins, & Hong, 1991; Jones & Hong, 2001). Sometimes, infants' glance toward their social partner might be accompanied by pointing to or displaying the toy. In such cases, we could certainly understand their attempt to attract adults' attention to the toy that holds their interest. This attempt to direct others' attention toward the object of one's own attention is termed *initiating joint attention (IJA)* (Mundy, Fox, & Card, 2003; Mundy & Willoughby, 1996; Seibert, Hogan, & Mundy, 1982).

IJA is a part of joint attention (JA), which is defined as the state wherein two persons simultaneously direct their attention to a particular object (Yato, 2000). Mature IJA should include understanding of the availability of one's gaze or pointing behavior as a tool to elicit others' attention and an anticipation of others' response following their gaze shift and pointing behavior. Therefore, at which point and in what manner does it become possible for infants to attract others' attention in anticipation of others' attentional responses?

In order to reflect upon this question, we are to consider the development of the remaining part of JA, which *responds to joint attention (RJA)*. Mature RJA is believed to include the knowledge that others' gazes have certain directivity,

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and that the gaze direction indicates the object to which they direct their attention. RJA develops rapidly in the latter half of the first year. At 6 months of age, infants appeared to follow others' head and eye movements (Butterworth, 1991, 1995; Butterworth & Jarrett, 1991). In this period, infants could follow the approximate direction of others' attention within their field of view; however, they had difficulty finding the correct target that the adults were gazing at when there were several targets in the adults' attention direction (Butterworth, 1995; Butterworth & Jarrett, 1991). Furthermore, the infants found it difficult to follow the adults' attention only by gaze direction without a head-turn (Corkum & Moore, 1995, 1998). The 8- to 9-month-old infants could learn to follow others' gaze direction if they had been given contingent feedback to understand the relation between others' gaze direction and the objects of their interest. On the other hand, 10- to 11-month-old infants exhibited gaze-following even without feedback (Corkum & Moore, 1995, 1998). There is little doubt that infants need to learn the association between others' gaze direction and the objects of interest so as to establish gaze-following. Meanwhile, Baron-Cohen (1995) proposed that there is a biological and evolutionary mechanism—called an eye-direction detector (EDD)—to detect others' eye gaze direction. The open eyes of a human attract the attention of even neonates who are only a few hours old (Batki, Baron-Cohen, Wheelwright, Connellan, & Ahluwalia, 2000), and those who are 2 to 5 days old prefer a directed gaze to an averted one (Farroni, Csibra, Simion, & Johnson, 2002). Furthermore, Farroni, Mansfield, Lai, and Johnson (2003) showed that 4-month-old infants could follow adults' eye movements if they had been engaged in a period of mutual gaze (eye contact) with upright face stimuli. These basic mechanisms to detect eye gaze direction were considered to support the acquisition of RJA, with tendencies to prefer the human face or eyes and to follow movements (Sumioka, Hosoda, Yoshikawa, & Asada, 2005). A general survey of previous studies indicates that contingent learning is necessary to foster the development of RJA behaviors, and that some biological mechanisms provide infants with the advantage to learn contingency between others' gaze direction and the object of their interest.

Then, how would IJA be acquired? Unfortunately, the developmental mechanism of IJA is still unclear. Do biological mechanisms or learning ones have any influence on the acquisition of IJA? Venezia, Messinger, Thorp, and Mundy (2004) argued that the expression of IJA holds considerable significance in infants' development because it indicates the beginning of a voluntary intentional communication. The researchers defined the onset of IJA as an infant coordinating visual attention between an object and a social partner. The primary style of IJA was considered to begin as infants' gaze shift from an interesting object to their social partner. With regard to the developmental mechanisms of RJA, infants were considered to learn the contingency between their gaze shift (toward their social partner) and their social partner's responses in their early days. However, there were some reports that 6-month-old infants have difficulty looking at their caregivers when they are interested in an object. Infants could not stop fixating on the object because they were too attracted to it. What would it take to shift the infants' eyes from an interesting toy to their social partner? Does this occur only by coincidence or is there a preface? An interesting idea proposed by Adamson and Russell (1999) provides some hints for answering this question. They pointed out the possibility that the emotional charge of the situation—in this case, the arousal of positive emotions toward the objects—might increase the likelihood of infants' gaze shift from the object to their social partner.

In relation to the role of positive emotion in the development of IJA, Venezia et al. (2004) observed a transition of the timing of smile expressions within IJA episodes. According to their report, infants began to shift their gaze from a toy to the experimenter with an *already smiling face*. Gaze shift with already smiling face was rare at 8-month-olds, but increase at 10-month-olds and remained high at 12-month-olds (Venezia et al., 2004). Jones et al. (1991) termed this already smiling face preceded gaze shift toward social partner as an "anticipatory smiling", distinguished from a reactive smile which was expressed after looking at their social partner, with the interpretation that the smile reflects infants' anticipation of social contact with the social partner. The anticipatory smile was considered to develop between 8- and 10-month-olds (Jones et al., 1991; Jones & Hong, 2005; Venezia et al., 2004). Interestingly, Jones and Hong (2005) reported that infants' looking toward their social partner was not driven by their smiling at 8-month-olds. This finding was seemed incongruous with the proposition by Adamson and Russell (1999) that the arousal of positive emotion would increase infants' gaze shift from the object to a caregiver. Whether the arousal of positive emotion drives infants' gaze shift toward social partner or not?

In the field of emotional psychology, emotion was considered to perform the function of leading specific patterns of behaviors and cognitions (Frijda, 2000; Izard & Ackerman, 2000). It was well known that negative emotion such as anxiety and anger held some program to narrow attention and limit individual cerebration and behavior to certain types (Carver, 2003; Izard & Ackerman, 2000). On the other hand, positive emotions such as joy or happiness have been considered to increase openness to experiences and cognition (Carver, 2003; Fredrickson, 1998, 2001; Fredrickson

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