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I see what you're saying: Voice signals influence children's judgments of direct and averted gaze

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ABSTRACT

Adults use gaze and voice signals as cues to the mental and emotional states of others. We examined the influence of voice cues on children's judgments of gaze. In Experiment 1, 6-year-olds, 8-year-olds, and adults viewed photographs of faces fixating the center of the camera lens and a series of positions to the left and right and judged whether gaze was direct or averted. On each trial, participants heard the participant-directed voice cue (e.g., "I see you"), an object-directed voice cue (e.g., "I see that"), or no voice. In 6-year-olds, the range of directions of gaze leading to the perception of eye contact (the cone of gaze) was narrower for trials with object-directed voice cues than for trials with participant-directed voice cues or no voice. This effect was absent in 8-year-olds and adults, both of whom had a narrower cone of gaze than 6-year-olds. In Experiment 2, we investigated whether voice cues would influence adults' judgments of gaze when the task was made more difficult by limiting the duration of exposure to the face. Adults' cone of gaze was wider than in Experiment 1, and the effect of voice cues was similar to that observed in 6-year-olds in Experiment 1. Together, the results indicate that object-directed voice cues can decrease the width of the cone of gaze, allowing more adult-like judgments of gaze in young children, and that voice cues may be especially effective when the cone of gaze is wider because of immaturity (Experiment 1) or limited exposure (Experiment 2).

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Introduction

The direction of people's gaze provides a cue to the focus of their attention and thereby allows inferences about their intentions (Baron-Cohen, 1995; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Senju & Johnson, 2009). Direct gaze can signal interest in the viewer, threat, or dominance, whereas averted gaze can signal attention directed toward an object in the environment, deception, or avoidance (Argyle & Cook, 1976; Einav & Hood, 2008; Kendon, 1967). Voice cues can also convey information about a person's attention and/or intention. For example, saying a person's name can signal the intent to communicate (Moray, 1959; Senju & Csibra, 2008), whereas an object-directed voice cue (e.g., "That looks nice!") can signal attention toward an object in the environment (e.g., Parise, Cleveland, Costabile, & Striano, 2007). The combination of information from voice and gaze cues may facilitate social judgments by allowing individuals to use information from voice cues to interpret ambiguous gaze cues. Previous research indicates that children's judgments of direct and averted gaze do not become adult-like until around 8 years of age (Vida & Maurer, 2012a). Here, we asked whether children combine information from gaze and voice cues when making judgments of direct and averted gaze and whether the combination allows young children to make more adult-like judgments of gaze. We investigated these questions by having 6-year-olds, 8-year-olds, and adults judge the direction of gaze in photographs of faces while hearing voice cues implying that the model was looking at the participants (e.g., "I see you") or at an object in the environment (e.g., "I see that").

Adults' judgments of direct and averted gaze

Adults can detect horizontal and vertical differences of approximately 1° in the direction of someone else's gaze toward objects in the environment (e.g., Symons, Lee, Cedrone, & Nishimura, 2004; Vida & Maurer, 2012b, 2012c). However, the range of directions of gaze over which adults perceive eye contact (the cone of gaze) is much larger at approximately 5.5° in width (Gibson & Pick, 1963; Lord & Haith, 1974; Vida & Maurer, 2012a) and 7° in height (Vida & Maurer, 2012a). These values indicate that adults tend to attribute eye contact over a range of directions of gaze corresponding with the width and height of an adult's own face (Vida & Maurer, 2012a). Adults' tendency to attribute eye contact over a relatively large range of directions of someone else's gaze may minimize social costs associated with missing an invitation to interact with someone who is looking toward them.

In the only previous study of the effect of voice cues on judgments of direct and averted gaze, adults viewed faces that had direct gaze or gaze averted in a series of directions to the left and right (Stoyanova, Ewbank, & Calder, 2010). Each face was accompanied by a voice calling the participant's own first name or another person's first name. The cone of gaze was wider when the participant heard his or her own name than when the participant heard another person's name. Hearing one's own name could signal that someone is directing attention toward the participant, whereas hearing another person's name could signal that someone is attending to another person in the environment. Hence, the effect of voice cues in Stoyanova and colleagues (2010) could indicate that the cone of gaze becomes wider when the participant hears his or her own name, becomes narrower when the participant hears another person's name, or both.

Development of sensitivity to direct and averted gaze

From birth, infants respond preferentially to eye contact, at least when shown faces with direct gaze and gaze averted far to the side. When shown such a pairing, newborns look longer at the face that makes eye contact (Farroni, Csibra, Simion, & Johnson, 2002). By 4 months of age, infants not only look but also smile longer at faces with direct gaze (Hains & Muir, 1996; Symons, Hains, & Muir, 1998), and the N240 event-related potential (ERP) is larger for such faces compared with faces with averted gaze (Farroni, Johnson, & Csibra, 2004). The ERP difference may reflect greater cortical processing of faces with direct gaze. By 4 or 5 months of age, infants will look in the same direction as a face with averted gaze (e.g., look to the left when the face looks to the left), but only after a period of mutual