Tell-Tale Eyes: Children’s Attribution of Gaze Aversion as a Lying Cue

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This study examined whether the well-documented adult tendency to perceive gaze aversion as a lying cue is also evident in children. In Experiment 1, 6-year-olds, 9-year-olds, and adults were shown video vignettes of speakers who either maintained or avoided eye contact while answering an interviewer’s questions. Participants evaluated whether the speaker was telling the truth or lying on each trial. The results revealed that at both ages, children were more likely to attribute lying to speakers in the gaze aversion condition; however, the effect was significantly greater among 9-year-olds. Significant gender differences were also uncovered, with girls demonstrating strongest sensitivity to the gaze cue. Experiment 2 replicated the gender effect in 6-year-olds but found that when the speakers’ verbal responses were removed, boys’ use of the gaze cue increased and the gender difference disappeared. These findings indicate that at 6 years old, children interpret interpersonal gaze behavior as a socially informative cue. Furthermore, the growing appreciation of the stereotypic gaze behavior associated with lying and the reputed female advantage in gaze sensitivity may reflect differential processing of multimodal communication.

Keywords: gaze perception, mental state attribution, nonverbal deception cues, social cognition, sex differences

As adults, we regularly attend to people’s gaze behavior to obtain information about their mental states. Indeed, visual scan paths have revealed that when individuals observe a face or a social scene, the eyes represent the primary focus of their attention (Klin, Jones, Schultz, Volkmar & Cohen, 2002; Yarbus, 1967). The mentalistic inferences that adults readily draw from the eyes can be specific—for example, identifying what someone is referring to or feeling at a given moment (Baron-Cohen, 1995; Baron-Cohen, Wheelwright & Jolliffe, 1997)—but have also been found to influence more global attributions about the nature of a social relationship, or core aspects of people’s personality, such as their credibility, dominance, confidence, and competence levels (for a review, see Argyle & Cook, 1976; Kleinke, 1986).

There is a wealth of empirical evidence to suggest that sensitivity to gaze is an early emerging capacity. From birth, infants demonstrate awareness of the eyes, showing visual preference for open rather than closed eyes (Bartki, Baron-Cohen, Wheelwright, Connellan, & Aahuwalia, 2000) and for direct rather than averted gaze (Farroni, Cisbra, Simion, & Johnson, 2002). Furthermore, 2-month-old infants, like adults, spend longer looking at the eyes than at any other internal facial feature (Maurer & Salapatek, 1976). By 2 years of age, infants can use gaze direction to relate an adult’s emotional display to a specific referent and to relate a novel verbal label to the target of the speaker’s gaze (Baldwin & Moses, 1994; Phillips, Wellman, & Spelke, 1998; Sodian & Thormer, 2004; Woodward, 2003). By the time they reach their 3rd year, children begin using gaze direction cues for making explicit judgments about people’s mental states, including focus of attention (Doherty & Anderson, 2000), desires (Baron-Cohen, Campbell, Karmiloff-Smith, Grant, & Walker, 1995; Lee, Eskritt, Symons, & Muir, 1998), and knowledge (Pratt & Bryant, 1990). In addition, 4- and 5-year-olds are able to make use of temporal aspects of gaze such as duration and frequency for inferring goal and preference (Einav & Hood, 2006; Montgomery, Bach, & Moran, 1998).

So far, research has concentrated on children’s early use of object-directed gaze behavior for judging another’s mentalistic relation toward physical objects, but comparatively little is known about children’s use of interpersonal gaze behavior when making social appraisals. This is an essential issue to address given that the gaze channel plays such a central role in face-to-face social interaction. The levels of eye contact that individuals display toward one another as they interact can reveal a lot about the relation that exists between them (e.g., distant, friendly, or hostile; for a review, see Kleinke, 1986). Being able to interpret such cues involves more than simply identifying an agent’s primary visual target—the typical required response in previous gaze-reading studies. Rather, the child needs to be sensitive to the quality of gaze shown by one person to another and to recognize its mentalistic significance.

Very young infants can discriminate between direct eye contact and averted gaze (Farroni et al., 2002; Vecera & Johnson, 1995),
but at what age do children begin to perceive such variation in gaze as socially meaningful? To answer this question, we need to examine whether children make use of gaze cues within a socially embedded context.

Deception detection provides a particularly pertinent social context. A prime example of adults’ reliance on gaze in their social appraisals is the widely held view that a speaker who maintains good eye contact is more likely to be telling the truth than one who avoids mutual gaze. Empirical findings have confirmed that participants rate speakers who do not look directly toward the target of their communication as less credible than those who do so (Hemsley & Doob, 1978; Kraut & Poe, 1980; Riggio & Friedman, 1983; Vrij & Semin, 1996). The premise is that gaze aversion is an involuntary deception cue that “leaks” information about deceptive intent (DePaulo et al., 2003). In fact, this stereotype is misguided because studies have found that speakers engage in increased eye contact when lying, especially those rated as high in Machiavellianism, suggesting that they may strategically control their gaze to appear sincere (see Kleinke, 1986). Conversely, gaze aversion does not necessarily imply that deception is taking place but may simply be a result of thinking, particularly during a cognitively demanding task (Doherty-Sneddon, Bruce, Bonner, Longbotham, & Doyle, 2002; Glenberg, Schroeder, & Robertson, 1998).

Nevertheless, because people typically display a high degree of mutual gaze during conversation, gaze aversion represents a negative deviation from the norm and, as a result, constitutes a highly salient and suspicion-arousing behavior (Hemsley & Doob, 1978). Thus, adults’ deeply rooted belief that liars avert their eyes more than truth tellers acts as a potent stereotype that influences their social judgments and behavior just as if it was a valid cue. We were therefore interested in assessing whether children also attend to gaze behavior when evaluating the veracity of a speaker’s words.

The limited available evidence on children’s sensitivity to interpersonal gaze cues indicates that at the age of 6 years children begin to use eye contact for making judgments about social relations. They are more likely to attribute friendship to individuals who display mutual gaze (Post & Hetherington, 1974), and they exhibit the adult tendency (Argyle, Lefebvre, & Cook, 1974) of preferring to interact with a person who maintains rather than avoids eye contact with them (Abramovitch & Daly, 1978). Children of this age therefore appear to be sensitive to the quality of gaze behavior displayed toward themselves and others: Like adults, they perceive eye contact more favorably than gaze aversion. Also relevant is the finding that from the age of 4, children interpret a person whose eyes are directed upward and away to be thinking (Baron-Cohen & Cross, 1992). For present concerns, this suggests that they understand that gaze behavior can reflect an individual’s underlying mental state or activity even when it is not directed at any particular external object. Although they may specifically represent upward gaze as indicating thought, it is possible that they would perceive any form of gaze aversion in this way, which could influence their lying attributions.

A recent study by Freire, Eskritt, and Lee (2004) has shown that 4-year-olds also attach significance to the direction of another’s gaze in a deceptive situation. Specifically, when they view an actor whom they know to be lying display contradictory verbal and eye gaze clues about the location of a hidden toy, they will preferentially use the gaze cue to find the toy. Although this important finding indicates that children judge a known liar’s gaze direction as more reliable than their words, it does not address whether children use gaze behavior such as looking away to evaluate whether an individual is being deceptive in the first place.

In contrast, Rotenberg (1991) specifically asked 7- to 11-year-olds to report the types of nonverbal cues that they would expect to see if they were involved in a hypothetical situation. The presenter indicated at that age children associate the behavior with instances of deception. Notably, this response was more frequent in the older children, suggesting that the association increases in strength during the intervening years. However, because of the methodology used, this study cannot offer any substantial evidence that the age trend generalizes beyond children’s self-reports. The finding that older children provided more frequent spontaneous recall of gaze aversion as a deception cue under hypothetical conditions does not necessarily mean that younger children would not show comparable recognition of it as such in a real social situation. Moreover, although children may associate gaze aversion with deception, we do not know whether they will in fact judge a speaker to be lying on the basis of this behavior.

The current study was designed to directly assess children’s interpretation of gaze aversion displays using video vignettes of speakers who either maintained or avoided eye contact while answering an interviewer’s questions. We investigated the development of children’s sensitivity to this cue between the ages of 6 and 9 years, alongside an adult comparison group. (Piloting with younger children established 6-year-olds as the earliest age group we could feasibly test because of the linguistic and attentional demands of the task.) We anticipated finding increasing sensitivity to gaze behavior over this period, which is characterized by a growing ability to use nonverbal information in making social appraisals. Previous studies have found that in a variety of social contexts, including deception detection, children younger than age 7 tend to base their judgments of others on lexical content of speech rather than paralinguistic information or facial expression (e.g., DePaulo & Jordan, 1982; Eskritt & Lee, 2003; Morency & Krauss, 1982; Rotenberg, Simourd, & Moore, 1989; see Friend, 2003, for a review). This lexical bias is in clear contrast to adults’ common “actions speak louder than words” heuristic (e.g., Blanck & Rosenthal, 1982; Demorest, Meyer, & Phelps, 1984) and, according to Friend (2000), reflects “a perceptual bias emerging from selective attention to language” (p. 150) in early childhood. We therefore expected that the 9-year-olds would be more proficient at simultaneously attending to the verbal and nonverbal channels than the 6-year-olds, who would be more likely to fixate on the former. We also anticipated that older children would be more cognizant of the significance of the gaze cue, as they will have had greater opportunity to assimilate the adult stereotype of the gaze-averting liar and to learn directly about the norms of visual behavior through their own social interactions.

The only related experimental work to date is by Rotenberg and Sullivan (2003), which investigated whether children infer deception from cues associated with high anxiety levels such as gaze aversion and fidgeting. Groups of 5-, 7-, 10-, and 12-year-olds were asked to judge the truthfulness of videotaped acting peers who displayed systematic variations in either gaze (direct vs. indirect) or limb movements (active vs. still) when making verbal statements about their supposed liking or disliking of several objects. Only the two older age groups were found to attribute
significantly more lying to the high rather than the low anxiety cues. However, Rotenberg and Sullivan did not report the data for the gaze and limb cues separately, only collectively, thereby obscuring the extent to which each of the age groups responded to the gaze aversion cue alone. In addition, the experiment did not include a control to verify that performance was not influenced by any vocal discrepancies that may have existed between the high- and low-anxiety cue conditions. This concern is particularly plausible given that the actors were 7- to 12-year-olds who might not have been able to strictly control their vocal intonation and speech rate across the two conditions. Consequently, they may have sounded more like they were lying when they were gaze averting or fidgeting than when they maintained eye contact or remained still. We addressed this by having an audio-only condition that required a control group of participants at each age to make deception judgments using only the audio component of the vignettes. We were thus able to establish whether participants differentiated between the two gaze conditions on this level.

A further aim of our study was to examine whether any sex differences exist in children’s sensitivity to gaze aversion, following recent claims by Baron-Cohen (2003) that females, as better “empathizers,” have a greater propensity for reading the nonverbal signals emitted by others and, in particular, the information that is conveyed by their gaze. Among adults, there is supporting evidence of women scoring significantly higher than men on the Mind in the Eyes test, which involves identifying cognitive and affective states from varying eye displays (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Baron-Cohen, Wheelright, & Jolliffe, 1997; Carroll & Yung, 2006). This result is consistent with the general finding that females outperform males in discriminating or interpreting nonverbal cues (Hall, 1978, 1984; Rosip & Hall, 2004).

More important, Baron-Cohen (2003, p. 1) proposed that this sex difference, although no doubt augmented by environmental factors, is essentially biological in origin. More specifically, he argued that “the female brain is predominantly hard-wired for empathy,” whereas “the male brain is predominantly hard-wired for understanding and building systems.” To support his hypothesis, Baron-Cohen cited a range of data that indicate an early emerging sex difference in social perception. For example, from birth females look longer at faces and particularly at people’s eyes, whereas males are more likely to look at mechanical objects (Connelan, Baron-Cohen, Wheelright, Batki, & Ahluwalia, 2000; Lutchmaya, Baron-Cohen, & Raggatt, 2002). In light of this, we might expect to find that females show greater sensitivity to facial information, including gaze cues, during childhood. The latest meta-analysis on children’s facial expression processing does show a small but statistically significant female advantage from infancy through adolescence (McClure, 2000; cf. Brody, 1985). However, it has not yet been established whether a female superiority specific to gaze decoding exists in children. Unfortunately, the majority of gaze-reading studies have neglected to test for sex differences (see, e.g., Baron-Cohen et al., 1995; Pratt & Bryant, 1990). Moreover, the available evidence offers mixed results. No gender differences have been found with respect to preschoolers’ ability to identify another’s preferred object from their gaze direction or duration (Einav & Hood, 2006; Lee et al., 1998). In contrast, Post and Hetherington (1974) found that girls begin to use eye contact levels to infer friendship earlier than boys.

### Experiment 1

Participants were presented with video vignettes of actors who either maintained eye contact or displayed gaze aversion while answering an interviewer’s questions. We introduced the task to children as a detective game, informing them that the speakers would sometimes be telling the truth and sometimes lying and that after each conversation they would need to judge whether they believed the speaker. In addition to this forced-choice response, participants were asked to justify their verdict on each trial. This afforded an examination of whether they would explicitly verbalize their use of the gaze cue and allowed us to identify any alternative sources of information that may have influenced decisions. Although we cannot be sure that these retrospective explanations reliably reflect the actual basis for participants’ judgments, these data are clearly important in demonstrating which aspects of the vignettes were particularly salient to them.

Prerecorded enacted scenes were used for the stimuli rather than live or spontaneous interactions to obtain systematic variation of the speakers’ gaze behavior and control over other potentially confounding variables. Examples of previous gaze-reading studies that have successfully used prerecorded video stimuli can be found in Lee et al. (1998), Montgomery et al. (1998), and most recently in Freire et al. (2004).

#### Method

**Participants.** Sixty-four 6-year-olds (32 boys and 32 girls; mean age = 6 years, 5 months; range = 5 years, 10 months, to 7 years, 1 month) and 64 9-year-olds (32 boys and 32 girls; mean age = 9 years, 7 months; range = 9 years, 1 month, to 10 years, 1 month) took part in this experiment after their parents provided informed consent. The data from an additional 4 6-year-olds were replaced before analysis as they had scored 11 or more trials (out of 12) as either all truths or all lies, suggesting that they did not adequately understand the contents of the vignettes or the task requirements. The children were all native English speakers, recruited from a number of schools in a predominantly middle-class area in Bristol, England. The adult participants were 64 undergraduate psychology students (32 men and 32 women; mean age = 19 years, 2 months; range = 18 years, 4 months, to 21 years, 7 months).

**Design.** A within-subject design was used for the gaze manipulation. Each participant was tested under two gaze behavior conditions (eye contact vs. gaze aversion, henceforth referred to as EC and GA, respectively). Within age groups, participants were randomly assigned to one of two presentation modes (audiovisual vs. audio only). In the audiovisual condition, participants could see and hear the protagonists during the interview, whereas in the audio-only condition, the original soundtracks were presented on their own. Dependent measures were percentage of trials judged as lies and justifications for judgments.

**Materials.** The stimuli consisted of 12 short (running time approximately 15-s) vignettes, presented as QuickTime movies or audiotracks, according to condition, on a Mac G4 laptop. Each vignette was introduced by a brief narration and followed a standardized interview format of two related question-and-answer couples. Examples are provided in the Appendix. The interviewees were two female protagonists (ages 18 and 20, respectively) who
appeared separately on alternating trials. The protagonists were interviewed about a different topic in every vignette. Each protagonist displayed three EC and three GA responses, according to a predetermined random order, for a total of six EC and six GA trials. Strict counterbalancing procedures were used so that each vignette was presented equally under EC and GA conditions by each of the two actors across participants.

The audiovisual presentation mode featured a head-and-shoulders view of the protagonist (see Figures 1a and 1b). In the EC condition (Figure 1a), she maintained eye contact with her interviewer (who was always off-camera) throughout the scenario and effectively appeared to be looking directly at the participant. In the GA condition (Figure 1b), the protagonist maintained eye contact while listening to the questions, but her replies were always accompanied by downward/sideways shifting gaze behavior that avoided eye contact. Note that upward gaze aversion was not used because this cue is widely interpreted as a thinking signal by adults and children (Argyle & Cook, 1976; Baron-Cohen &

Figure 1. Examples of the gaze cue in the eye contact (a) and gaze aversion (b) conditions used in Experiments 1 and 2.
Cross, 1992), and hence represents a different cue from the deceiver stereotype, which typically involves looking away shiftily to the side or downward. The protagonists delivered their lines in a naturalistic but relatively neutral fashion, avoiding any extreme emotional expression or vocal intonation. More important, we ensured that these factors were comparable across gaze conditions by piloting multiple versions of the enacted vignettes on adults who rated how well each of the corresponding EC and GA clips matched vocally and whether they contained any potentially confounding facial expressions.

Although the actors used were young adults, as this allowed for stricter control over gaze, facial expression, and vocal intonation, the interview topics were typical and age-relevant situations for children (e.g., discussing late homework or a party invitation) to ensure that even the youngest children understood their content. To set this in context, the protagonists were introduced to participants as two girls who would be answering questions about their school, friends, and hobbies. Only 3 child participants enquired about the protagonists’ age, and all others appeared to accept the protagonists’ responses at face value and did not seem confused by any age discrepancy. Different types of potential lies (excuses for misdeeds [two], hiding one’s emotions to maintain self-presentation [two], ostentatious lying for self-enhancement [two], justification for not being able to do something [two], white lies [two], and no obvious motive for lying [two]) were incorporated to attempt to generalize the results over a wide range of lying situations that may be encountered by children in everyday life (DePaulo, Stone, & Lassiter, 1985; Lewis, 1993).

The verbal content of the answers was intentionally neutral and ambiguous, with the confederate conceivably telling the truth or lying on every trial. Answers were selected on the basis of pilot work with 6- to 9-year-olds who judged responses for plausibility. Actors’ responses varied between one and two sentences of roughly the same total length in all scenarios. Any potential differences in length or complexity of responses were counterbalanced as each scenario was presented equally under both gaze conditions across participants.

Procedure. Each individual testing session lasted approximately 25 min. The experimenter explained to participants that they would be playing a kind of detective game in which they would be watching or hearing (according to condition) two girls who would sometimes be telling the truth and sometimes lying when answering the questions posed to them. Participants were asked to decide whether the girls were telling the truth or lying each time. A practice vignette without feedback was presented to familiarize the participant with the task. Twelve experimental trials were then administered. At the end of each vignette, the video/audio track was paused, and the participant was asked a judgment question, “Do you think she was lying or telling the truth that time?” (note that the order of the lying and telling-the-truth options in this question alternated across trials for each child to avoid any bias), and a justification question, “How could you tell she was lying [telling the truth]?” No feedback concerning accuracy was given between trials.

Scoring. Participants received two separate percentage scores that indicated the proportion of trials that they judged as lies under each of the gaze conditions. Justifications for responses in the audiovisual condition were coded into five categories: (a) gaze (e.g., “She looked like she was lying”); for justifications placed in this category, further probes such as “In what way?” did not elicit references to gaze), (c) paralinguistic cues (e.g., “She was talking really fast”), (d) verbal content (e.g., “It’s an excuse so she won’t get into trouble”), and (e) residual (any other response, including “Don’t know,” paraphrasing, and nonsense justifications). This coding scheme was used to individually code every trial for each participant. On rare occasions when a participant gave more than one justification for a judgment, the trial was given a “mixed” classification. However, if gaze was among the reasons mentioned, a “gaze” classification was given to avoid underrating participants’ awareness of the cue. Each participant received an overall categorization that reflected his or her most frequent explanation type across the 12 trials. Participants who cited two or more explanation types with the same frequency were classified as mixed. An independent rater coded half of the responses from each age group, and interrater agreement (agreements/ agreements + disagreements) was 94% (Cohen’s κ = .91). Disagreements were resolved by discussion.

Results

Judgments. Preliminary analyses indicated no actor effects on performance; therefore, the data were collapsed on this dimension. Table 1 presents the mean percentage of trials judged as lies per gaze condition as a function of age and presentation mode. It can be seen that in the audiovisual condition, participants of all ages were more likely to attribute lying to a vignette when the protagonist averted her gaze rather than maintained eye contact. However, as expected, this gaze effect appears to get stronger with age. In contrast, participants in the control condition judged approximately equivalent proportions of EC and GA soundtracks as lies, thereby demonstrating that they did not differentiate between the two gaze conditions on an audio level.

Before data analyses, the percentage of EC and GA trials judged as lies for each participant were arcsine transformed to correct for heterogeneity of variance. All subsequent analyses used transformed scores, unless otherwise indicated. Untransformed means are reported to facilitate interpretation of the data. We conducted a 2 (gaze behavior: EC or GA) × 3 (age: 6-year-olds, 9-year-olds, nonverbal behavior or facial expression (e.g., “She looked like she was lying”); for justifications placed in this category, further probes such as “In what way?” did not elicit references to gaze), (c) paralinguistic cues (e.g., “She was talking really fast”), (d) verbal content (e.g., “It’s an excuse so she won’t get into trouble”), and (e) residual (any other response, including “Don’t know,” paraphrasing, and nonsense justifications). This coding scheme was used to individually code every trial for each participant. On rare occasions when a participant gave more than one justification for a judgment, the trial was given a “mixed” classification. However, if gaze was among the reasons mentioned, a “gaze” classification was given to avoid underrating participants’ awareness of the cue. Each participant received an overall categorization that reflected his or her most frequent explanation type across the 12 trials. Participants who cited two or more explanation types with the same frequency were classified as mixed. An independent rater coded half of the responses from each age group, and interrater agreement (agreements/ agreements + disagreements) was 94% (Cohen’s κ = .91). Disagreements were resolved by discussion.

Table 1

<table>
<thead>
<tr>
<th>Presentation mode and age</th>
<th>Eye contact</th>
<th>Gaze aversion</th>
<th>Difference</th>
<th>Effect size (η²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audiovisual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 years old</td>
<td>53.6 (22.7)</td>
<td>68.2 (19.1)</td>
<td>14.6*</td>
<td>.25</td>
</tr>
<tr>
<td>9 years old</td>
<td>40.6 (21.1)</td>
<td>83.8 (19.2)</td>
<td>43.2**</td>
<td>.64</td>
</tr>
<tr>
<td>Adult</td>
<td>18.2 (17.1)</td>
<td>90.1 (14.6)</td>
<td>71.9**</td>
<td>.89</td>
</tr>
<tr>
<td>Total</td>
<td>37.5 (25.0)</td>
<td>80.7 (19.8)</td>
<td>43.2**</td>
<td>.58</td>
</tr>
<tr>
<td>Audio only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 years old</td>
<td>58.9 (16.9)</td>
<td>60.4 (20.2)</td>
<td>1.5, ns</td>
<td>.00</td>
</tr>
<tr>
<td>9 years old</td>
<td>50.5 (17.7)</td>
<td>57.3 (20.3)</td>
<td>6.8, ns</td>
<td>.05</td>
</tr>
<tr>
<td>Adult</td>
<td>41.7 (18.0)</td>
<td>47.4 (22.0)</td>
<td>5.7, ns</td>
<td>.03</td>
</tr>
<tr>
<td>Total</td>
<td>50.3 (18.7)</td>
<td>55.0 (21.4)</td>
<td>4.7, ns</td>
<td>.03</td>
</tr>
</tbody>
</table>

Note. n = 32 per group. Standard deviations appear in parentheses. *p < .01. **p < .001.
or adults) × 2 (presentation mode: audiovisual or audio only) × 2 (gender) mixed analysis of variance (ANOVA), with repeated measures on the first variable, on the transformed percentage of trials judged as lies. The Bonferroni correction was applied where necessary to account for multiple comparisons (α = .05). The ANOVA confirmed a main effect of gaze, \( F(1, 180) = 143.61, p < .001, \eta^2 = .44 \), with participants overall judging a significantly greater percentage of GA trials as lies (\( M = 67.9\%, SE = 1.4 \)) in comparison to EC trials (\( M = 43.9\%, SE = 1.4 \)). Presentation mode also had a significant effect on performance, \( F(1, 180) = 14.03, p < .001, \eta^2 = .07 \), with the audiovisual groups making higher attributions of lying (\( M = 59.1\%, SE = 1.3 \)) than the audio-only groups (\( M = 52.7\%, SE = 1.3 \)). In addition, a significant age effect was observed, \( F(2, 180) = 11.58, p < .001, \eta^2 = .11 \). Post hoc testing revealed that there was no difference in the overall proportion of trials judged as lies between the 6- and 9-year-olds (60.3% vs. 58.1%) but that adults judged significantly fewer trials as lies (49.3%) than the two child groups (\( ps < .005 \)).

The expected two-way interaction between gaze behavior and presentation mode emerged, \( F(1, 180) = 96.42, p < .001, \eta^2 = .35 \). Post hoc t tests revealed a significantly greater percentage of lie judgments on GA than on EC trials in the audiovisual condition (respective Ms: 80.7% vs. 37.5%), \( t(95) = 11.30, p < .001, \eta^2 = .58 \), but no significant difference in the control condition, in which participants were only given access to the audio portions of these same trials (Ms: EC = 50.3%, GA = 55.0%), \( t(95) = 1.62, ns, \eta^2 = .03 \).

An interaction was also found between age and gaze, \( F(2, 180) = 20.48, p < .001, \eta^2 = .19 \), which was further qualified by a three-way interaction between presentation mode, age, and gaze, \( F(2, 180) = 16.08, p < .001, \eta^2 = .15 \). Simple effects analysis confirmed that age and gaze interacted significantly in the audiovisual mode, \( F(2, 90) = 33.77, p < .001, \eta^2 = .43 \), but not in the audio-only mode, \( F(2, 90) < 1, ns, \eta^2 = .01 \), thereby indicating that the age groups responded differently to the visual gaze manipulation but were comparable in their responses to the audio tracks. Planned comparison t tests revealed that all three age groups judged significantly more GA than EC trials as lies \( (95) \), \( t(95) = 11.58, \eta^2 = .34, ns \).

Justifications. Participants in the audiovisual mode each received a predominant explanation classification, based on the type of reasoning they most frequently gave to explain their judgments across the 12 trials. Figure 2 presents the relative proportions of the various explanation types, according to age group. It can be seen that a large majority of the adults (84%) primarily justified their judgments with specific reference to the actor’s gaze behavior. Nine-year-olds tended to be more varied in their explanations. Although half of them chiefly attributed their judgments to gaze, 28% primarily cited the visual contents of the vignettes as the reasoning for their judgments instead. This verbal strategy constituted the most common explanation type for the 6-year-olds (38%), offered by more than double the number of children who primarily alluded to the gaze cue (16%). It is worth pointing out that 75% of the 6-year-olds who justified their judgments by referring to the verbal channel were male. In addition, 19% of 6-year-olds were found to attribute their judgments to the actor’s nonverbal behavior, without referring to the gaze. In some cases, participants referred to the actor’s appearance in general terms, and it may be that they had implicitly integrated the gaze cue into the actor’s demeanor (e.g., “She looked suspicious”).

Furthermore, we found that 41% of 6-year-olds referred to gaze at least once in their justifications and could therefore be said to demonstrate explicit awareness of the relevance of the cue even if they did not consistently apply it in their judgments. This figure

<table>
<thead>
<tr>
<th>Gender and age</th>
<th>Eye contact</th>
<th>Gaze aversion</th>
<th>Difference</th>
<th>Effect size (( \eta^2 ))</th>
</tr>
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<tbody>
<tr>
<td>Male 6 years old</td>
<td>61.5 (20.8)</td>
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<td>3.1, ns</td>
<td>.02</td>
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<td>9 years old</td>
<td>45.8 (20.6)</td>
<td>84.4 (17.7)</td>
<td>38.6**, .62</td>
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<td>85.4 (18.1)</td>
<td>65.6**, .84</td>
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<td>Female Total</td>
<td>42.4 (25.5)</td>
<td>78.1 (21.5)</td>
<td>35.7**, .48</td>
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<tr>
<td>Male 6 years old</td>
<td>45.8 (22.4)</td>
<td>71.9 (14.6)</td>
<td>26.1**, .57</td>
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</tr>
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<td>19.7 (19.2)</td>
<td>94.8 (8.0)</td>
<td>78.1**, .94</td>
<td></td>
</tr>
<tr>
<td>Female Total</td>
<td>32.6 (23.8)</td>
<td>83.3 (17.9)</td>
<td>50.7**, .69</td>
<td></td>
</tr>
</tbody>
</table>

Note. \( n = 16 \) per group. Standard deviations appear in parentheses. **\( p < .001 \).
increased with age, rising to 88% of 9-year-olds and 100% of adults.

Finally, we wished to examine whether participants’ gaze-based justifications were related to the magnitude of the gaze effect shown in their judgments. We therefore correlated the number of gaze-based justifications (out of 12) offered by each participant with their gaze difference score. Pearson’s correlational analyses were run separately for each age group. A strong positive correlation was revealed for both 9-year-olds, \( r(32) = .71, p < .001 \), and adults, \( r(32) = .54, p < .005 \), suggesting that the number of times that participants referred to the actor’s gaze behavior in their justifications was a good indicator of the extent to which they were using this information in their judgments. In contrast, 6-year-olds showed no correlation, suggesting that their explicit reference to the gaze cue was not related to their use of the cue in their judgments.

**Discussion**

Experiment 1 revealed that 6-year-olds, 9-year-olds, and adults were all significantly more likely to judge a speaker to be lying when she avoided rather than maintained eye contact with her interviewer. Nonetheless, the magnitude of this gaze effect increased significantly with age as anticipated. Replicating earlier findings (e.g., Hemslcy & Doob, 1978; Kraut & Poe, 1980), adults showed marked response differentiation between the eye contact and gaze aversion trials, being almost five times more likely to attribute deception to speakers in the latter condition. The 9-year-olds were also highly sensitive to the gaze cue, although to a lesser extent than the adults, judging approximately twice as many GA as EC trials as lies. Their response differentiation was in turn significantly more pronounced than that of the 6-year-olds, who showed a statistically significant but much reduced gaze effect. Across all age groups participants in the control condition who were presented with the extracted audio tracks of these vignettes did not differentiate between the two gaze conditions in their judgments, suggesting that the significant finding in the audiovisual condition reflects an effect that is over and above participants’ response to any vocal distinctions.

Examination of the types of explanations that participants gave for their decisions in the audiovisual condition indicated that the older children were much more likely to justify their responses with reference to gaze. Almost 90% of 9-year-olds offered this rationale on at least one trial, demonstrating that at this age the association of gaze behavior and credibility is explicitly held and easily verbalized. Six-year-olds were more variable, with approximately 40% citing the gaze cue at least once, suggesting that explicit awareness of the gaze cue, or perhaps the ability to articulate it, is emerging but not generally prevalent at this age.

The explanations data also revealed that despite citing gaze on at least one occasion, many children did not make consistent use of the cue across trials. Rather, they appeared to attribute considerable weight to the verbal contents of the actor’s responses, even though these had been designed to be ambiguous and ultimately inconclusive. At 6 years old, reference to the verbal contents constituted the most common explanation, and even at 9 years old there remained more than a quarter of participants who predominantly justified their decisions in this way. Typically, in such cases children would attribute deception to a vignette as soon as they identified a potential lying motive for the protagonist (e.g., “She’s lying so she won’t get into trouble”). This may explain why they tended to judge certain scenarios as lies (ostentatious lying; excuses for misdeeds) more often than others (white lies; no obvious motive for lying). Moreover, children attributed truth to a vignette if the protagonist’s reply agreed with what they accepted as truisms (e.g., “She’s telling the truth because buses are always late”) or with their own personal experiences (e.g., “She’s telling the truth because that happened to me once”). They frequently appeared to fixate on such theoretical rationales as actual evidence for the existence of a truth or lie, rather than basing their decision on the manner in which the protagonist delivered her statement. This strategy of placing greater weight on what is being said rather than how it is said is consistent with the aforementioned empirical finding of a lexical bias in children’s social appraisals during middle childhood (Eskritt & Lee, 2003; Friend & Bryant, 2000; Morton & Trehub, 2001; Morton, Trehub, & Zelazo, 2003). Interestingly, at 6 years old boys were three times more likely than girls to justify their decisions in this way.

Thus, it appears that the verbal contents posed a salient source of competition for the younger children in particular, which may to some extent have overridden their sensitivity to the gaze cue. One aim of Experiment 2 was therefore to investigate the effect of removing the verbal content of the vignettes on 6-year-olds’ use of the gaze aversion cue for deception attribution.

A second aim was to determine whether the obtained gender effect would replicate for a new sample of 6-year-olds. In Experiment 1, females showed greater sensitivity to the gaze cue in their judgments. This sex difference was evident across age groups but was most notable among the 6-year-olds—the only age at which girls alone judged significantly more GA than EC trials as lies. Moreover, the original experimental design was limited by its presentation of only female protagonists. Evidence from previous research regarding the presence of an interaction between sex of decoder and sex of encoder in facial expression decoding tasks is mixed. Hall’s (1978) meta-analysis of studies spanning a wide range of age groups found no evidence for same-sex benefits.
However, a subsequent study has suggested that children may find it easier to identify facial expressions displayed by members of their own sex than they do expressions of opposite-sex individuals (Fellman, Barden, Carlson, Rosenberg, & Masters, 1983). Thus, it may be the case that the girls’ performance in this experiment was selectively enhanced by a same-sex effect. Furthermore, the present results showed that 6-year-old boys tended to judge a large proportion of trials as lies, regardless of the displayed gaze behavior. It is possible that this response pattern stemmed from a biased belief that girls usually lie, which may have prevailed over their sensitivity to the gaze cue. This account is plausible given that the ratio of time spent with same-sex relative to opposite-sex peers at this age is 11 to 1 (Maccoby & Jacklin, 1987); such segregation may engender a certain amount of distrust between the sexes. To rule out the above explanations for the obtained sex differences, Experiment 2 incorporated both male and female actors into its design.

Experiment 2

Experiment 2 examined whether 6-year-olds would reveal greater sensitivity to gaze aversion as a lying cue if the competition from the verbal contents of the speaker’s responses was removed. To achieve this, participants were tested on a visual-only task in addition to the original audiovisual task, and the magnitude of the gaze effect was compared between the two presentation modes. Furthermore, this experiment was designed to test the robustness of the gender effect obtained in Experiment 1 across actors of different sex. If girls were found to maintain their superior responsiveness to the gaze cue when presented with male speakers, then a strong case would be made for the generalizability of the gender difference in 6-year-olds beyond any moderating same-sex effect.

Method

Participants. Sixty-four 6-year-olds took part in this study (32 boys and 32 girls; mean age = 6 years, 7 months; range = 5 years, 10 months, to 7 years, 2 months) after their parents gave informed consent. An additional 2 participants were omitted from the original sample and replaced because of noncompliance. The children were from a number of schools in a predominantly middle-class area in Bristol, England. None of the children had taken part in Experiment 1.

Design. The gaze manipulation was once again carried out using a within-subject design, with trials split evenly between the EC and GA conditions according to a predetermined random order. Counterbalancing ensured that each vignette was presented equally under both gaze conditions across participants. The availability of the verbal content was also a within-subject variable. This was achieved by presenting participants with the same six vignettes in normal (audiovisual) and mute (visual-only) mode, respectively. In the former condition, participants could see and hear the protagonists during the interview, whereas in the latter condition the soundtrack was completely removed so that participants were not able to hear either the questions being asked or the protagonists’ responses. These conditions were blocked, and block order was counterbalanced across participants. In addition, participants were randomly assigned to one of two actor gender groups (two male or two female actors) subject to the constraint that the relative number of girls and boys in each group would be equal ($n = 16$). Participant gender constituted the final independent variable. Dependent measures were percentage of trials judged as lies and justifications for judgments.

Materials and procedure. The stimuli consisted of 12 short (running time approximately 15 s) video vignettes, presented as QuickTime movies on a Mac G4 laptop. The female actor vignettes were a subset of those used in Experiment 1. The male actor vignettes were newly created and depicted the same interview topics as the female actor vignettes. A few minor details in the verbal contents were modified to be more suitable for the male speaker (e.g., the present received by the actor was a book rather than a red sweater). These new stimuli were also piloted on adults to ensure that corresponding EC and GA clips matched vocally and that the actors did not display any potentially confounding facial expressions.

The testing procedure followed the same format as in Experiment 1. In the visual-only condition, children were told that they would be looking in on the conversations through a window and so would not be able to hear what was being said. All responses and justifications were scored and coded as before. An independent rater coded half of the responses. Interrater agreement was 91% (Cohen’s $\kappa = .88$) in the audiovisual condition and 97% in the visual-only condition (Cohen’s $\kappa = .95$). Disagreements were resolved by discussion.

Results

Initial analyses revealed no effects of order of presentation mode; therefore, the data were collapsed on this dimension. Furthermore, there was no main effect of actor gender, $F(1, 60) < 1$, $ns$, $\eta^2 = .00$, nor did this factor significantly interact with participant gender, $F(1, 60) < 1$, $ns$, $\eta^2 = .00$, or any other variable, indicating that girls’ and boys’ responses to the male and female speakers were comparable. For this reason, the data were also collapsed across this condition in all subsequent analyses. Table 3 illustrates the mean percentage of trials judged as lies as a function of gaze condition, mode, and participant gender.

We conducted a 2 (gaze: EC or GA) $\times$ 2 (mode: audiovisual or visual only) $\times$ 2 (participant gender) mixed ANOVA, with repeated measures on the first two variables, on the percentage of

<table>
<thead>
<tr>
<th>Presentation mode and gender</th>
<th>Eye contact</th>
<th>Gaze aversion</th>
<th>Difference</th>
<th>Effect size ($\eta^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audiovisual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>66.7 (25.4)</td>
<td>70.8 (29.0)</td>
<td>4.2, ns</td>
<td>.01</td>
</tr>
<tr>
<td>Female</td>
<td>42.7 (29.6)</td>
<td>85.4 (23.9)</td>
<td>42.7*, 54</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>54.7 (29.9)</td>
<td>78.1 (27.4)</td>
<td>23.4*, .23</td>
<td></td>
</tr>
<tr>
<td>Visual only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>33.3 (23.9)</td>
<td>60.4 (29.9)</td>
<td>27.1*, .35</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>34.4 (24.7)</td>
<td>71.9 (28.2)</td>
<td>37.5*, .40</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>33.9 (24.1)</td>
<td>66.1 (29.4)</td>
<td>32.3*, .37</td>
<td></td>
</tr>
</tbody>
</table>

Note. $n = 32$ per group. Standard deviations appear in parentheses. $*p < .001$. 

Table 3

Mean Percentage of Trials Judged as Lies Per Gaze Condition as a Function of Participant Gender and Presentation Mode in Experiment 2
trials judged as lies. The analysis revealed a main effect of mode, $F(1, 62) = 34.93, p < .001, \eta^2 = .36$, indicating that participants judged more trials as lies in the audiovisual mode than in the visual-only mode ($Ms = 66.4\%$ and 50.0\%, respectively). In addition, there was a main effect of gaze, $F(1, 62) = 50.06, p < .001, \eta^2 = .45$, with participants overall judging more GA than EC trials as lies ($Ms = 72.1\%$ and 44.3\%, respectively). There was no main effect of participant gender, $F(1, 62) < 1, ns, \eta^2 = .00$, which indicates that in general boys and girls did not differ in their proportion of lie attributions. The interaction between mode and gaze was not significant, $F(1, 62) = 1.90, ns, \eta^2 = .03$, suggesting that the magnitude of the gaze effect for the sample as a whole was comparable across presentation modes (audiovisual: $EC M = 54.7\%, GA M = 78.1\%$; visual only: $EC M = 33.9\%, GA M = 66.1\%$). However, a significant Gender $\times$ Gaze interaction was revealed, $F(1, 62) = 9.66, p < .005, \eta^2 = .14$, which was further qualified by a three-way interaction between mode, gender, and gaze, $F(1, 62) = 4.80, p < .05, \eta^2 = .07$.

This interaction was explored by comparing boys’ and girls’ performance on the audiovisual and visual-only modes separately. Simple effects analysis of the audiovisual data revealed a significant interaction between gaze and gender, $F(1, 62) = 15.79, p < .001, \eta^2 = .20$. Post hoc paired-sample $t$ tests (with Bonferroni correction) revealed that while the girls judged significantly more GA than EC trials as lies, $t(31) = 6.05, p < .001, \eta^2 = .54$ (EC $M = 42.7\%$; GA $M = 85.4\%$), the boys did not do so, $t(31) < 1, ns, \eta^2 = .01$; rather, they tended to judge trials as lies regardless of the gaze cue (EC $M = 66.7\%$; GA $M = 70.8\%$). In contrast, on visual-only trials, the interaction between gaze and gender was nonsignificant, $F(1, 62) < 1, ns, \eta^2 = .02$, with boys showing similar levels of discrimination between the gaze conditions (EC $M = 33.3\%$; GA $M = 60.4\%$) as the girls (EC $M = 34.4\%$; GA $M = 71.9\%$). Planned comparison $t$ tests confirmed that in the visual-only condition both girls and boys showed a significant gaze effect, $t(31) = 4.52, p < .001, \eta^2 = .40$, and $t(31) = 4.10, p < .001, \eta^2 = .35$, respectively. This pattern of results is shown in Table 3.

**Justifications.** Participants’ rationales for each of their judgments in the audiovisual and visual-only trials were classified according to the coding scheme used in Experiment 1. Participants then received a predominant explanation classification based on the most frequently given explanation type over the six audiovisual and six visual-only trials, respectively. The results of the audiovisual condition closely replicated those obtained in Experiment 1. Children were once again most likely to primarily cite the verbal content as the basis for their judgments (33\% of participants), whereas only 19\% of participants referred consistently to the gaze cue in their explanations. This proportion doubled in the visual-only condition (38\% of participants) in which there was no option to answer in terms of the verbal contents. Although not sufficient for statistical analysis, it is worth noting that on audiovisual trials, three times as many girls (3 boys vs. 9 girls) were classified as primarily providing gaze-based explanations, whereas twice as many boys (14 boys vs. 7 girls) were classified as primarily providing verbal-based explanations. In contrast, in the visual-only condition an equal number of boys and girls justified the majority of their judgments with reference to the displayed gaze behavior (12 out of 32, respectively). The remaining participants in the audiovisual condition primarily cited these other explanations: general nonverbal behavior, 19\%; vocal cues, 10\%; residual, 13\%; and mixed responses, 7\%. The remaining participants in the visual-only condition primarily cited these other explanations: general nonverbal behavior, 38\%; residual, 19\%; and mixed responses, 6\%.

Finally, 39\% of children cited gaze at least once in their justifications on the audiovisual trials. Although this figure rose to 58\% on the visual-only trials, it appears that a substantial proportion of children may have been responding implicitly to the gaze cue in their judgments or at least were not able to articulate their use of the cue in their explanations. Nevertheless, we found that the more participants discriminated between the EC and GA conditions in their judgments, the more likely they were to justify their responses with reference to the gaze cue in both the audiovisual, $r(64) = .54, p < .001$, and visual-only, $r(64) = .41, p < .002$, conditions.

**Discussion**

Experiment 2 revealed a number of important findings. First, it replicated the previously obtained sex difference in sensitivity to gaze aversion as a lying cue with a new sample of 6-year-olds and demonstrated that it is robust across male and female stimulus speakers. Second, this sex difference was found to disappear with the removal of the verbal contents from the vignettes. In the audiovisual mode, girls alone judged significantly more gaze aversion than eye contact trials as lies, whereas in the new visual-only mode boys also showed this response pattern to the extent that their performance did not differ from that of the girls. On audiovisual trials, boys had a propensity to judge vignettes as lies regardless of the displayed gaze behavior. From their self-reported explanations, it appears that the judgments of many of the boys were predominantly based on the content of the actors’ utterances. When this verbal strategy was prevented in the visual-only condition, boys judged fewer EC trials as lies but maintained a relatively high level of deception attribution on GA trials, thereby demonstrating sensitivity to the gaze cue. They were also more likely to explicitly refer to the gaze behavior when justifying their responses. In contrast, girls consistently exhibited strong differentiation between gaze conditions, judging twice as many GA than EC trials as lies in both the audiovisual and the visual-only presentation modes.

Taken together, these results indicate that the boys generally perceived gaze aversion as a relevant lying signal but only made reliable use of it when they did not have access to the actual verbal message. The girls’ use of the gaze cue for inferring deception, however, extended to the more naturalistic situation in which the specific content of the speaker’s words could be heard. What then, accounts for these sex differences? Why is it that the presence of the verbal contents thwarted only the boys’ usage of the gaze aversion cue? One interpretation is that the gaze cue made a stronger impact on the girls’ perceptions such that they were able to overcome the lexical bias typical of this age (Friend, 2003) and weigh it as the decisive factor in their judgments. In contrast, boys’ awareness of the importance of the cue may have been more tenuous and therefore more easily displaced by the competing lexical information.

It is also possible, however, that these findings reflect more general differences in the way girls and boys attend to, and
integrate, information from the verbal and nonverbal channels. There is limited evidence to suggest that girls are better at simultaneously attending to the two channels of communication when judging deception. Rotenberg et al. (1989) found that in the 5- to 9-year-old age bracket, girls were more consistent at inferring lying when viewing an actor whose verbal and nonverbal communications did not match in terms of valence (i.e., positive verbal statement, e.g., “I like that shirt,” with negative nonverbal behavior, e.g., a frown), and at inferring truth when they did match, compared with boys. Thus, it may be that in this experiment girls were more proficient at concurrently considering what the speakers said and how they said it when viewing the vignettes and making their decisions, whereas the boys may have fixated on the former source of information, at the expense of the latter. In other words, the boys may have faced stronger interference from the verbal channel, which was therefore more likely to override their response to the gaze cue.

So far, the body of literature documenting children’s lexical bias has neglected to examine whether any differences exist between the sexes with respect to this phenomenon. In some cases, studies have been carried out on highly uneven numbers of male and female participants, preventing an assessment of gender differences (Eskritt & Lee, 2003; Friend & Bryant, 2000). In others, researchers have failed to specify the ratio of male to female participants in their samples (Friend, 2000; Morton & Trehub, 2001) or to mention the existence or absence of gender effects in their results (e.g., Morton et al., 2003). Our findings strongly suggest that future studies should not ignore this factor.

General Discussion

In two experiments, we investigated children’s sensitivity to a speaker’s gaze behavior when evaluating the speaker’s honesty. This is one of the few studies to examine young children’s mentalistic interpretation of gaze in the context of dyadic social interaction as compared with object-oriented attention. Furthermore, it broadens the focus of previous work on children’s use of gaze during cooperative communication to the context of deceptive communication in which gaze is known to play a key role for adults (e.g., Hemsley & Doob, 1978; also see current adult data). Our data revealed that children as young as 6 years old are more likely to judge speakers to be lying if they avoid rather than maintain eye contact with their interactant. This tendency was present even when children did not refer explicitly to the gaze cue as a basis for their decisions. Nevertheless, we found that between 6 and 9 years of age, the influence of gaze on judgments, as well as children’s explicit reference to this cue, increases significantly. Even more interesting is the sex difference that was found in both experiments, indicating that females were more responsive to the gaze cue in their judgments compared to males. This sex difference was particularly strong among the younger children but disappeared when speakers’ verbal responses were removed, suggesting that 6-year-old boys and girls do not necessarily differ in gaze processing but rather in the extent to which they attend to, or integrate, information from the verbal and nonverbal channels in their social appraisals.

We believe our findings make a number of important contributions to the field of developmental gaze perception. Although 6-year-olds’ interpretation of gaze aversion as a deception marker may ultimately be misplaced, it crucially demonstrates that they are sensitive to the quality of interpersonal gaze behavior and appreciate its significance as a social cue. This is consistent with early evidence of 6-year-olds interpreting eye contact as a sign of friendship between individuals (Abramovitch & Daly, 1978; Post & Hetherington, 1974). Clearly, then, at this age children’s gaze perception abilities extend beyond the use of object-centered gaze as a referential cue for disambiguating an individual’s attentional focus. They not only have the capacity to read another’s gaze in terms of a specific viewed object (Baron-Cohen et al., 1995; Lee et al., 1998), they also recognize that levels of eye contact between interactants can convey relevant information about their mental states.

Nevertheless, our justifications data suggest that at 6 years old, children’s response to the gaze aversion cue is not necessarily articulated and may even operate implicitly, whereas by the time they are 9 years old their evaluations are explicitly based on this information. So, what underlies children’s increasing awareness of gaze aversion as a deception cue between 6 and 9 years of age? As previously noted, this age gap straddles the documented shift in children’s relative attendance to the verbal and nonverbal channels, whereby an early fixation on the verbal content of a message gives way to a growing sensitivity to its nonverbal context (for a review, see Friend, 2003). Consequently, older children are more likely to take nonverbal cues into consideration when assessing whether a speaker is lying. However, we can also expect them to attach more significance to the speaker’s gaze behavior in particular for a number of reasons. First, children may gradually assimilate the cultural convention of the gaze-averting liars through exposure to everyday allusions. Second, children tend to engage in more eye contact during peer conversations as they grow older (Levine & Sutton-Smith, 1973) and in so doing may personally come to expect direct eye contact from interactants. Third, it is possible that children learn to associate avoidant gaze with lying from their direct experience of deception “in the playground.” Although young children and adults do not appear to avoid mutual gaze when they lie (Kleinke, 1986; Lewis, Stranger, & Sullivan, 1989; Talwar & Lee, 2002), a recent study has found that 7- to 9-year-olds do display this behavior (McCarthy, Muir, & Lee, 2007). Accordingly, at 9 years old, children will have had greater opportunity to observe the co-occurrence of gaze aversion and lying in their peers than at 6 years old.

In addition to these experiential factors, cognitive processes are likely to contribute to the developmental change. Although it is possible that children’s perception of gaze aversion as a lying cue stems from acquiring a simple behavioral “gaze aversion = lying” rule, it is also possible that it draws from their growing insight into the mental and emotional states that accompany deception (see Bussey, 1999). Perhaps as children learn through their own lying that this act typically involves a greater degree of concentration and anxiety than truth telling (DePaolo et al., 1985; Vrij, 2002), they are more likely to deduce deception from averted gaze, which they may already associate with these mental states (Baron-Cohen & Cross, 1992; Rotenberg & Sullivan, 2003). Indeed, our 9-year-olds frequently volunteered that a speaker they believed to be lying was looking away because she had to think about what to say in her lie or because she was feeling nervous about being found out.

A further notable finding of the present research is that females were more responsive to the gaze aversion cue, consistent with
Baron-Cohen’s (2003) claims that females, as greater empathizers, are more likely to use the eyes for “mind-reading” purposes than are males. However, given the conflicting evidence in the developmental gaze literature to date, there is no justification in assuming a general female superiority in gaze cue use during childhood. Rather, researchers should seek to pinpoint the crucial factors that may be central to eliciting significant sex differences in this sociocognitive skill. It may be that methodological variations across studies (e.g., in sample size, number of trials, or salience of the gaze cue) are responsible. A more interesting explanation is that the female advantage is somehow dependent on the nature of the displayed gaze cue. For example, perhaps it is more likely to emerge when the cue is a social signal conveying interpersonal information, as in the current task (see also Post & Hetherington, 1974), rather than a primarily object-directed behavior (Einav & Hood, 2006; Lee et al., 1998; Montgomery et al., 1998). This explanation is necessarily speculative at this point but suggests a potential line of enquiry for future work.

Although the obtained gender effect in Experiment 1 was not qualified by age, the degree of disparity between the sexes was much reduced by 9 years of age and among adults. One may argue that this diminishing gender effect is more indicative of a transient developmental rather than consistent difference between males and females. However, we note that the current study may not have been sufficiently sensitive to reveal marked gender differences among the older participants because of ceiling effects caused by the saliency of the gaze stimulus. The gaze aversion cue was intentionally conspicuous to ensure that even the youngest participants would not fail to perceive the difference in gaze behavior between EC and GA trials. It is therefore possible that the older males were made aware of the cue to a greater extent than they would be in real life, where gaze aversion is likely to be less obvious. Future studies should investigate whether a greater divergence might also be found among older observers if the cue was presented more subtly.

The finding that among 6-year-olds the gender effect disappeared under visual-only conditions points to the key role played by the verbal content in differentiating between the sexes at this age. Although boys and girls showed comparable recognition of the importance of the gaze aversion cue on visual-only trials, only the girls reliably responded to it on audiovisual trials. This result may be interpreted as indicating that the verbal channel did not pose as much of a distraction for the girls as a result of their comparatively stronger sensitivity to the gaze information, in line with Baron-Cohen’s (2003) view. Yet, we cannot at present rule out the alternative possibility that girls faced less interference from the verbal channel than the boys and were therefore better able to focus on the gaze cue. Further research examining gender differences in children’s lexical bias should help to unravel the relative contributions of these mechanisms.

Either way, this result demonstrates that children’s use of gaze cues is determined by more than their ability to interpret the signal appropriately; they must also be able to make functional use of it in the presence of competing sources of information that are part and parcel of the social scenario (see Einav & Hood, 2006). The implication of this finding is particularly important when considering the impairments of individuals with autistic spectrum disorders on gaze-reading tasks, which have previously been taken as evidence that they are unaware of the mentalistic significance of the eyes (Baron-Cohen et al., 1995). As our results have shown, insensitivity to a gaze cue use may arise from a child’s failure to focus on the gaze and inhibit a response toward other salient aspects of the scene rather than necessarily reflecting a fundamental incompetence in recognizing the meaning of the signal. It is therefore important to establish in the future to what extent competitive effects, as opposed to deficits in gaze interpretation per se, underlie gaze processing difficulties in children with autistic spectrum disorders, especially given the impairments in executive control associated with this disorder (for a review, see Hill, 2004).

Like many studies investigating children’s use of nonverbal cues (e.g., Freire et al., 2004; Morency & Krauss, 1982; Rotenberg et al., 1989), we opted to use prerecorded video vignettes, as opposed to live interactions, to achieve rigorous standardization of the stimuli. Consequently, participants were given the role of observers and required to judge whether the speaker was lying to the interviewers in the video rather than to them personally. However, it is also worth exploring children’s sensitivity to a range of interpersonal gaze behaviors in situations in which they are active participants in a live exchange and the direct recipients of another’s gaze signals. Likewise, it would be particularly interesting to examine the magnitude of sex differences under such conditions of high participant involvement.

In sum, our finding that children as young as 6 years old interpret gaze aversion as an indication of a speaker’s deception provides strong evidence that they are sensitive to the mentalistic significance of interpersonal gaze behavior. These results underscore the importance of examining not only how gaze functions as a referential cue for children but also as a signal that influences their social appraisals. We have shown that children monitor the way in which a speaker looks at his or her interlocutor to evaluate the speaker’s mental state. Whether children similarly use this channel to assess a listener’s mental state in response to another’s words (e.g., level of attentiveness) and thereby achieve a representation of the interpersonal situation as a whole is a fascinating question that awaits future research.

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**Appendix**

**Two Vignette Examples**

**Narrated Introduction**

Claire went to the fairground yesterday with her brother. Let’s watch (listen to) [according to condition] her talking about it.

Interviewer: “Did you go on lots of rides at the fairground, Claire?”
Speaker: “Yes, I even went on the really big roller coaster and didn’t shut my eyes.”
Interviewer: “Weren’t you scared?”
Speaker: “No, it was fun. I can’t wait to do it again.”

**Narrated Introduction**

Mel didn’t hand her homework in to her teacher this morning. Let’s watch (listen to) [according to condition] her talking about it.

Interviewer: “Why didn’t you hand your homework in on time, Mel?”
Speaker: “I was going to but when I looked in my bag it wasn’t there. I thought I put it there last night.”
Interviewer: “So you did finish your homework?”
Speaker: “Yes, of course I did. I just left it at home by accident.”

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