



Shyness and face scanning in children

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ABSTRACT

Contrary to popular beliefs, a recent empirical study using eye tracking has shown that a non-clinical sample of socially anxious adults did not avoid the eyes during face scanning. Using eye-tracking measures, we sought to extend these findings by examining the relation between stable shyness and face scanning patterns in a non-clinical sample of 11-year-old children. We found that shyness was associated with longer dwell time to the eye region than the mouth, suggesting that some shy children were not avoiding the eyes. Shyness was also correlated with fewer first fixations to the nose, which is thought to reflect the typical global strategy of face processing. Present results replicate and extend recent work on social anxiety and face scanning in adults to shyness in children. These preliminary findings also provide support for the notion that some shy children may be hypersensitive to detecting social cues and intentions in others conveyed by the eyes. Theoretical and practical implications for understanding the social cognitive correlates and treatment of shyness are discussed.

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The eyes convey important information for facial identification (Gold, Sekuler, & Bennett, 2004; Heisz & Shore, 2008) and intention detection (Baron-Cohen, Wheelwright, & Jolliffe, 1997). Clinically impaired populations characterized by extreme social deficits are known to avoid the eyes during face scanning. For example, children with autism tend to dwell on the mouth rather than the eyes when processing faces (Klin, Jones, Schultz, Volkmar, & Cohen, 2002) and show impaired face recognition performance (Dawson et al., 2002). Evidence on the extent to which these findings generalize to non-clinical populations characterized by social deficits is relatively limited.

Individuals who are socially anxious are characterized by social deficits (see Crozier & Alden, 2005, for a review). Non-clinical socially anxious individuals are known to make less eye contact with an interviewer than their non-socially anxious counterparts (Daly, 1978). People who are socially anxious look less at their audience than non-anxious individuals (Eves & Marks, 1991), and their looking-time is related to their level of anxiety (Jurich & Jurich, 1974). Still others have noted that increased social anxiety was related to decreased eye contact in social interactions (Farabee, Holcom, Ramsey, & Cole, 1993). However, a relation between level of anxiety and eye gaze behavior is not always observed (Hofman, Gerlach, Wender, & Roth, 1997). Taken together, these studies are potentially limited by the behavioral

coding method of monitoring eye movements, which can only provide a crude measure of gaze position in contrast to the more reliable methods presently available.

Using eye tracking, one study found that adults with social phobia avoided the eye region of the face more than normal controls (Horley, Williams, Gonsalvez, & Gordon, 2003). However, a more recent study, using eye tracking with a non-clinical adult sample reported that women high in social anxiety tended to fixate longer at the eye region than medium or low socially anxious women (Wieser, Pauli, Alpers, & Mulhberger, 2009). Even though direct gaze generated more anxiety (as measured by increased heart rate), fixations to the eye regions by high socially anxious women were observed regardless of whether the gaze direction of the stimuli was direct or averted. These results suggest that social anxiety may not be associated with gaze aversion—at least in a laboratory setting.

The primary goal of the present study was to extend recent findings of Wieser et al. (2009) by examining the relation between temperamental shyness and face scanning behavior in a non-clinical sample of 11 year-old children. Shyness and social anxiety are known to be conceptually and empirically related and have often been used interchangeably in the extant literature even though they have, in part, different meanings (Rubin & Asendorpf, 1993; Schmidt & Buss, 2009). Although social anxiety and shyness reflect the process of affective (e.g., nervousness), cognitive (e.g., fear of evaluation) and behavioral (e.g., awkward social responses) uneasiness in social situations, temperamental shyness is presumed to be an enduring trait-like characteristic of one's personality (Biedel & Turner, 1998; Kagan, 1994).

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Shyness is known to be associated with avoidant behavior, especially during social interactions, and such behaviors are prevalent throughout development. As early as the second year of post-natal life, 10–15% of typically developing toddlers consistently turn away and hide from novel people, objects, and situations (Fox, Henderson, Rubin, Calkins, & Schmidt, 2001; Kagan, 1994, 1999). Of these toddlers, some will maintain their avoidant tendencies and develop into temperamentally shy children and adults (Biedel & Turner, 1998; Schmidt & Schulkin, 1999). Interestingly, although the avoidance of eye contact is an observable behavior presumed to maintain non-clinical shyness (Cheek & Buss, 1981; Garcia, Stinson, Ickes, Bissonnette, & Briggs, 1991; Pilkonis, 1977), no studies have used eye tracking to reliably capture precise face scanning patterns in relation to shyness among non-clinical samples and apparently none with children.

To do so, we used the *Jane test* of face identity (Mondloch, Le Grand, & Maurer, 2002). Twelve new versions of a single Caucasian female face ('Jane') were created. Four differed in the shape of the eyes and mouth (feature set), four differed in the shape of the external contour (contour set), and four differed in the spacing among facial features (spacing set). During the task, participants made same/different judgments for pairs of faces from each of the three face sets. This task has been used previously to measure developmental changes in sensitivity to each of these cues to facial identity (Mondloch et al., 2002), the effects of early deprivation on later face processing (Le Grand, Mondloch, Maurer, & Brent, 2001; Le Grand, Mondloch, Maurer, & Brent, 2003), face processing in individuals with Williams syndrome (Karmiloff-Smith et al., 2004), and to compare the sensitivity of shy versus non-shy children to each of these cues to facial identity (Brunet et al., in press).

We elected to use the Jane task in the current study for two reasons. First, it allowed us to determine whether scanning patterns differed across the three face sets. Each face set isolates a different aspect of the face that can be used for identification: the shape of facial features (feature set), the shape of the face (contour set), and configural face information represented by the distance among features (spacing set). We anticipated greater fixation on the eye region during the feature block than during the spacing and contour blocks; attending to a single internal feature (eye or mouth) would result in high accuracy on the feature set, whereas high accuracy on the spacing requires integration across the internal features and high accuracy on the contour set would require attending to either a local external feature (e.g., chin shape) or global face shape. Second, in a previous study, we tested 40 typically developing 10-year-old children on this task and, based on their scores on maternal report of shyness using the Colorado Child Temperament Inventory (CCTI; Buss & Plomin, 1984; Rowe & Plomin, 1977), we assigned them to one of three groups: low, medium, and high shy (Brunet et al., in press). The high-shy children made more errors than their non-shy peers on the spacing set, but not on either of the feature or contour sets. These results suggest that the relation between shyness and face processing may vary with the type of information that is critical for discrimination.

In the present study, we re-tested a subset of our original sample (28 of the original 40 children) one year later. For each face set, we examined whether scanning patterns differed as a function of shyness. The present investigation appears to be the first study to explore the relation between shyness and face scanning using eye-tracking technology in a non-clinical sample of children, and thus it provides a test of two contrasting hypotheses.

According to an *avoidance* hypothesis, a positive relation between shyness and eye avoidance during face scanning is expected. Shyness is characterized by avoidance behaviors (Pilkonis, 1977), and one very salient avoidant behavior is not looking at the eyes and eye region because these areas convey possible social threat (Farabee et al., 1993).

Alternatively, shy individuals may exhibit hyper-vigilance looking to the eyes for important social cues, albeit brief, as a result of their heightened self-consciousness during social interactions (Crozier, 1979). Shy people are overly concerned that other people will evaluate them negatively during social interactions. Fatis (1983) found that shy individuals report greater negative cognitions during social interactions, including self-consciousness about their social skills during the interaction, worry about how the other person is evaluating them, and general unpleasantness of the situation. This latter hypothesis is in line with the recent report that socially anxious adults fixate longer at the eyes during face scanning (Wieser et al., 2009), leading to the *hyper-vigilance* hypothesis: a positive relation between shyness and dwell time to the eyes.

1. Method

1.1. Participants

Twenty-eight (14 males) 11-year-old children (M age = 11.14 years, $S.D.$ = 6.49 months) and their parents were recruited from a Child Database maintained by the Department of Psychology, Neuroscience & Behaviour at McMaster University. The database contains contact information of children born at hospitals in the Hamilton, Ontario region whose mothers volunteered to be contacted about research at the time of the child's birth. All children were Caucasian, born healthy and full-term, were typically developing, and had normal or corrected to normal vision at the time of testing. Participants were first recruited one year prior for another research study. At that time, participants were selected based on their age. They were not selected based on their temperament scores. Parents and children were not assessed for anxiety or psychological disorders at either time points.

1.2. Face identity task

The face stimuli have been used in previous studies (e.g., Mondloch et al., 2002). A single Caucasian female face (Jane) was modified to create 12 new versions ('Jane's sisters'). Four sisters (the spacing set) differed only in the spacing of features (e.g., spacing between the eyes), four (e.g., the featural set) differed only in the appearance of the eyes and mouth, and four (e.g., the contour set) differed only in the shape of the external contour. Jane and three completely novel faces ('Jane's cousins') comprised the control stimuli; these faces differed on all three dimensions. All stimuli were 10.2 cm wide and 15.2 cm high ($5.7^\circ \times 9.1^\circ$ from the testing distance of 100 cm).

1.3. Temperament measure

The CCTI is a widely used instrument to index children's temperament and has excellent psychometric properties (Buss & Plomin, 1984; Rowe & Plomin, 1977). The CCTI comprises 30 items and six subscales: shyness, sociability, activity, attention span, emotionality, and soothability. Of particular interest were the shyness (e.g., "Child takes a long time to warm up to strangers") and sociability (e.g., "Child likes to be with people") subscales. In the present study, the alpha coefficients were .77 and .67 for the shyness and sociability subscales, respectively. We examined sociability to determine specificity, given that sociability is conceptually and empirically orthogonal to shyness but related to social behavior (Cheek & Buss, 1981; Schmidt, 1999). Items were answered on a 5-point scale, with 1 representing "not at all like my child" and 5 for "a lot like my child." There are 5 items per subscale, thereby giving a possible range of 5–25.

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