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Young children with Autism Spectrum Disorder look differently at positive versus negative emotional faces

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Abstract

One of the core issues in Autism Spectrum Disorder (ASD) is problematic social interaction, which for an important part is reflected by poor processing of emotional information. Typically, adults show specific viewing patterns while scanning positive and negative emotional expressions in faces. In this study, we investigated whether the same pattern is present in a group of 3- to 6-year-old children with ASD and a 5-year-old control group. We found that although the group with ASD looked less at feature areas of the face (eye, mouth, nose) than the control group, both the children with ASD and the normally developing children displayed differential scanning patterns for faces displaying positive and negative emotions. Specifically, we found increased scanning of the eye region when looking at faces displaying negative emotions. This study shows that, although young children with ASD exhibit abnormal face scanning patterns, they do exhibit differential viewing strategies while scanning positive and negative facial expressions.

Keywords: Autism Spectrum Disorder; Pervasive developmental disorder; Face perception; Emotion perception

Autistic Spectrum Disorder (ASD) is a pervasive neurodevelopmental disorder that is characterized by impairments in social interaction, communication, and repetitive/stereotypic behaviors (American Psychiatric Association, 2000). Social symptomatology includes unusual eye contact, and inadequate affect comprehension and expression. Social perception in ASD has been investigated in a number of studies showing that individuals with ASD process faces in a different manner than typically developing individuals. The first experimental evidence comes

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from a study by Langdell (1978), who showed that 9- and 14-year-old children with ASD were as fast as their controls in identifying faces of their peers. However, if identification had to be based on the lower part of the face, individuals with ASD were actually faster than controls. Moreover, the 9-year-old group performed less well, than the other groups at identifying emotional expressions solely on the basis of the upper half of the face. A recent study on adults with ASD found that they were also slower at discriminating between faces (e.g., Behrmann et al., 2006) This impairment in face processing is congruent with neuroimaging findings showing atypical activation of the fusiform gyrus, the preeminent area in face processing (e.g., Pierce, Muller, Ambroses, Allen, & Courchesne, 2001, but also see Pierce, Haist, Sedaghat, & Courchesne, 2004).

At all ages, human faces constitute an important source of information. For efficient communication with another person, it is thus crucial to determine whether he or she is known or unknown and to identify his or her mood and intention. Efficient face scanning is at the core of these skills. Furthermore, evidence suggests that the basis for face perception is deeply rooted in the human endowment. From birth on, young infants are frequently confronted with faces and show a preference for faces from their first days on (Goren, Sarty, & Wu, 1975; Johnson, Dziurawiec, Ellis, & Morton, 1991; Maurer & Barrera, 1981). However, compared to adults, infants seem to perceive faces in a more piecemeal fashion. For instance, 3-month-olds treat a face comprising the internal features of one familiar face, with the contour of another familiar face, as a familiar face and not until 4 months of age do they treat the recombined face as novel (Cashon & Cohen, 2003). Several studies have investigated infants' perception of faces using precise eye movement measurement techniques. When infants scan the face of a person, they look at its key features already from the first weeks of life (Hunnius & Geuze, 2004). Their visual scanning patterns, however, are different from adults and undergo rapid development during the first months after birth (Bronson, 1994). Very young infants tend to show limited face scanning with long fixations on a few locations of the face, whereas 3- to 4-month-olds scan faces routinely, spending most of the time looking at the particularly meaningful areas of the face: the eyes and the mouth (Haith, Bergman, & Moore, 1977; Hunnius & Geuze, 2004; Maurer & Salapatek, 1976). However, it still takes some time before the scanning becomes adult-like (Bronson, 1994), that is, increased scanning of the eyes, nose and mouth, with about 70% of all fixations being directed at the eyes (Walker-Smith, Gale, & Findley, 1977).

Several eye-tracking studies have shown abnormalities in the visual scanning of faces by individuals with ASD. Klin, Jones, Schultz, Volkmar, and Cohen (2002) showed that adolescents with ASD scanned dynamic social scenes in a deviant way. Compared to controls, the group with ASD showed heightened scanning of the mouth, bodies and objects, at the expense of scanning of the eyes. Recent observations also found evidence for these effects in younger children; less scanning of the eyes was found in the case of a 15-month-old infant with ASD (Klin & Jones, 2008). Furthermore, Pelphrey et al. (2002) found that when scanning static images of faces, adults with ASD tended to spent more time scanning the non-feature areas (e.g., ears, chin) and spent less time scanning feature areas (eyes, nose, mouth) than controls. However, there are several studies that have not found abnormal attentional allocation to faces, or face scanning in individuals with ASD (e.g., Bar-Haim, Shulman, Lamy, & Reuveni, 2006; Dapretto et al., 2006; Van der Geest, Kemner, Camfferman, Verbaten, & van Engeland, 2002). For recent overviews, see e.g., Sasson (2006) and Jemel, Mottron, and Dawson (2006). The reason for this discrepancy is still unclear, but variation in context is likely to play a role. For example, Klin et al. studied face scanning when participants watched a complex social scene