



Social attention and autism symptoms in high functioning women with autism spectrum disorders



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ABSTRACT

Background: Research has suggested a different, less visible, clinical manifestation of Autism Spectrum Disorders (ASD) in females. There is, however, limited research into possible underlying mechanisms explaining the female phenotype.

Aims: This study investigates social attention in females with ASD.

Methods and procedures: 26 women diagnosed with ASD and 26 typical female controls were shown three video clips containing intense emotions. Social attention was assessed by measuring eye fixation patterns during the video clips. Autism symptoms were assessed using the informant reported Social Responsiveness Scale (SRS).

Outcome and results: Results show normal time to first fixation to the face, but lower fixation duration to the face in women with ASD. Analyzing the visual patterns further, there were similar impairments in fixation to mouth, eyes and other facial areas. Relating social attention to autism symptoms revealed several significant correlations within the ASD group.

Conclusions and implications: Women with ASD show abnormalities in social attention and these abnormalities are related to level of autism symptoms. In contrast to other studies which investigate male dominated ASD samples, a hyperfocus to the mouth area could not be found.

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1. What this paper adds

There is increasing evidence that females with ASD have a different clinical manifestation, with less visible behavioral issues. Unfortunately, information on the behavioral level alone limits our understanding of the female ASD phenotype and may even provide less accurate or incomplete information as diagnostic instruments tend to be developed based on the male phenotype. Our study used eye tracking to examine the underlying mechanism of social attention to understand the female ASD phenotype. We found evidence for impaired social attention, as evidenced by a lower fixation duration to face and all parts of the face. In contrast, females with ASD showed a normal initial orienting response, fixating the face at equal speed compared to the control group. We also found a relationship between social attention and autism symptoms. Our findings

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suggest that, while females with ASD may be difficult to identify using standard instruments, they do show impairments in the area of social attention.

1.1. Social attention and autism symptoms in women with Autism Spectrum Disorders

One of the hallmarks of Autism Spectrum Disorders (ASD) is a qualitative impairment in social interaction ([American Psychiatric Association \[APA\], 2013](#)). Impairments in this realm include difficulty to develop peer relationships, a reduced sharing of affect, and impairments in the use of nonverbal behaviors such as facial expressions and eye contact ([APA, 2013](#)). Recently, however, several researchers have suggested an altered phenotype for females with ASD ([Head & McGillivray, & Stokes, 2014](#); [Lai et al., 2011](#); [Mandy et al., 2012](#)). This research suggests that females with ASD are more interested in social interaction compared to males with ASD ([Kirkovski, Enticott, & Fitzgerald, 2013](#)) and may present with a less obvious clinical picture. As a consequence, females on the spectrum are diagnosed at a later age compared to males, with delays ranging from roughly two years in young samples with Asperger's syndrome to four years in adult samples with autistic disorder ([Begeer et al., 2013](#)). There is also evidence that females with significant autistic traits are less likely than males to achieve a diagnosis in the absence of additional problems which may warrant attention for diagnostic assessment ([Dworzynski, Ronald, Bolton, & Happé, 2012](#)). This suggests that females with ASD may show less pronounced or different core deficits compared to their typically developing counterparts, which makes it harder to diagnose ASD in females. This study investigates this hypothesis for the area of social attention, which is regarded as an important marker of ASD.

Social attention is defined as spontaneous attention to socially relevant stimuli, for example to people and in particular their faces and eyes ([Klein, Shepherd, & Platt, 2009](#)). As such, it can provide important clues as to the emotional state of others, which in turn affects successful engagement in communication and social interaction ([Itier & Batty, 2009](#)). Already in early childhood, humans show a preponderance to look at social stimuli ([Gliga & Csibra, 2007](#)) and this preponderance seems to last into adulthood ([Boraston & Blakemore, 2007](#)).

In contrast, there is evidence suggesting reduced attention to social cues in individuals with ASD, with evidence ranging from infants at risk (e.g. [Chawarska, Macari, & Shic, 2013](#)) to adolescents and adults ([Bird, Press, & Richardson, 2011](#); [Riby & Hancock, 2009](#)). In addition to a reduced attention to social stimuli in general, several researchers have suggested an impairment in visual exploration of faces in ASD. For example, using video clips, [Klin, Jones, Schultz, Volkmar, and Cohen \(2002\)](#) found that adolescent males with ASD looked less at the eyes but more to the mouth compared to typical controls. [Spezio, Adolphs, Hurley and Piven \(2007\)](#) found similar results in their male sample of adults with ASD using static pictures. However, not all studies have established this atypical visual exploration with decreased attention to the eyes and increased attention to the mouth. For example, both [Pelphrey et al. \(2002\)](#) and [Dalton et al. \(2005\)](#) failed to find evidence for increased attention to the mouth in their all male adult ASD samples.

More recently, the focus has switched to a more fine-grained analysis of eye fixations. [Fletcher-Watson, Leekam, Benson, Frank and Findlay \(2009\)](#) for example, paired complex pictures of social and non-social scenes and investigated fixation duration to different areas as well as location of the first fixation. Their ASD group comprised of mostly male adolescents and adults aged 16–23. Overall, there were no significant differences in fixation duration between the ASD group and the typical control group. Upon further analyses however, Fletcher-Watson et al. found a lower number of first fixations to the social scenes in the ASD group.

Investigating visual fixation patterns in complex scenes using single pictures, [Freeth, Chapman, Ropar and Mitchell \(2010\)](#) also found normal fixation duration to the face in their adolescent ASD group consisting of 21 males and three females. A time course analysis did find a different pattern in first time fixations. Whereas the control group was quicker to first fixate the face, the ASD group was quicker to first fixate an object. Similarly, [Riby and Hancock \(2009\)](#) found that adolescents with ASD (18 males, 6 females) were slower to fixate the face during natural scene viewing with a small embedded face compared to TC adolescents. The results of these studies suggest subtle differences in the timing of first fixations to the face or the pattern of gazing behavior in high functioning adolescents and adults with ASD even in the presence of normal fixation duration to social areas of interest (AOIs). This superficially normal performance with normal fixation duration to social information may be the result of more developed social skills in high functioning individuals ([Fletcher-Watson et al., 2009](#)).

1.2. Social attention in females

Despite the growing body of research on social attention in ASD, most research so far has neglected to investigate social attention in females with ASD either by using male dominated samples (e.g. [Fletcher-Watson et al., 2009](#); [Freeth et al., 2010](#); [Riby & Hancock, 2009](#)), or by eliminating females altogether (e.g. [Dalton et al., 2005](#); [Klin et al., 2002](#); [Pelphrey et al., 2002](#); [Spezio et al., 2007](#)). As the male-female gender ratio of ASD is estimated at 4.3:1 and even 5.5:1 in individuals with average to high intellectual abilities ([Campbell, Davarya, Elsabbagh, Madden, & Fombonne, 2013](#)), an overrepresentation of males in ASD research is to be expected. However, there are at least two reasons that warrant caution in assuming the current results regarding social attention can be generalized to the female ASD population. The first reason stems from research in the general population. [Connellan, Baron-Cohen, Wheelwright, Batki, and Ahluwalia \(2000\)](#) demonstrated that female infants show a preference to look at faces compared to mobiles, while the opposite is visible in male infants. Similarly, [Lutchmaya, Baron-Cohen and Raggatt \(2002\)](#) found that one-year-old females make more eye contact compared to their

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