Characterizing the use of local and global processing strategies for face identification in children, adolescents and adults with Autism Spectrum Disorder

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BACKGROUND

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by atypical social communication and restricted and repetitive behaviours (APA, 2013).

ASD is differentiated from other neurodevelopmental disorders by a unique and distinctive visuo-perceptual profile (e.g. Mottron et al., 2006). This is defined by a relative facility for processing non-social, spatial information with concurrent difficulty in perceiving complex, socially laden information- exemplified in face perception (Simmons et al., 2009).

Atypical face perception in individuals with ASD may result from local or detailed perceptual strategies (Behrmann et al., 2006) that change with age (Guy et al., 2016). This is highlighted by a decreased ability to discriminate facial identities when access to local facial cues is minimized (e.g. Morin et al., 2015).

Although evidence of locally oriented atypical face perception is present for individuals with ASD with above average IQ, research in individuals with below average IQ is not well established.

OBJECTIVES

The objectives of this study were

1. To utilize eye tracking methods to assess whether individuals with ASD with <av IQ perform atypically on a facial identity recognition task when access to local cues are diminished.
2. Assess the trajectory of perceptual profiles across developmental age.

METHODS

Participants

Nineteen individuals with ASD (17 M, 2 F; M_{age} = 15.00, SD_{age} = 3.81) were recruited from the Summit Centre for Education Research and Training (SCERT). Participants were measured on the Social Responsiveness Scale (SRS-2): mean SRS parent t score = 73.11. The Wechsler Abbreviated Scale of Intelligence - 2nd Edition (WASI-II) was also administered: mean FSIQ = 86.53; PRI IQ = 97.36; VCI IQ = 77.79.

Procedure

Participants completed a 2AFC facial identity discrimination task where they answered ‘same’ or ‘different’ to two synthetic face stimuli (Wilson et al, 2002) presented simultaneously on a computer screen 60 cm from the participant (see Figure 1). The task consisted of 64 trials: 8 blocks of 8, including practice trials. Regions of interest were defined for the hairline, eyes, nose mouth and jawline of each face stimulus and participants' eye gaze patterns were assessed for each of these regions.

The face identity discrimination task incorporated two view conditions (1. Same View and 2. View Change) where access to local and global cues were manipulated.

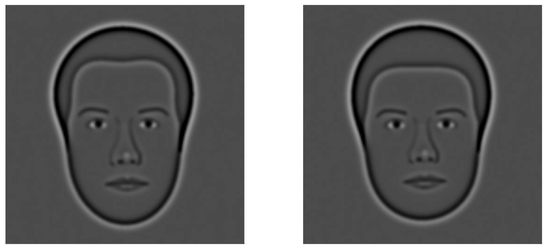


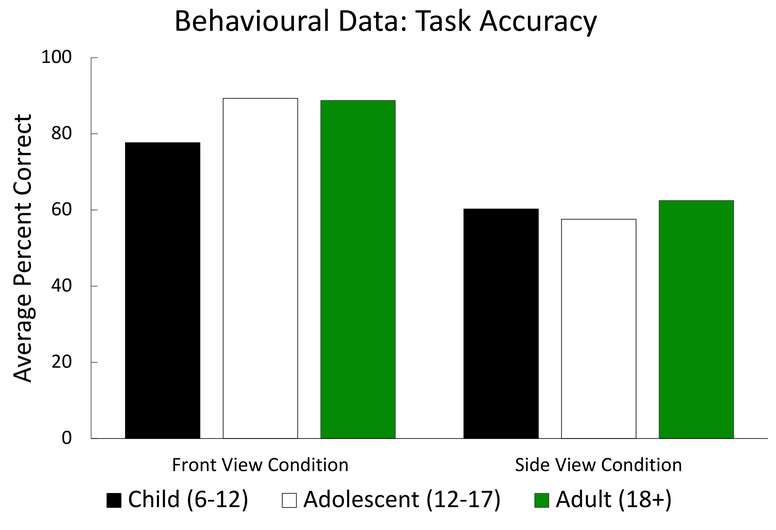
Figure 1. Same View condition. Face pairs were presented in a front-facing, same view condition allowing for identity judgements to be based on local facial cues (e.g., comparing noses). Participants were asked to identify if the stimulus was the ‘same’ or ‘different’.

Figure 2. View Change condition. Face pairs were presented in a View Change condition where face pairs had one front facing and one side facing stimulus (20 deg.), resulting in a decreased access to local information, and a greater reliance on a global analysis to complete the task. Participants completed a 2AFC task of the identity of face being ‘same’ or ‘different’.

RESULTS

Behavioral data

A significant effect of condition (F (2, 32) = 38.4, p <0.001) was found, suggesting that individuals with ASD were significantly more accurate in the front-front condition (facilitating local strategies) compared to the front-side condition (facilitating global strategies). However, no significant effect of developmental age was found.



Eye-tracking data

Regions of interest (ROIs) were plotted for hairline, eyes, nose, mouth and jawline. Percentage of time looking at each ROI were analyzed using a 2 x 5 repeated measures ANOVA. Results revealed no significant main effect of view condition. However, a main effect of ROI was found, indicating that individuals with ASD utilized information from the eyes and hairline significantly more than the nose, mouth and jawline.

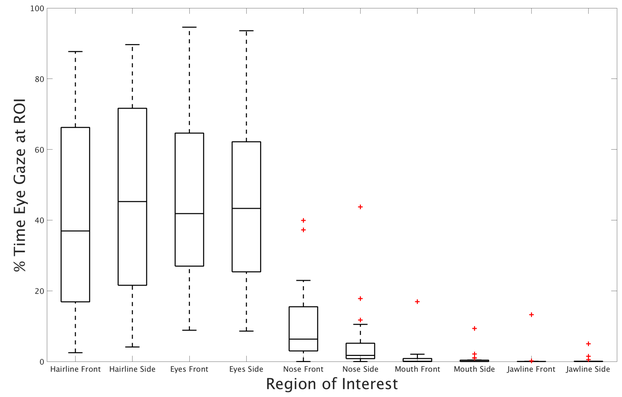


Figure 3. Average time spend looking at each ROI for the Front View and Side View Conditions.

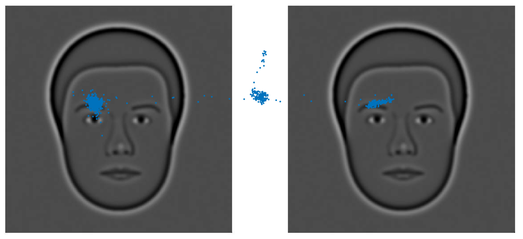


Figure 4. Example of scan paths used to make identity judgements in the Front View Condition.

DISCUSSION

Individuals with ASD utilized a local viewing strategy in both conditions despite accuracy on the task being significantly lower in the global, View Change condition. These results indicate a pattern of viewing that isolates specific areas of the face (i.e., local processing) as opposed to rapid use of several regions to create a perceptual ‘whole’ (i.e., global processing). Results also indicated that individuals with ASD utilize the eye region over and above the lower regions of the face, which counters claims that individuals with ASD do not effectively use the eye region in face processing (e.g. Rutherford et al 2007). Overall, this study demonstrates that individuals with ASD with below average IQ use local processing strategies during face-identity discrimination consistently across developmental age.

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