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Reevaluating the selectivity of face-processing difficulties in children and adolescents with autism

Louise Ewing [a,*], Elizabeth Pellicano [a,b], Gillian Rhodes [a]

[a] ARC Centre of Excellence in Cognition and Its Disorders, School of Psychology, University of Western Australia, Crawley, WA 6009, Australia
[b] Centre for Research in Autism and Education (CRAE), Institute of Education, University of London, London WC1H 0AL, UK

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ABSTRACT

There are few direct examinations of whether face-processing difficulties in autism are disproportionate to difficulties with other complex non-face stimuli. Here we examined discrimination ability and memory for faces, cars, and inverted faces in children and adolescents with and without autism. Results showed that, relative to typical children, the difficulties of children and adolescents with autism were not limited to, or disproportionately severe for, faces. Rather, these participants demonstrated significant difficulties in remembering and discriminating between faces *and* cars. This lack of face selectivity is inconsistent with prominent theories that attribute face-processing difficulties in autism to fundamental problems with social motivation or social attention. Instead, our results are consistent with a more pervasive perceptual atypicality that may affect autistic processing of non-face stimuli as well as face stimuli.

Introduction

A growing body of research documents atypical face processing in autism (see Webb, Faja, & Dawson, 2011; Weigelt, Koldewyn, & Kanwisher, 2012; but see also Jemel, Mottron, & Dawson, 2006). For example, individuals with autism are widely reported to show difficulties with face recognition memory and discrimination relative to age- and ability-matched peers. These atypicalities have

* Corresponding author. Fax: +61 8 6488 1006.
E-mail address: louise.ewing@uwa.edu.au (L. Ewing).

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been linked to the characteristic profile of sociocommunicative difficulties in the condition (Dawson, Webb, & McPartland, 2005; Sasson, 2006; Webb et al., 2011).

Many theorists attribute the face-processing difficulties in autism to reduced social interest and motivation (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012; Dawson et al., 2005; Grelotti, Gauthier, & Schultz, 2002). They propose that a specific failure to attend to faces and accumulate experience with them from early in development diminishes motivation to engage in reciprocal social interactions and impedes the development of face-processing expertise and associated cortical specialization. Thus, although atypicalities in visual processing of other stimuli may also be present, proponents of "social motivation" accounts propose that face perception should be selectively, or *disproportionately*, affected in autism.

In contrast, other theorists suggest that difficulties in discriminating and remembering faces are part of a more pervasive processing atypicality in autism that may affect the way these individuals process face and non-face stimuli alike (e.g., Behrmann, Thomas, & Humphreys, 2006; Mottron, Dawson, Souliéres, Hubert, & Burack, 2006). For example, according to weak central coherence theory (Happé & Frith, 2006), face-processing difficulties are the product of a domain-general cognitive style that favors detail-focused processing and hinders the identification and discrimination of any perceptually homogeneous stimulus category that benefits from sensitivity to configural/holistic information. For these accounts, processing difficulties with faces should be comparable to those observed for other, similarly complex categories.

Interestingly, the question of whether processing difficulties in autism are selective (i.e., disproportionately greater) for faces, relative to other comparable stimulus classes, has not yet been fully resolved. Despite the large body of research into autistic face perception (see Weigelt et al., 2012, for a thorough review), which includes some studies that assess processing ability for both face and non-face stimuli, there have been surprisingly few direct comparisons of participants' performance across categories. To date, the results from studies that have included tests of both face- and non-face-processing abilities appear to support a face-selective processing difficulty (e.g., Boucher & Lewis, 1992; Hauck, Fein, Maltby, Waterhouse, & Feinstein, 1998; McPartland, Webb, Keehn, & Dawson, 2011). We suggest, however, that this evidence is equivocal and that strong conclusions regarding the selectivity of such deficits have been limited by methodological issues.

We propose that three criteria must be met to demonstrate selectivity. First, it is not sufficient to identify significant "deficits" in individuals with autism relative to typical individuals for face stimuli but not non-face stimuli. To constitute strong evidence for a face-selective atypicality, there must be a significant interaction between participant group (autism or non-autism) and stimulus category (face or non-face), such that the group difference for faces is larger than that for non-faces. Studies that do not examine or report a significant participant group by stimulus category interaction cannot definitively establish whether difficulties with faces are disproportionately more severe than those observed with non-face objects (e.g., Behrmann et al., 2006; Blair, Frith, Smith, Abell, & Cipolotti, 2002; Gepner, de Gelder, & de Schonen, 1996; Hobson, Ouston, & Lee, 1988; Kuusikko-Gauffin et al., 2011; McPartland et al., 2011; Wilson, Brock, & Palermo, 2010; Wolf et al., 2008). Equally, studies that report significant participant group by stimulus type interactions alone, without follow-up between-group comparisons for the different stimulus types, also remain uninformative regarding the selectivity of any face-processing difficulties (common in investigations of face inversion effects; e.g., Faja, Webb, Merkle, Aylward, & Dawson, 2009; Lahaie et al., 2006; Riby, Doherty-Sneddon, & Bruce, 2009; Rose et al., 2007).

Second, processing ability for faces must be assessed relative to a non-face stimulus category with comparable processing demands. As a highly perceptually homogeneous stimulus category, faces pose a substantive challenge for the visual system to recognize and discriminate. If non-face stimuli are drawn from categories that are less perceptually homogeneous than faces, then group differences might be masked by the easier individuation of these items. For example, several studies assess processing ability for faces and common objects (e.g., Behrmann et al., 2006; Hauck et al., 1998; Scherf, Behrmann, Minshew, & Luna, 2008)[1], which differ in both parts and their first-order configuration.

[1] Scherf and colleagues' (2008) study also included a more perceptually homogeneous stimulus category—Greebles. Unfortunately, the direct statistical comparison between these two more complex categories (e.g., faces vs. Greebles) alone was not reported.