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Cognition

Brief article

Typical integration of emotion cues from bodies and faces in Autism Spectrum Disorder

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ABSTRACT

Contextual cues derived from body postures bias how typical observers categorize facial emotion; the same facial expression may be perceived as anger or disgust when aligned with angry and disgusted body postures. Individuals with Autism Spectrum Disorder (ASD) are thought to have difficulties integrating information from disparate visual regions to form unitary percepts, and may be less susceptible to visual illusions induced by context. The current study investigated whether individuals with ASD exhibit diminished integration of emotion cues extracted from faces and bodies. Individuals with and without ASD completed a binary expression classification task, categorizing facial emotion as 'Disgust' or 'Anger'. Facial stimuli were drawn from a morph continuum blending facial disgust and anger, and presented in isolation, or accompanied by an angry or disgusted body posture. Participants were explicitly instructed to disregard the body context. Contextual modulation was inferred from a shift in the resulting psychometric functions. Contrary to prediction, observers with ASD showed typical integration of emotion cues from the face and body. Correlation analyses suggested a relationship between the ability to categorize emotion from isolated faces, and susceptibility to contextual influence within the ASD sample; individuals with imprecise facial emotion classification were influenced more by body posture cues.

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1. Introduction

The facial expressions of others are a rich source of social information, conveying cues to affective and mental states. Correct interpretation of facial expressions is therefore important for fluent social interaction and wider socio-cognitive development (Adolphs, 2002; Frith, 2009). Previous research indicates that facial emotion perception is affected by the context in which a facial expression is encountered, suggesting that interpretations are informed by our knowledge and experience (de Gelder et al., 2006; Feldman-Barrett, Mesquita, & Gendron, 2011). Categorization of morphed facial expressions, for example, is biased by the concurrent presentation of social interactants (Gray, Barber, Murphy, & Cook, 2017) and other non-interacting faces (Masuda et al., 2008). Perceived facial expression can also be influenced by affective vocal cues (de Gelder & Vroomen, 2000; Massaro &
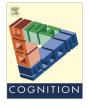
Egan, 1996), situational stories (Carroll & Russell, 1996), and visual scenes (Righart & De Gelder, 2008a, 2008b).

A particularly strong form of contextual influence is exerted by body postures (Hassin, Aviezer, & Bentin, 2013). The same facial expression can vary in appearance when presented with different bodily expressions; for example, a facial expression may be classified as angry when presented in the context of a body expressing anger, but disgusted when presented in the context of a body expressing disgust (Aviezer, Trope, & Todorov, 2012b; Aviezer et al., 2008). These findings imply that the attribution of affective states involves the integration of emotion cues from across the face and body. The influence of posture contexts is often automatic; it occurs despite explicit instructions to disregard non-face information (Aviezer, Bentin, Dudarev, & Hassin, 2011), and modulates early neurophysiological markers of visual person processing (Meeren, van Heijnsbergen, & de Gelder, 2005).

The present study sought to examine whether observers with Autism Spectrum Disorder (ASD) integrate emotion cues from body posture contexts when interpreting others' facial emotion. ASD is a neurodevelopmental condition associated with social

and communication difficulties, repetitive behaviors and restricted routines (American Psychiatric Association, 2013). There has been considerable interest in the visual perception of individual with ASD (Dakin & Frith, 2005; Simmons et al., 2009). Observers with ASD may exhibit a local processing style that hinders their ability to form unified global percepts (Behrmann, Thomas, & Humphreys, 2006; Happé, 1999; Happé & Frith, 2006). For example, ASD is associated with good detection of embedded figures, which requires observers to disregard extraneous information present within a complex pattern or scene, to locate a target element (Ropar & Mitchell, 2001; Shah & Frith, 1983). Those with ASD may also be less susceptible to context-induced visual illusions than typical individuals (Happé, 1996; Shah, Bird, & Cook, 2016; but see Manning, Morgan, Allen, & Pellicano, 2017) and show reduced global-to-local interference when responding to ("Navon") compound letter arrays (Behrmann, Avidan, et al., 2006). Similarly, individuals with ASD may rely less than typical individuals on contextual cues to distinguish homographs when reading (Frith & Snowling, 1983; López & Leekam, 2003).

Should observers with ASD exhibit a local processing style, their judgements of facial emotion may be less susceptible to modulation by body posture contexts. Where observed, aberrant integration of emotion cues from bodies and faces may contribute to difficulties attributing affective states sometimes seen in this population (Gaigg, 2014). Observers with ASD and matched control participants were required to classify expressions drawn from a morph continuum as either 'Anger' or 'Disgust'. Target expressions were either judged in a no-context baseline condition, in the presence of a task-irrelevant disgusted posture, or a task-irrelevant angry posture.

2. Method

2.1. Participants

Nineteen individuals with a clinical diagnosis of ASD (three female; M_{age} = 34.84 years), and 27 individuals with no current or previous clinical diagnosis (eight female; M_{age} = 33.85 years) took part in the current study. All participants were aged between 18 and 65 years. Typical participants were recruited from local participant pools populated by university students and members of the general public. ASD participants were recruited from a database maintained by the authors. Individuals with ASD were diagnosed by an independent clinician, and the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) was used to assess current severity. Autistic traits were also measured in all participants using the Autism-Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001). Higher AQ scores, indicative of more ASD traits, were seen in the ASD group than in the typical group [$t(44)$ = 7.28, $p < 0.001$]. Alexithymia, a trait associated with difficulties identifying and describing one's own emotions (Brewer, Cook, & Bird, 2016a, 2016b), measured by the Toronto Alexithymia Scale (TAS-20; Bagby, Taylor, & Parker, 1994), was also more severe in the ASD group (M = 59.16, SD = 15.81) than the typical group (M = 46.58, SD = 12.77) [$t(43)$ = 2.95, p = 0.005]. However, the ASD and typical groups did not differ significantly in their age [$t(44)$ = 0.27, p = 0.787], proportion of female participants [X^2 = 0.13, p = 0.248], or IQ [$t(43)$ = 1.032, p = 0.308]. Detailed diagnostic information is provided in Table 1.

2.2. Stimuli

Facial stimuli (Fig. 1a) were static images drawn from a morph continuum created by blending two images of the same actor expressing disgust and anger (images taken from Ekman & Friesen, 1975) using Morpheus Photo Morpher Version 3.11 (Morpheus Software, Inc). The continuum parametrically manipulated the actor's expression between disgust and anger in seven equidistant steps of 10%. The body contexts depicted the same actor posing angry and disgusted postures (Fig. 1b). Where these posture contexts have been used previously (e.g., Aviezer et al., 2008, 2012b), the disgusted body posture has been shown gripping a disgusting object. In the present study, this object was removed to ensure that perceptual bias, where observed, was attributable to integration of face and body cues, and not additional semantic information. The morphed facial expressions were presented within a dark grey oval intended to resemble a hood. The relative location of the facial target did not vary as a function of expression intensity. In the baseline no-context condition, observers saw the expressions presented within the oval, but in the absence of a body posture. We opted for this baseline condition in light of concerns about the value of the neutral emotion construct (e.g., Lee, Kang, Park, Kim, & An, 2008); for example, a supposedly "neutral" body posture, where an actor's arms are clenched by their side, may be perceived as angry. In all three conditions, facial stimuli subtended 3.5° vertically when viewed at 57 cm.

2.3. Procedure

Each trial in the experimental procedure began with a central fixation point (1000 ms), followed by presentation of a facial target drawn from the morph continuum (1200 ms). The facial target was always presented centrally. In the baseline no-context condition, the facial target was presented in isolation. In the two context conditions, the facial target was accompanied by an angry or disgusted body posture. Following stimulus offset, participants were prompted to categorize the facial emotion as either 'Disgust' or 'Anger' using a key press. Participants were explicitly instructed to disregard the body context. The procedure consisted of 420 trials (7 facial stimuli × 20 presentation × 3 context conditions) and was presented on an LCD display. Stimuli were presented in a randomized order, with the three context conditions interleaved. The experimental program was written in MATLAB (The MathWorks, Inc) using the Psychophysics Toolbox (Brainard, 1997; Pelli, 1997).

For each observer, we fitted separate psychometric functions for the three context conditions, each modelling how the probability of a disgust response varied as a function of the strength of the disgust signal in the stimulus. Cumulative Gaussian functions were fitted using the Palamedes toolbox (Prins & Kingdom, 2009). Each function estimated two key parameters: Decision noise and the point of subjective equality (PSE). Decision noise is a measure of the precision with which stimuli are categorized, defined as the standard deviation of the symmetric Gaussian distribution underlying each cumulative Gaussian function. Lower noise estimates indicate that observers can perceive subtle differences in stimulus strength and vary their responses accordingly. Greater noise estimates reveal that participants' responses are relatively invariant to changes in stimulus strength. Noise estimates are inversely related to the slope of the psychometric function; steep and shallow slopes are associated with low and high noise estimates, respectively. The PSE is a measure of bias that represents the hypothetical emotion intensity equally likely to be judged as 'Disgust' and 'Anger'. Observers' susceptibility to the contextual modulation was inferred from the difference between PSE of the anger function and the PSE of the disgust function (Fig. 1c).

3. Results

One individual in the ASD group (participant 19) produced psychometric functions that could not be modelled so was excluded