Schizophrenia Research 183 (2017) 157–160

Contents lists available at ScienceDirect

Schizophrenia Research

journal homepage: www.elsevier.com/locate/schres

Subtle cues missed: Impaired perception of emotion from gait in relation to schizotypy and autism spectrum traits

Scott D. Blain *, Joel S. Peterman, Sohee Park

Department of Psychology, Vanderbilt University, 111, 21st Avenue South, Nashville, TN 37240, United States

ARTICLE INFO

Article history:
Received 10 June 2016
Received in revised form 4 October 2016
Accepted 4 November 2016
Available online 9 November 2016

Keywords:
Biological motion
Embodiment
Emotion perception
Schizophrenia
Autism

ABSTRACT

Background: Deficits in emotion perception are central features of schizophrenia and autism spectrum disorders. These conditions are also associated with disrupted embodiment and impaired processing of biological motion. However, medication and the impact of illness over time complicate the study of socioemotional processing in such neuropsychiatric populations. Thus, the current study investigated the perception of emotional cues from gait, in relation to autistic and schizotypal traits in the general population.
Methods: Self-report measures of schizotypy and autism-spectrum were obtained from 107 healthy participants. An affective biological motion task that required participants to discriminate emotions from the gait patterns of polygonal avatars at varying levels of emotional intensity was used to assess accuracy of emotion perception.
Results: Emotion perception accuracy depended on the stimulus intensity. Those with elevated autism spectrum quotient and those with elevated positive syndrome (cognitive-perceptual) schizotypy showed deficits in emotion perception from gait.
Conclusions: Perception of emotion from low-intensity gait cues is compromised in those who may carry liability for autism or psychosis. Emotion perception deficits may be a core feature of autism and schizophrenia, rather than simply being a downstream consequence of illness duration or medication.

1. Introduction

Accurate emotion perception serves adaptive functions in the "real world" and predicts social outcome (Elfenbein et al., 2007; Hooker and Park, 2002). Typically, emotion perception has been investigated using faces (e.g., Ekman, 1993) but in daily life, we utilize multiple channels including voices, postures, and movements to perceive and express emotions. Bodily cues such as gait patterns are especially useful when stimuli are at a distance or faces are obscured (Atkinson et al., 2007; de Gelder, 2006). Deciphering the emotion of an approaching person can influence social decision-making in real time (e.g., decision to approach or withdraw).

Social impairments including deficits of facial emotion perception are well documented in schizophrenia (Couture et al., 2010; Pinkham et al., 2008) and autism (Lozier et al., 2014; Pinkham et al., 2008). Schizophrenia and autism are also associated with impaired decoding of emotions from gait and posture (Atkinson, 2009; Hubert et al., 2007; Peterman et al., 2014). Both autism- and schizophrenia-spectrum show social cognitive impairments, including deficits of face processing, emotion recognition, and theory of mind at the behavioral and neural levels (see Sasson et al., 2011; Pinkham et al., 2008). Nonetheless, given the impact of the illness and medication over time, it is difficult to conclude whether emotion processing impairment is a fundamental feature of these conditions, or an outcome of the illness itself. Studying elevated autistic or schizotypal traits in healthy participants can address these concerns. Facial emotion perception impairments are associated with schizotypy (e.g., Brown and Cohen, 2010; Germine and Hooker, 2011), and elevated autism-spectrum traits (e.g., Harms et al., 2010; Poljac et al., 2013). Less is known about emotion perception from gait or body posture. Biological motion perception deficits have been shown in autism (Blake et al., 2003; Miller and Saygin, 2013) and schizophrenia (Kim et al., 2005; Kim et al., 2011), but emotion perception from gait has not been elucidated in relation to autistic/schizotypal traits. Thus, we sought to elucidate emotional gait perception in relation to schizotypal and autism traits.

We hypothesized that schizotypal and autistic traits would correlate inversely with gait perception accuracy. Current psychometric models of schizotypy consist of three factors (cognitive-perceptual, interpersonal and disorganized) that correspond to positive, negative and disorganized syndromes of schizophrenia (Raine, 1991; Raine et al., 1994). Depending on the nature of the deficits in emotion perception in schizophrenia (e.g., perceptual abnormalities or socio-emotional processing), performance on the affective gait task may be differentially associated with the sub-factors of schizotpy. If emotion perception deficits in

* Corresponding author.
E-mail addresses: scottblain7@icloud.com (S.D. Blain), joel.peterman@vanderbilt.edu (J.S. Peterman), sohee.park@vanderbilt.edu (S. Park).

http://dx.doi.org/10.1016/j.schres.2016.11.003
0920-9964/

schizotypal individuals stem from perceptual difficulties, gait task accuracy would be inversely correlated with the perceptual-cognitive factor. If, on the other hand, emotion perception deficits arise from abnormal socio-emotional processing rather than perceptual problems, accuracy should be inversely associated with interpersonal schizotypy.

2. Methods

2.1. Participants

107 students (75 women) were recruited from Vanderbilt University. Exclusion criteria were diagnosed psychiatric and neurological disorders, substance use within 6 months, history of head injury and current psychotropic medication. See Table 1 for demographic information. The study protocol was approved by the Vanderbilt University Institutional Review Board. Participants gave written informed consent and received course credit.

2.2. Procedure

All participants completed self-report measures before the gait perception task.

2.3. Self-report questionnaires

The Schizotypal Personality Questionnaire (SPQ; Raine, 1991) is a 74-item, true/false, questionnaire consisting of cognitive-perceptual, interpersonal, and disorganized factors.

The Autism-spectrum Quotient 10 (AQ-10; Allison et al., 2012) is designed to assess autism traits in adults. Participants respond using a four-point scale (1 = strongly disagree; 4 = strongly agree). Responses are coded as zero or one, with one point awarded if a participant endorses the "autistic trait."

2.4. Emotion perception from gait

The stimuli were polygonal 'walking' avatars created with motion morphing, which allowed for parametric adjustment of the emotional 'signal' in the stimulus (see Roether et al., 2009 for the details of standardization of the emotional gait stimuli). There were both angry and happy stimuli, each with three intensity levels: 50% (attenuated), 100% (prototypical) and 150% (exaggerated). Aspects of the movement that defined the emotional content were flexion of the head and arms (head tilted forward for anger and tilted backward for happy), and postural positioning of the torso (pitched forward for anger and leaned back for happy).

For each trial, participants were asked to view a walking avatar on a computer screen for 1 s and determine whether the avatar's gait resembled happy or angry emotion. Participants indicated their choice by pressing the "H" key for happy or "A" key for angry. There was no time limit. Accuracy and reaction time were recorded. Happy and Angry stimuli were interspersed randomly. There were 96 happy stimuli (32 per intensity level), 96 angry stimuli (32 per intensity). There were 10 practice trials before testing. See Fig. 1 for the stimuli and procedure.

Table 1
Demographic information and self-report data.

Mean age		19.73 (SD = 1.30)
Race/ethnicity		59.6% White 20.2% Asian 10.1% African-American 0.9% Hispanic/Latino 8.3% Multiracial 0.9% Other
AQ-10		3.0 (SD = 1.6), Range = [0, 7]
SPQ	Total	18.4 (SD = 10.7), Range = [1, 54]
	Cognitive-perceptual	6.8 (SD = 5.2), Range = [0, 24]
	Interpersonal	8.9 (SD = 6.2), Range = [0, 26]
	Disorganized	4.6 (SD = 3.5), Range = [0, 15]

Table 2
Gait perception accuracy.

Task performance at three intensities		Mean raw score (s.d.)	Mean % correct (s.d.)
Total	50%	50.0 (6.2)	78.2 (9.6)
	100%	59.6 (4.5)	93.1 (7.1)
	150%	61.7 (3.6)	96.4 (5.6)

3. Results

Repeated-measures ANOVA showed a significant effect of intensity on accuracy ($F(2, 216) = 414.07$, $p < 0.001$). A repeated-measures ANCOVA revealed a significant interaction effect of intensity and AQ on accuracy ($F(2, 214) = 4.27$, $p < 0.05$). Although there was no effect of intensity on accuracy for SPQ-total ($F(2, 214) = 1.49$, $p > 0.23$), there was a significant interaction of stimulus intensity and cognitive-perceptual factor of SPQ ($F(2, 214) = 5.47$, $p < 0.01$). There were no interactions of intensity and interpersonal or disorganized factors of schizotypy ($p > 0.05$).

Overall accuracy for 100% and 150% intensity was at ceiling (Table 2). Thus, correlations between 50% (low-intensity) gait perception accuracy and self-report measures were calculated. There was a significant correlation between AQ and gait perception accuracy at 50% ($r = -0.26$, $p < 0.01$). Although total SPQ score was not significantly associated with gait perception, since the cognitive-perceptual factor had a significant interaction effect with intensity on accuracy, we examined correlations between gait perception and SPQ factors. Gait perception accuracy at 50% intensity correlated negatively with cognitive-perceptual ($\rho = -0.22$, $p = 0.023$), but not with interpersonal ($p > 0.86$) or disorganization ($p > 0.51$) factors. Correlations of gait perception with AQ and SPQ could not be explained by selection bias for happy stimuli, as bias was not directly correlated with AQ or SPQ ($p < 0.05$). Furthermore, there were no significant correlations with reaction time at any intensity ($p < 0.05$).

Multiple regression analysis was conducted to assess the independent effects of AQ and SPQ sub-factors on gait perception accuracy at 50%. The overall model had significant fit ($F(4, 104) = 4.57$, $R^2 = 0.15$, $p = 0.002$). AQ ($\beta = -0.32$, $p = 0.002$) and cognitive-perceptual schizotypy ($\beta = -0.30$, $p = 0.007$) had independent negative effects on accuracy, while affective schizotypy and disorganization had no significant effects ($p < 0.05$).

Lastly, AQ was positively correlated with SPQ ($\rho = 0.40$, $p < 0.001$) as well as cognitive-perceptual ($\rho = 0.28$, $p < 0.01$), affective ($\rho = 0.36$, $p < 0.001$), and disorganization ($\rho = 0.36$, $p < 0.001$) sub-factors.

4. Discussion

Recent research showed impaired perception of emotional cues in gait, in patients with schizophrenia (Peterman et al., 2014), adding to a growing body of work documenting emotion perception deficits in individuals with schizophrenia and autism (Couture et al., 2010; Hubert et al., 2007; Lozier et al., 2014), as well as those with latent liability (Miller and Lenzenweger, 2012; Miller and Saygin, 2013; Platek et al., 2005; Poljac et al., 2013). We sought to extend this research by investigating gait perception in relation to schizotypy and autistic traits.

Cognitive-perceptual schizotypy and autism-spectrum quotient were negatively associated with emotion perception at low stimulus intensity, despite intact ability to categorize emotions at higher intensities. Furthermore, these associations remained after inclusion of AQ