

Individual differences in perceptual sensitivity to emotional human movement

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Previous research has shown that typical adults demonstrate a heightened visual sensitivity to potentially threatening biological motion (Chouchourelou, Matsuka, Harber, & Shiffrar, 2006). Namely, typical adults are more sensitive to the presence of an angry point-light walker as compared to the presence of happy, fearful, sad, or neutral walkers. This is known as the anger-superiority effect. In a series of psychophysical studies, we asked whether individual differences in social skills influence the visual analysis of emotional human motion. Typical adults display a wide range of social abilities. Autism is a disorder that compromises social ability. Importantly, autism is a continuous disorder and autistic traits have been shown to exist in the general population. Given the associations between autism and dysfunction of the pSTS (a neural area involved in the visual detection of human movement; Boddaert et al., 2004), the amygdala (a neural area involved in emotion recognition and threat detection; Howard et al., 2000), and their interconnection, we examined the relationships between the magnitude of autistic traits in the general population and visual sensitivity to emotional human action. We predicted that individuals with excellent social skills (i.e., few autistic traits) would show levels of visual sensitivity to human motion that were emotion dependent, whereas individuals with poor social skills (i.e., more autistic traits) would show emotion-independent visual sensitivity to human motion.

METHODS

Twenty-three Rutgers undergraduates took part in the study. Participants completed the Autism-Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001), a self-administered questionnaire that

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measures the amount of autistic traits in adults with normal intelligence. Participants also completed a psychophysical task in which they viewed masked point-light displays of walkers displaying anger, fear, happiness, neutrality, or sadness. The order of AQ questionnaire administration and psychophysical task were counterbalanced across participants. Participants were not informed of the emotional content in the displays. Rather, their task was simply to detect the presence of a person within the cloud of dots (point-light mask). On each trial, participants viewed a 3 s movie. Each movie contained coherent or scrambled walker within a mask of scrambled human movement. The masking elements were individually constructed for each walker so that the points in each mask had motion trajectories that were identical to the points of the scrambled or coherent walker.

RESULTS

The participants' AQ scores fell in the expected normal range (mean = 17.35, $SD = 4.69$). For analysis, we created two groups of participants using a median split of AQ score. The dependent measure on the psychophysical task was perceptual sensitivity to the point-light walkers. To measure this, we calculated d' scores for individuals' sensitivity to each emotional category of walker; these were computed by subtracting the standardized rate of false alarms from the standardized rate of hits. Overall, as expected, subjects were most sensitive to the presence of angry walkers. However, the low and high AQ groups displayed different patterns of results (see Figure 1). An ANOVA with AQ group as the between subjects variable showed a significant effect of autistic traits on sensitivity to angry walkers, $F(21, 1) = 4.719$, $p < .05$. Notably, AQ score did not influence sensitivity to walkers exhibiting any other emotions. The low AQ group demonstrated heightened sensitivity to angry walkers versus the other emotional movements, but the high AQ group failed to exhibit this perceptual advantage. Individuals with few autistic traits exhibited the anger-superiority effect, where angry walkers were detected with greater accuracy than walkers expressing other emotions.

CONTROL EXPERIMENT

Do socially adept observers demonstrate heightened visual sensitivity to angry point-light walkers because perceptual processes are enhanced for potentially threatening stimuli or because angry movement consists of velocity profiles with abrupt transitions? In other words, do AQ scores correlate with detecting the presence of angry emotional content per se, or with detecting the presence of abruptly changing velocities in general? To address this question, the previous experiment was replicated with inverted

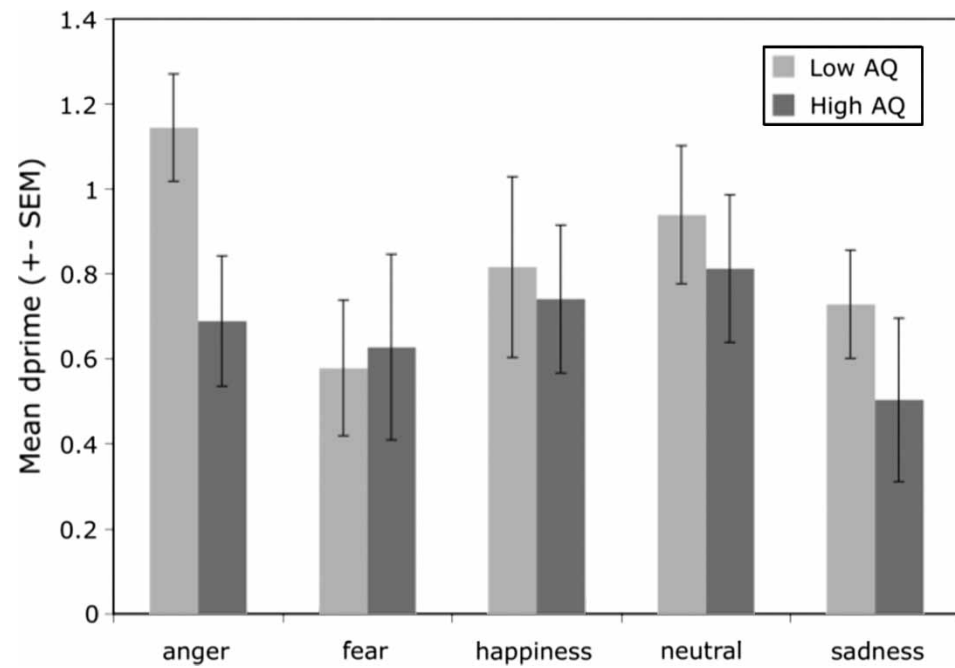


Figure 1. Sensitivity to emotions by AQ group.

displays. Specifically, a different group of participants again reported whether or not a coherent, but now inverted, point-light walker was present within a scrambled mask. The results of this control experiment indicated that the anger-superiority effect decreased significantly with inverted displays. Since the velocity profiles are identical in the upright and inverted displays, these results suggest that visual sensitivity to angry human movements, per se, is modulated by the observer's social abilities.

DISCUSSION AND IMPLICATIONS

This set of psychophysical experiments systematically examined the relationship between social skills and perceptual sensitivity to biological motion. A median split of AQ scores found that individuals with high AQ scores did not demonstrate heightened sensitivity to point-light displays of angry, and thus potentially threatening, human gaits. Conversely, our results also indicate that observers with more autistic traits exhibit relatively decreased visual sensitivity to such potential threat. Such decreased sensitivity to anger is interesting because it (1) supports the idea that autistic traits extend into the general population, (2) compliments and extends findings of impaired visual analysis of biological motion in individuals with autism (Blake, Turner, Smoski, Pozdol, & Stone, 2003; Kaiser, Delmolino, & Shiffrar, 2008), and (3) highlights the critical connection between social skills and sensitivity to negative emotions as essential for social survival.

A large body of research has shown that visual analysis of human movement differs from the analysis of object movement and is supported by distinct neural mechanisms in typical adults. Many studies have assumed that this privileged analysis of human action is characteristic of the typical population. This research indicates that individual differences in social skills may influence, or be influenced by, perceptual sensitivity to emotional movements.

REFERENCES

- Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The Autism-Spectrum Quotient (AQ): Evidence from Asperger Syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders*, 31, 5–17.
- Blake, R., Turner, L. M., Smoski, M. J., Pozdol, S. L., & Stone, W. L. (2003). Visual recognition of biological motion is impaired in children with autism. *Psychological Science*, 14, 151–157.
- Boddaert, N., Chabane, N., Gervais, H., Good, C. D., Bourgeois, M., Plumet, M.-H., et al. (2004). Superior temporal sulcus anatomical abnormalities in childhood autism: A voxel-based morphometry MRI study. *Neuroimage*, 23, 364–369.
- Chouchourelou, A., Matsuka, T., Harber, K., & Shiffrar, M. (2006). The visual analysis of emotional actions. *Social Neuroscience*, 1, 63–74.

- Howard, M. A., Cowell, P. E., Boucher, J., Brooks, P., Mayes, A., Farrant, A., & Roberts, N. (2000). Convergent neuroanatomical and behavioural evidence of an amygdala hypothesis of autism. *NeuroReport*, 11, 2931–2935.
- Kaiser, M. D., Fermano, Z., & Shiffrar, M. (2008, May). *Visual sensitivity to human movement and the magnitude of autistic traits*. Paper presented at the annual International Meeting for Autism Research, London, UK.

Context-free inhibition: Attentional biases transfer strongly across temporal and spatial search tasks

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Visual search has traditionally been studied in the context of bottom-up (display-driven) and top-down (knowledge-driven) factors (Treisman & Gelade, 1980; Wolfe, 1994). Recently, there has also been a growing interest in the role of recent experience on visual search performance (e.g., intertrial effects; Maljkovic & Nakayama, 1994). Our research focuses on one specific intertrial effect in visual search: The distractor previewing effect (DPE; Goolsby, Grabowecky, & Suzuki, 2005; Lleras, Kawahara, Wan, & Ariga, 2008). The DPE occurs in the context of an oddball search task, when target-present trials are preceded by target-absent trials (i.e., a trial with no oddball). The DPE refers to the finding that an observer's ability to select an oddball target is impaired when on the immediately preceding target-absent trial, all the distractors belonged to the same visual category as the current oddball target (e.g., all prior distractors were green, and the current target is green).

The DPE and most intertrial effects have been primarily studied within the context of spatial search tasks in which all stimuli are presented simultaneously on a single display. Recently, however, an analogous pattern of results was observed in the context of temporal search tasks, using rapid serial visual presentation stimuli (RSVP; see Lleras, Kawahara, Levinthal, & Polychronopoulos, 2008): When observers are asked to identify the odd-coloured letter in an RSVP stream of homogeneously coloured letters, selection of that target is impaired if the target has the same colour as the distractors on the immediately preceding RSVP stream.

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