Consciousness and Cognition 65 (2018) 271–279

Contents lists available at ScienceDirect

Consciousness and Cognition

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

An investigation of global-local processing bias in a large sample of typical individuals varying in autism traits

Dana A. Hayward[a,*], Can Fenerci[b], Jelena Ristic[b,*]

[a] Department of Psychology, University of Alberta, P-217 Biological Sciences Building, Edmonton, AB T6G 2R3, Canada
[b] Department of Psychology, McGill University, 1205 Dr Penfield Ave, Montreal, QC H3A 1B1, Canada

ARTICLE INFO

Keywords:
Navon hierarchical figures task
Autism traits
Visual processing
Global-local processing
Individual differences

ABSTRACT

Although individuals with an autism spectrum disorder display impaired function across several social and behavioral domains, they possess intact, and often superior visual processing abilities for local relative to global aspects of their visual environment. To address whether differences in visual processing similarly vary within typical individuals as a function of their level of social competence, using the Navon hierarchical figures task, here we examined the relationship between global-local visual processing style and the number of autism-like traits in a large sample of 434 typically developed persons. In line with the existing literature, our data indicated an overall global processing bias. However, this overall visual processing style did not vary with participants' number of autism-like traits. These results suggest that the visual processing of Navon figures may be different in typical individuals vs. those with an autism spectrum disorder, with those differences potentially reflecting specific stimulus and task settings.

1. Introduction

Autism spectrum disorder (ASD) is marked with difficulties in social communication and restricted and repetitive interests and behaviors (American Psychiatric Association, 2013). Research shows that these social and behavioral difficulties may partly reflect the differences by which individuals with ASD perceive their visual environment (e.g., Behrmann et al., 2006; Bertone, Mottron, Jelenic, & Faubert, 2003, 2005; Happé, 1999; Hayward & Ristic, 2017; Muth, Hönekopp, & Falter, 2014; Plaisted, Swettenham, & Rees, 1999; Wang, Mottron, Peng, Berthiaume, & Dawson, 2007). Typically developing (TD) individuals tend to process visual information as a global whole, focusing on the overall information (i.e., demonstrating the so-called global processing advantage; Love, Rouder, & Wisniewski, 1999; Navon, 1977; Poirel, Pineau, & Mellet, 2008) while individuals with ASD tend to process visual information as a series of parts, focusing on the local visual elements (i.e., demonstrating the so-called local processing advantage; Behrmann et al., 2006; Muth et al., 2014; Wang et al., 2007). Here we examined if global-local visual processing style varied as a function of the number of autism-like traits within a large sample of TD individuals.

Global and local visual processing is often measured by performance on the Navon hierarchical figures task (Navon, 1977), which assesses the extent to which individuals allocate their attention to either the whole visual form (global) or its constituent features (local). In this procedure, participants are presented with a global stimulus (i.e., a large letter) made up of local stimuli (i.e., small letters; Fig. 1). The identity of the global and local forms is manipulated as either compatible (i.e., congruent, with identical global and local forms) or incompatible (i.e., incongruent, with different global and local forms). Participants are asked to respond to a target letter occurring at either the global or the local level.

* Corresponding authors.
E-mail addresses: dana.hayward@ualberta.ca (D.A. Hayward), jelena.ristic@mcgill.ca (J. Ristic).

https://doi.org/10.1016/j.concog.2018.09.002
Received 5 April 2018; Received in revised form 23 July 2018; Accepted 2 September 2018

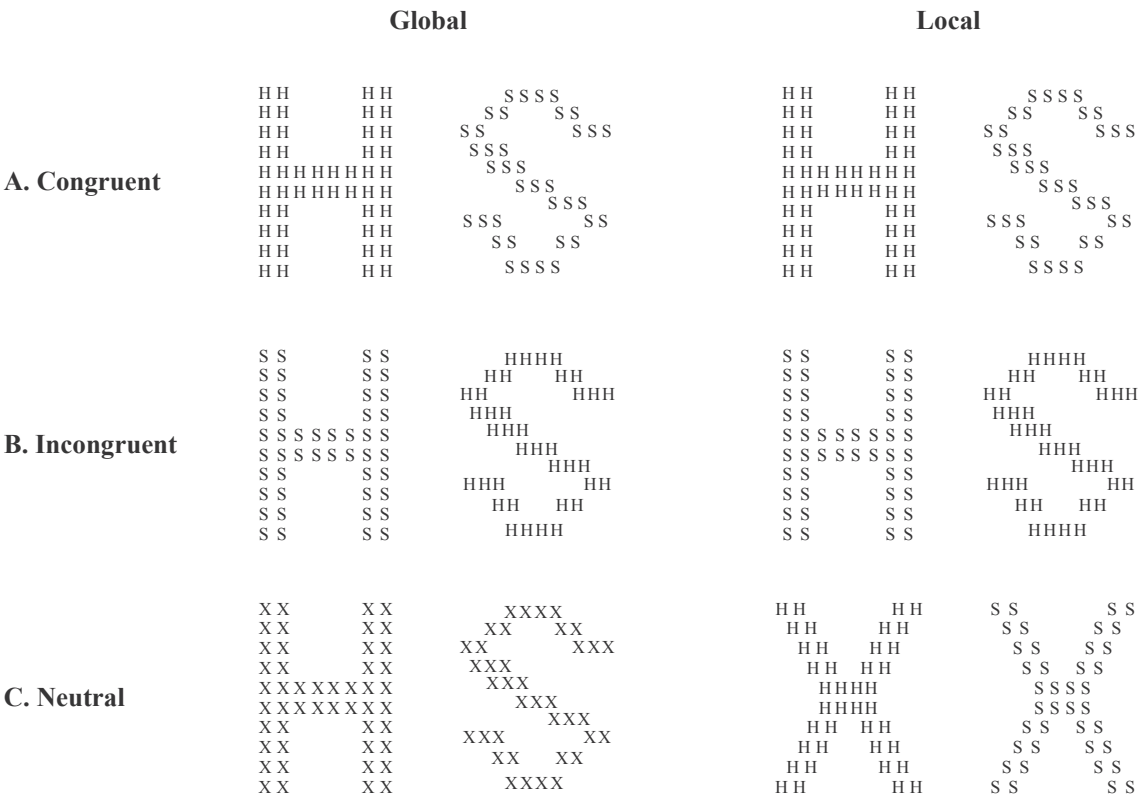

Fig. 1. Stimuli (not to scale) used for the Global and Local tasks, as a function of Congruency.

Two response patterns characterize the performance of TD individuals. One, participants are faster and more accurate when responding to the global relative to the local form. That is, TD participants show a global processing advantage (Love et al., 1999; Navon, 1977; Poirel et al., 2008). Two, on incongruent trials, they are slower and less accurate when asked to respond to the local form relative to when they are asked to respond to the global form. That is, TD participants also show global interference (Love et al., 1999; Navon, 1977; Poirel et al., 2008).

The data collected with individuals with ASD are not as clear-cut. Studies that have investigated global-local visual processing within this group using a variety of tasks (e.g., block design task, Bölte, Hubl, Dierks, Holtmann, & Poustka, 2008; auditory sequences of tones, Bouvet, Simard-Meilleur, Paignon, Mottron, & Donnadieu, 2014; embedded figures test, Jolliffe & Baron-Cohen, 1997) have found a local processing advantage, whereby persons with ASD performed equivalently or superiorly compared to TD individuals for the local forms (Behrmann et al., 2006; Muth et al., 2014; Plaisted et al., 1999, divided attention task; Wang et al., 2007). For example, Behrmann et al. (2006) examined the performance of 14 individuals with ASD on a typical Navon hierarchical figures task, and found overall faster responses for the local as compared to the global forms (i.e., local advantage) as well as slower responses for the incongruent trials when global form identification was required (i.e., local interference). Other researchers however have not been able to find the same effects (e.g., Hayward et al., 2012; Mottron, Burack, Iarocci, Belleville, & Enns, 2003; Ozonoff, Strayer, McMahon, & Filloux, 1994). For example, Hayward et al. (2012) reported no difference in the performance between ASD and TD young adults, with both groups demonstrating global advantage and global interference effects. In addition, while typically developing individuals show a consistent global visual processing advantage and global interference effects on the Navon task, the performance of individuals with ASD, although not as robust, shows some indication that they are slower to process global content relative to matched controls (see Van der Hallen, Evers, Brewaeys, Van den Noortgate, & Wagemans, 2015 for a recent meta-analysis).

One possible reason for these mixed results could be individual variability in ASD symptom severity, such that there could be a relationship between global and/or local visual processing bias and degree of between-individual autism symptomology (e.g., Brunsdon & Happé, 2014; Van Eylen, Boets, Steyaert, Wagemans, & Noens, 2018). Typically, due to restrictions in sample size, clinical studies tend to investigate the differences between ASD and TD participants by contrasting average group performance. As such, only a modest number of studies (Chen, Rodgers, & McConachie, 2009; Eussen, Van Gool, Louwerse, Verhulst, & Greaves-Lord, 2016; Van Eylen et al., 2018) have so far investigated the relationship between individual ASD symptom severity and visual processing style. One of those studies conducted by Van Eylen et al. (2018) used a battery of non-Navon visual tasks and found that indices of global-local processing correlated with social and non-social ASD symptom severity as measured by the Social Responsiveness Scale (Constantino & Gruber, 2005) and the Repetitive Behavior Scale-Revised (Bodfish, Symons, Parker, & Lewis, 2000),