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The content and function of interests in the broad autism phenotype

Kerriane E. Morrison*, Lacey K. Chambers, Daniel J. Faso, Noah J. Sasson

School of Behavioral and Brain Sciences, The University of Texas at Dallas, 800 W. Campbell Rd., GR41, Richardson, TX 75080, USA



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ABSTRACT

Background: The Broad Autism Phenotype (BAP) refers to mild characteristics of autism spectrum disorder (ASD) that extend beyond the threshold of diagnosis into the general population. Individuals with BAP traits exhibit reduced social skill and social cognitive ability relative to individuals without these traits, but the degree to which non-social aspects of ASD extend to the BAP has received considerably less attention. The current study examined whether a prominent non-social characteristic of ASD, circumscribed interests (CIs), are qualitatively similar in the BAP.

Method: Typically-developing adults (N = 174) categorized as either BAP positive (n = 49) or BAP negative (n = 125) on the Broad Autism Phenotype Questionnaire rated their subjective emotional responses to images of common CIs and non-CIs (i.e., interests not commonly reported in ASD). Participants also completed the Interests Scale measuring the number of their current interests and the intensity with which they pursue their primary interest.

Results: BAP positive adults rated CIs more arousing (i.e., more energizing) and non-CIs lower on valence (i.e., less pleasurable) compared to BAP negative adults. Additionally, BAP positive males but not females showed higher valence responses for CIs relative to their BAP negative counterparts. BAP positive adults also endorsed more CIs than BAP negative adults on the Interests Scale, and reported greater intensity and inflexibility when engaging with their primary interest.

Conclusions: These findings suggest that many aspects of the content and function of CIs reported for autism extend to the BAP in the general population in a milder form.

1. Introduction

The Broad Autism Phenotype (BAP) consists of mild autism-related traits that do not rise to the level of diagnosis (Bolton et al., 1994; Constantino & Todd, 2003; Piven & Palmer, 1999). Although the BAP includes traits that are both social (e.g., social reticence and unctactful behavior) and non-social (e.g., rigid or perfectionistic behaviors) corresponding to core features of Autism Spectrum Disorder (ASD; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001; Hurley, Losh, Parlier, Reznik, & Piven, 2007; Losh et al., 2009), research examining cognitive and behavioral manifestations of the BAP has largely focused on its social features. These studies have demonstrated that social BAP traits in the general population are associated with reduced social skill and social cognitive ability (Ingersoll, 2010; Losh et al., 2009; Losh & Piven, 2007; Sasson, Nowlin, & Pinkham, 2013), and poorer social outcomes, including higher levels of loneliness and lower friendship satisfaction (Faso, Corretti, Ackerman, & Sasson, 2016; Jobe & White, 2007; Wainer, Ingersoll, & Hopwood, 2011; Wainer, Block, Donnellan, & Ingersoll, 2013).

By comparison, there has been little work examining how non-social characteristics of ASD extend to the BAP. Non-social

* Corresponding author.

E-mail address: kerriane.morrison@utdallas.edu (K.E. Morrison).

characteristics of ASD generally fall under the category of repetitive and restricted behaviors, including motor stereotypies, ritualistic behavior, sensory sensitivities, and circumscribed interests (CIs; [Esbensen, Seltzer, Lam, & Bodfish, 2009](#)). CIs are defined as an abnormally intense preoccupation with a restricted range of activities or objects that interfere with daily functioning ([American Psychiatric Association, 2013](#)). They affect up to 88% of individuals with ASD ([Klin, Danovitch, Merz, & Volkmar, 2007](#)), making it one of the most prevalent characteristics of the disorder. Although strong interests are normative during early childhood ([DeLoache, Simcock, & Macari, 2007](#)), both the content and function of these interests differ between children with ASD and typically developing children ([Anthony et al., 2013](#); [Baron-Cohen & Wheelwright, 1999](#); [Turner-Brown, Lam, Holtzclaw, Dichter, & Bodfish, 2011](#)). For example, individuals with ASD typically show more interest in non-social systematizing domains (e.g., understanding machines, numbers), and less interest in social domains and activities (e.g., sports; [Anthony et al., 2013](#); [Baron Cohen & Wheelwright, 1999](#); [South, Ozonoff, & McMahon, 2005](#)). These patterns do not abate in adolescence or adulthood, and can negatively impact communication and daily functioning ([Bruckner & Yoder, 2007](#); [Chowdhury, Benson, & Hillier, 2010](#); [Piven, Harper, Palmer, & Arndt, 1996](#); [South et al., 2005](#); [Turner-Brown et al., 2011](#)). Indeed, parents of children with ASD report that the accommodation needed to manage circumscribed interests and behaviors is among the biggest challenges they encounter on a day-to-day basis ([Mercier, Mottron, & Belleville, 2000](#); [South et al., 2005](#)). Thus, although CIs offer positive benefits to many individuals with ASD, providing reward and pleasure ([Dichter et al., 2010](#); [Sasson, Dichter, & Bodfish, 2012](#)), areas of unique strength ([Mercier et al., 2000](#)), and can in some cases create avenues to specialized skills and vocational ability ([Koenig & Hough, 2017](#)), they are clinically-relevant in ASD because they can impair daily functioning and interfere with the development of social skills ([Turner-Brown et al., 2011](#)).

The BAP, however, is not a clinical diagnosis and therefore is not presumed to be clinically impairing. Thus, interests in the BAP may be similar in content (e.g., a greater preference for non-social and systemizing domains) and function (e.g., pursued with high intensity and inflexibility) to those in ASD, but not to an impairing degree. The current study assessed whether the content and function of interests differ for individuals with and without the BAP. Specifically, we tested whether individuals with the BAP would demonstrate a greater tendency than those without the BAP to pursue and derive pleasure from common CIs in ASD, and interact with them in a more circumscribed and restricted manner. This was assessed in several ways.

First, participants provided subjective ratings of valence and arousal for a series of images depicting CIs commonly reported in ASD and interests not commonly reported as CIs. Valence and arousal are separable components of emotion elicited in response to various stimuli ([Lang, 1995](#)). Whereas valence refers to the perceived “pleasantness” of a stimulus that evokes a positive or negative state of mind associated with approach and withdrawal behavior, arousal is the perceived feeling of energy generated by a stimulus, ranging from calm to excited. Given prior findings indicating that adults with ASD report elevated positive valence but not higher arousal ratings to images of common CIs and less positive valence ratings to social images than typically-developing controls ([Sasson et al., 2012](#)), we anticipate similar differences to emerge in the current study between adults high and low on BAP traits. Second, participants completed the Interests Scale ([Bodfish, 2003](#)), a validated inventory developed to measure the current number of CIs and the intensity of involvement of a primary interest, including whether (as is often seen in ASD) the interest interferes with other aspects of life, requires accommodation, and is pursued inflexibly. We hypothesized that individuals with the BAP would endorse fewer total interests than those without the BAP, signifying a more “circumscribed” range of interests, but more CIs than those without the BAP. We also expected for high BAP individuals to report greater intensity, involvement, and inflexibility with their primary interest. Finally, we also explored whether these patterns might be differently associated with social and non-social sub-domains of the BAP.

2. Methods

2.1. Participants

One hundred and seventy-nine undergraduates ranging in age from 18 to 39 participated in this study. Undergraduates were recruited through the university’s online study sign-up system that allowed them to receive course credit for participating in research. Five participants were excluded from data analyses for the following reasons: one reported an ASD diagnosis, two were younger than 18, and two did not complete the entire study battery. Using G*Power version 3.1, this sample size was determined to be sufficient to detect a small effect with at least 95% power ([Faul, Erdfelder, Buchner, & Lang, 2009](#)). The university’s Institutional Review Board approved this study and this study is consistent with the ethical standards of the Declaration of Helsinki. All participants provided informed consent.

2.2. Measures and procedures

Participants first completed the reading subtest of the Wide Range Achievement Test 3rd Edition (WRAT-3; [Wilkinson, 1993](#)) as an estimate of IQ, and then completed the following tasks in a counterbalanced order on a computer desktop through an online survey interface: the Broad Autism Phenotype Questionnaire (BAPQ), the Valence and Arousal of Interests task, the Interests Scale, and a demographic questionnaire.

2.2.1. Broad autism phenotype questionnaire

The self-report version of the Broad Autism Phenotype Questionnaire (BAPQ; [Hurley et al., 2007](#)) is a 36-item questionnaire assessing subclinical autistic traits. While many measures have been developed to parse autistic traits in the general population and ASD population (e.g., Autism Spectrum Quotient (AQ), Social Responsiveness Scale), the BAPQ was developed specifically to measure

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