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An examination of response variability in children with autism and the relationship to restricted repetitive behavior subtypes

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ABSTRACT

The current study investigated response variability in children with autism and its relationship to restricted repetitive behaviors, one of the core symptoms of the disorder. The "Penny-Hiding Game" (Baron-Cohen, 1992) was used as a measure of response variability. Variability was compared for children with autism ($n = 65$) and typically developing children ($n = 65$) and patterns of response variability were categorized from least variable to most variable for both groups. For the participants with a diagnosis of autism, these patterns were examined relative to their scores on the Repetitive Behavior Scale-Revised (RBS-R; Bodfish, Symons, & Lewis, 1999). Results showed that children with autism demonstrated significantly lower variability in their responding in the "Penny-Hiding Game" than their typically developing peers. Variability was significantly negatively correlated with total RBS-R scores and with the Stereotypy subscale and the self-injurious behavior subscale, indicating that lower variability in responding was related to higher rates of these types of restricted and repetitive behaviors. No significant correlations were observed between variability and the Compulsion subscale, the Ritualistic/Sameness behaviors subscale or the Restricted Interests subscale.

1. Introduction

Restricted repetitive behaviors may be regarded as a lack of behavioral variability as such behaviors are, by definition, invariable (Rodriguez & Thompson, 2014). Early research has previously demonstrated that children diagnosed with autism are prone to perseveration (Mullins & Rincover, 1985); do not sample available options in their environment (Boucher, 1977), and often respond to a limited portion of their environment (Lovaas, Schreibman, Koegel, & Rehm, 1971). In addition, they frequently demonstrate repetitive body movements and object manipulations, insistence on sameness of environment or daily routines and circumscribed interests (Gabriels et al., 2008).

Researchers in the field of the experimental analysis of behavior have been investigating behavioral variability for several decades (e.g., Blough, 1966; Maltzman, 1960; Pryor, Haag, & O'Reilly, 1969). In this time, robust methods for increasing variability have been devised (Machado, 1989; Page & Neuringer, 1985; Ross & Neuringer, 2002). As increasing numbers of

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applied researchers begin to investigate these methods, a growing discussion of the merit of using such procedures to decrease restricted repetitive behaviors in the clinical population, has been observed (Murray & Healy, 2013; Napolitano, Smith, Zarcone, Doodkin, & McAdam, 2010).

The term restricted repetitive behaviors (RRBs) refers to a broad class of behaviors characterized by repetition, rigidity, and invariance (Lewis, Tanimura, Lee, & Bodfish, 2007). A two-factor description of RRBs has been outlined in the research literature (Cuccaro et al., 2003; Turner, 1999). The "lower order" category, called Repetitive Sensory and Motor Behaviors (RSMB) is associated with lower IQ and the "higher order" category, called Insistence on Sameness (IS) is associated with higher IQ. While the RSMB category is observed across different disorders (e.g., Tourette's syndrome), the IS category may be especially important in autism research and intervention, as it appears to be particularly characteristic of this population (Lam, Bodfish, & Piven, 2008).

Lam et al. (2008) carried out an exploratory factor analysis using the scores of 316 participants with autism on the 10 items of the Autism Diagnostic Interview – Revised (Lord, Rutter, & Le Couteur, 1994) that assessed restricted repetitive behaviors. The authors recommended that a third category or factor, Circumscribed Interests (CI) be added as it appeared to be distinct from the RSMB and IS categories. In their sample, Lam et al. (2008) noted that RSMB was more prevalent in younger participants, those with lower IQ test scores and those with greater social and communication deficits. IS, on the other hand, was shown to be related to social and communication deficits and greater autism severity scores while CI was not significantly related to IQ or any of the other autism symptom domains on the ADI-R.

Despite the fact that the presence of RRBs is one of the diagnostic features of autism (American Psychological Association, 2013), it has been argued that these characteristics have not received the same level of attention in the research literature as social and communication deficits (Turner, 1999). Furthermore, RRBs form a class of behavior that many clinicians and researchers consider a problematic and pervasive aberrant behavior to target with intervention (Cunningham & Schreibman, 2008).

With applied researchers recommending that methods derived from research on variability be investigated as remediation strategies for RRBs in autism, this may represent a shift in the conceptualization of RRBs from a problem behavior that should be targeted through behavior reduction procedures (Rapp & Vollmer, 2005), to a deficit that may be addressed through reinforcement strategies (Lee, Sturmey, & Fields, 2007). The relationship between RRBs and behavioral variability has not been the subject of investigation to date. While researchers have shown that individuals with autism demonstrate lower variability than their typically developing peers (Baron-Cohen, 1992; Miller & Neuringer, 2000), the level and type of RRBs associated with low variability have not been investigated. Baron-Cohen (1992) examined response patterns and deception in individuals with autism using a simple game, commonly observed in parent–child interactions. He reported that children with autism ($n = 15$) were more likely to generate repetitive and predictable patterns than those with intellectual disability ($n = 15$) or their typically developing peers ($n = 15$). Miller and Neuringer (2000) examined variability in responding, on a computer task, with adolescents with autism ($n = 5$) and child ($n = 4$) and adult ($n = 5$) controls. The authors demonstrated that the adolescents with autism showed significantly lower variability on the task than the two control groups. Although the researchers demonstrated low variability in participants with autism, the extent of the relationship between patterns of variability in responding and the presence, severity and type of RRBs in individuals with autism is unknown.

Baron-Cohen (1992) investigated response patterns and deception in individuals with ASD using a naturalistic test, the "Penny-Hiding Game", which is commonly observed in parent–child interactions. The author reported that children with autism were more likely to generate repetitive and predictable patterns than those with intellectual disability or their neurotypical peers. This outcome has been cited as evidence for low variability in responding in individuals with ASD relative to their peers (Miller & Neuringer, 2000; Neuringer, 2002; Rodriguez & Thompson, 2014).

The "Penny-Hiding Game" was implemented in the current study as a test of response variability. The first aim was to investigate the difference in levels of variability shown by participants with and without autism using a larger sample of participants than Baron-Cohen (1992) and Miller and Neuringer (2000). The second aim was to determine whether lower behavioral variability was related to higher rates of RRBs among the participants with autism. The third aim was to determine whether particular categories of RRBs would be more or less related to low variability among this population.

2. Method

2.1. Participants

Two groups of children participated in this study. Group 1 consisted of 65 children with a diagnosis of autism (56 male, 9 female). Group 2 consisted of 65 typically developing children (27 male, 38 female). The mean age of the participants in Group 1 was 107.6 months (SD: 37.15 months; range: 49–203 months). The mean age of the participants in Group 2 was 112.28 months (SD: 42.63 months; range: 48–199 months). All participants in Group 1 had obtained a diagnosis of autism in line with DSM-IV criteria, from a registered psychologist, who was independent of this study. Participants in Group 1 were recruited from a wide range of educational settings, including mainstream schools, special classes in mainstream schools and special schools for children with autism and other developmental disabilities. Additional participant information, such as verbal ability and IQ was not gathered in the current study in order to keep response effort low for the relevant stakeholders.