



Intact non-word repetition and similar error patterns in language-matched children with autism spectrum disorders: A pilot study



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ABSTRACT

Purpose: We investigated whether enhanced auditory short-term memory may contribute to the learning of novel word forms in children with Autism Spectrum Disorder. We also evaluated whether delayed but qualitatively normal, versus atypical, cognitive processes underlie non-word repetition in this population *via* a detailed error analysis.

Method: English-speaking children with Autism Spectrum Disorder (who had significant language delay) and typically-developing children matched pairwise on language ability were compared on the Syllable Repetition Task (Shriberg et al., 2009).

Results: All children exhibited better performance on stimuli of shorter vs. longer syllable length. In addition there was a significant interaction whereby children with Autism Spectrum Disorder performed better than typically-developing children at the longest syllable length. Repetition accuracy was significantly correlated with language level in both groups. In contrast, the relationship between Repetition accuracy and age was only marginally significant in the Autism Spectrum Disorder group and did not reach significance in the typically-developing group. This underscores the importance of language level to non-word repetition performance, and supports the practice of matching on language rather than age alone. An error analysis (Shriberg et al., 2012) showed many similarities between groups in terms of number of consonants deleted, encoding accuracy, and transcoding accuracy components of the task. However the Autism Spectrum Disorder group tended to display better auditory short-term memory with a medium effect size, though this did not reach significance given the small sample size.

Conclusion: These findings extend evidence of delayed but qualitatively normal non-word repetition previously described in preadolescents with Autism Spectrum Disorder (Williams et al., 2013) to younger kindergarten-age children with Autism Spectrum Disorder and language delay, indicating that non-word repetition is not an area of specific difficulty for this population. With respect to enhanced auditory short-term memory, we found preliminary evidence of better memory for longer nonwords in children with Autism Spectrum Disorder compared to younger typically developing children who were matched on language.

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1. Introduction

Autism spectrum disorders (ASD) are defined by impairments in social interaction and communication as well as repetitive interests and behaviors (American Psychiatric Association [APA], 2013). Early language delays are common but not universal in young children with ASD (e.g., Luyster, Kadlec, Carter, & Tager-Flusberg, 2008; Weismer, Lord, & Esler, 2010). Yet, perhaps counterintuitively, aspects of auditory processing have been shown to be enhanced in adolescents and adults with Autism Spectrum Disorders (ASD), across a growing body of studies testing identification or discrimination of pitch of pure tones (e.g., Bonnel et al., 2003; Jones et al., 2009), complex tones (e.g., Heaton, 2003; Mottron, Peretz, & Ménard, 2000), as well as processing of pitch contour and rhythm in speech (Heaton, Hudry, Ludlow, & Hill, 2008; Järvinen-Pasley, Wallace, Ramus, Happé, & Heaton, 2008). A review of this literature in 2011 by Haesen, Boets, and Wagemans concluded that “identification and discrimination of isolated acoustic features (in particular pitch processing) is generally intact or enhanced in individuals with ASD, for pure as well as for complex tones and speech sounds.” (p. 701). With respect to the mechanism that leads to enhanced local auditory processing, Bonnel et al. (2003, p. 230) suggest that high-functioning individuals with ASD may have more robust auditory short-term memory for pitch that is relatively resistant to the temporal decay and interference that affect neurotypical individuals. Two theories, Weak Central Coherence (Frith, 2003; Frith & Happé, 1994; Happe, 1999), and Enhanced Perceptual Functioning (Mottron and Burack, 2001; Mottron, Dawson, Soulières, Hubert, & Burack, 2006), predict enhanced local processing in ASD (along with either decreased or optional global processing, not investigated in the current study). However, we do not know if enhanced perception of acoustic features may hold implications for language learning.

Does enhanced local auditory processing extend to the initial learning of novel word forms in children with ASD? Findings from an experimental word-learning task conducted by Norbury, Griffiths, and Nation (2010) suggest that it does. These authors found that 6- to 8-year-olds with ASD were significantly better at producing the phonological forms of novel words soon after learning them than were typically-developing children matched for age, nonverbal IQ, and vocabulary ability, although this difference was not maintained four weeks later. Norbury et al. (2010) proposed that this heightened phonological skill may provide a mechanism by which children with autism learn new vocabulary, despite relying less on social cues. That is, while typically-developing (TYP) children may pay particular attention to social information in word learning situations (Norbury et al., 2010; Parish-Morris, Hennon, Hirsh-Pasek, Golinkoff, & Tager-Flusberg, 2007), children with ASD may focus more of their attention on the sound structure of language (Järvinen-Pasley, Pasley, & Heaton, 2008; Norbury et al., 2010).

Non-word repetition tasks, where participants are asked to repeat a novel string of syllables in the absence of a referent, offer another window onto the initial processing of word forms. The aims of the current study are to better understand the nature of non-word repetition in younger children with ASD (mean age = 5;8) than those reported on previously by 1) comparing their non-word repetition accuracy to a typically-developing group matched on a global measure of receptive and expressive language 2) examining if repetition accuracy is more strongly associated with language level or with age in ASD, and 3) investigating different components of non-word repetition ability via an error analysis reflecting encoding, memory, and transcoding or production aspects of the task (Shriberg, Lohmeier, Strand, & Jackielski, 2012). Together these measures will provide evidence as to whether non-word repetition is delayed but in line with expressive language skills in ASD, or whether it is an area of particular impairment as reported for children with Specific Language Impairment (discussed in more detail below).

Prior work on non-word repetition reveals that *language impaired* children and adolescents with ASD (ASD + LI) perform poorly relative to standardized test norms (Kjelgaard and Tager-Flusberg, 2001) or age-matched TYP comparison groups (Gabig, 2008; Whitehouse, Barry, & Bishop, 2008). In contrast, children and adolescents with ASD and age-appropriate structural language are unimpaired in non-word repetition relative to TYP children of the same age (Kjelgaard and Tager-Flusberg, 2001; Whitehouse et al., 2008), highlighting that difficulties are tied to poor language ability rather than ASD per se. Notably, individuals with Specific Language Impairment demonstrate severe decrements in non-word repetition despite being matched on global measures of language ability to typically-developing groups, particularly when non-word stimuli are long (4 or 5 syllables in length, Riches, Loucas, Baird, Charman, & Simonoff, 2011; Whitehouse et al., 2008; Williams et al., 2013). Yet individuals with ASD, even those with significant language impairment, do not display the same pattern. The significantly better non-word repetition performance of participants with ASD + LI relative to those with Specific Language Impairment in several studies has provided evidence against overlap of these disorders, and for distinct underlying causes of non-word repetition difficulty in each case. These results are important in informing an active debate as to whether ASD and SLI share the same etiology (e.g., Kjelgaard and Tager-Flusberg, 2001; Leyfer, Tager-Flusberg, Dowd, Tomblin, & Folstein, 2008), or whether the similarities observed in language profiles are superficial but stem from distinct underlying causes (e.g., Whitehouse et al., 2008; Williams, Botting, & Boucher, 2008; Williams, Payne & Marshall, 2013).

As highlighted by Williams et al. (2013), a language-matched typically-developing comparison group is essential to understanding whether differences in performance stem from a qualitatively similar delay in a given ability, versus a deviant pattern of performance. Though this comparison is widely employed in the non-word repetition literature on SLI, Williams et al. (2013) were the first to conduct such a comparison among children (mean age 12 years) with ASD + LI, SLI, and typical development, as well as younger typically-developing children matched on verbal mental age. They developed 64 complex non-word stimuli (e.g., krifyimp, boflisentim) to examine known difficulties with increased syllable length and the production of medial consonant clusters in SLI (Marshall and van der Lely, 2009). Strikingly, they found that children with

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