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Is interference control in children with specific language impairment similar to that of children with autistic spectrum disorder?



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ABSTRACT

Aims: The purpose of the study was to examine resistance to proactive interference, which is strongly associated with working memory (WM) performance and language processing, in children with specific language impairment (SLI), with autism spectrum disorder (ASD), and with typical development (TD).

Methods: Sixty children (eight to ten years; matched in age and nonverbal IQ) participated in the study. Resistance to proactive interference was measured using a verbal conflict paradigm.

Results: Children with SLI and ASD show a deficit in resistance to proactive interference compared to their TD peers, but the source of the problem appears to be different for the two clinical groups. The interference problem exhibited by the children with SLI is related to a more complex deficit involving different cognitive-linguistic functions, whereas the children with ASD show a specific problem in cognitive flexibility.

Implications: The theoretical implications are that poor resistance to interference may be caused by weaknesses in different WM functions, such as a deficit in updating or responses based on familiarity rather than recollection. The clinical implications are that children with SLI and ASD show distinct patterns of performance; therefore they need different types of intervention to strengthen their resistance to proactive interference.

1. Introduction

Individual variations in inhibition-related functions are associated with different cognitive skills, including working memory (WM; Hasher, Lustig, & Zacks, 1988), reading comprehension (Gernsbacher, 1993), and language processing (Van Dyke, Johns, & Kukona, 2014), as well as with different disorders, such as ADHD (Barkley, 1997; Nigg, 2003), autism spectrum disorder (Adams & Jarrold, 2012; Bishop & Norbury, 2005), and specific language impairment (Marton, Campanelli, Scheuer, & Yoon, 2014; Spaulding, 2010). Although the terms inhibitory control and interference control are often used interchangeably in the clinical literature, most theorists distinguish these two functions from each other (Friedman & Miyake, 2004; Mazuka, Jincho, & Oishi 2009; Wilson & Kipp, 1998).

The present paper is based on Friedman and Miyake (2004) model of inhibitory control, which distinguishes between inhibition of prepotent responses, resistance to distractor interference, and resistance to proactive interference. While prepotent response

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inhibition is about blocking an automatic response, distractor interference refers to the suppression of irrelevant stimuli in the external environment that compete with the target. The focus in this paper is on resistance to proactive interference, which is the ability to suppress the intrusion of previously relevant but currently irrelevant information.

From a developmental perspective, the different inhibitory components show distinct developmental trajectories. Response inhibition develops typically during the preschool years (Mazuka et al., 2009), whereas interference control develops through adolescence (Bjorklund & Harnishfeger, 1990). Although there are shared underlying mechanisms behind automatic response inhibition, resistance to distractor interference and resistance to proactive interference, these three functions are separate (Dempster & Corkill, 1999; Friedman & Miyake, 2004). Further, it is resistance to proactive interference that plays a critical role in language processing and WM performance (Martin-Rhee & Bialystok, 2008; Van Dyke & Johns, 2012). The relationship between WM and interference control strengthens as children become older. An increase in the association between WM and resistance to interference is related to the development of stronger – more active – WM representations, more conscious differentiation between relevant and irrelevant items, and intentional suppression of irrelevant memory traces (Roncadin, Pascual-Leone, Rich, & Dennis 2007). In order to perform well on a WM or language task, current task goals have to be active and previous memory traces need to be suppressed as relevant and irrelevant items compete for the same limited capacity (Unsworth, Brewer, & Spillers 2013).

1.1. Interference control in children with specific language impairment (SLI)

In general, children with SLI exhibit typical sensory and intellectual skills but perform below average on different language tasks and on WM measures (Leonard, 2014; Marton & Schwartz 2003; Montgomery, 2003). Several terms have been used in the literature to classify these children (primary language impairment, developmental language disorder, expressive and receptive language impairment, etc.).¹ We refer to our participants as children with specific language impairment in this paper because this is the most widely used term within the research community. Although there are only a few studies focusing on interference control in children with SLI, there is evidence for a deficit in resisting interference in this population (Pauls & Archibald, 2016).

The first studies that reported problems with resistance to interference in children with SLI did not focus specifically on interference control but on WM capacity. Their error analysis data, however, revealed a weakness in resistance to interference in children with SLI (e.g., Gillam, Cowan, & Day, 1995; Marton, Kelmenson, & Pinkhasova 2007; Weismer, Evans, & Hesketh 1999). These children produced a relatively large number of perseverative errors, which is an indication of poor resistance to proactive interference.

A second line of research involved traditional executive function tasks, such as the Wisconsin Card Sorting test (WCST-64; Kongs, Thompson, Iverson, & Heaton, 2000) and variations of the Stroop test. Although the outcomes are somewhat mixed, the overall results show that children with SLI exhibit problems in tasks that require the selection of relevant information and the suppression of irrelevant stimuli or memory traces. In the Wisconsin Card Sorting test, children with SLI produced more perseverative errors than their peers. These children had difficulty switching from one sorting principle to another as the conditions changed (Marton, 2008). One reason for these perseverative errors may be a deficit in resisting proactive interference.

The results across studies using the Stroop task show inconsistent findings in children with SLI. Most researchers used a version of the color-word task in which children need to name the color of the ink of different color words (e.g., the word blue is printed in red and the correct response is red). To perform well on this task, children have to suppress their automatic response (i.e. reading the word) as they name the color of the ink. In one study, children with SLI exhibited a larger Stroop-effect than their typically developing (TD) peers (Im-Bolter, Johnson, & Pascual-Leone, 2006), whereas in a different study, children with SLI performed similarly to the TD controls (Lukács, Ladányi, Fazekas, & Kemény, 2016). In addition to variations in participants, these two studies also differed in their scientific approach. Im-Bolter and colleagues used the Stroop task to examine inhibition as the interruption of mental attention, whereas Lukács and colleagues viewed inhibition as one of the executive functions within the model of Miyake et al. (2000). The authors of the two studies also performed different data analyses that might have contributed to the contrasting outcomes.

Response inhibition has been found intact in children with SLI by other researchers as well (Laloi, De Jong, & Baker, 2017; Marton, Campanelli, Scheuer, Yoon, & Eichorn, 2012). As indicated by the inhibition and interference control model (Friedman & Miyake, 2004), these two functions are related to each other but are not the same. Based on previous findings, children with SLI perform better in tasks that require withholding an automatic response than in tasks where resistance to interference is needed (Laloi et al., 2017; Marton et al., 2014; Spaulding, 2010).

Henry, Messer, and Nash (2012) developed a different type of Stroop task. First, children were asked to repeat the experimenter's words (e.g., doll, car), then they were instructed to say *doll* when the experimenter said *car* and say *car* when the experimenter said *doll*. Blocks of copying and inhibiting followed each other. Children with SLI performed more poorly than the TD children and this outcome reflected a broader executive function deficit that involved both verbal and nonverbal domains and various functions (e.g., shifting, response inhibition, and working memory updating).

Findings from direct measures of interference control suggest that children with SLI show difficulty resisting both distractor and proactive interference (Marton et al., 2012; Marton et al., 2014; Spaulding, 2010). In Spaulding's study, preschool-age children with

¹ Following a recent debate, a group of researchers and clinicians suggested the use of developmental language disorder (e.g., Bishop, Snowling, Thompson, & Greenhalgh, 2016). Their argument was based on outcomes from a Delphi study. It takes some time, however, to see widespread changes in terminology use in the literature.

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