



Research paper

Performance on verbal and low-verbal false belief tasks: Evidence from children with Williams syndrome



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ABSTRACT

Previous studies that have investigated the relationship between performance on theory of mind (ToM) tasks and verbal abilities in individuals with Williams syndrome (WS) have reported contradictory findings with some showing that language abilities aid performance on ToM tasks while others have found that participants with WS fail these tasks because of their verbal demands. The current study investigated this relationship again comparing performance on a classical change-location task to two newly developed low-verbal tasks, one change-location task and one unexpected content task. Thirty children with WS (aged 5–17;01 years) and 30 typically developing (TD) children (aged between 2;10 years and 9;09 years), who were matched for vocabulary comprehension scores were included in the study. Although performance in the WS group was significantly poorer compared to the TD group on all three tasks, performance was not predicted by their receptive vocabulary or grammatical ability scores. In addition, ToM abilities in both groups depended on the cognitive demands of the task at hand. This finding shows that performance on ToM tasks in WS is not necessarily hindered by their delayed language abilities but rather by the task administered. This could potentially affect the diagnosis of developmental disorders, such as Autism Spectrum Disorders, and comparison of ToM abilities across developmental disorders.

Learning outcomes: Readers of this article should be able to (1) describe the current state of theory of mind research in Williams syndrome, (2) identify which cognitive abilities might explain performance on theory of mind tasks in both typically developing children and in children with Williams syndrome, and (3) interpret the importance of task demands when assessing children's theory of mind abilities.

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1. Introduction

Theory of mind (ToM) is the ability to infer mental states, such as beliefs, desires, intentions and emotions, in order to predict and explain actions (Baron-Cohen, Leslie, & Frith, 1985). Typically developing (TD) children younger than 4 years old generally consider only what they have seen or know, while older children understand that people can hold different beliefs from their own beliefs (Flynn, 2006; Wellman, Cross, & Watson, 2001). The ability to reason about mental states is important

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for social development as well as for language and communication. For example, in conversations we mentalize about the information already known to the listener and which information still needs to be communicated. Furthermore, ToM abilities allow us to monitor other people's beliefs, reason about other people's motives and manage reputations (Frith, 1989). Thus, impaired ToM abilities have been proposed as a possible explanation for some of the social communication difficulties observed in developmental disorders such as autism (Baron-Cohen, 2000). Although ToM abilities have been well researched in the past few decades, it is still unclear what abilities are necessary to develop ToM (Carlson, Moses, & Breton, 2002; Milligan, Astington, & Dack, 2007). For example, some have argued that domain specific abilities, such as certain vocabulary and grammatical abilities are necessary for the development of ToM (for a review see Milligan et al., 2007), whereas others have argued that general intelligence abilities and problem solving skills are better predictors for ToM abilities (Carlson et al., 2002; Carlson, Mandell, & Williams, 2004). In contrast to TD children, ToM abilities and those cognitive abilities that have been argued to be related to ToM understanding, often develop at different rates within developmental disorders and thus, developmental disorders allow investigation of how different abilities are related within development.

Williams syndrome (WS) is a rare neurodevelopmental disorder which is caused by a 1.55 Mb deletion on the long arm of chromosome 7, affecting approximately 28 genes (Schubert, 2009). Individuals with WS show an uneven cognitive profile with lower performance on non-verbal abilities, such as drawing, visuospatial, planning and number processing, compared to verbal ones (Bellugi, Lichtenberger, Jones, Lai, & St-George, 2000; Brock, 2007; Van Herwegen, Rundblad, Davelaar, & Annaz, 2011). However, the onset of language is delayed and thus, a verbal advantage is present in adults but not in very young children (Jarrold, Baddeley, & Hewes, 1998). Furthermore, language development is atypical in that TD children generally start pointing before they start talking, while young children with WS started to point only after they had acquired words (Laing et al., 2002). Socially, individuals with WS can be recognised by their extreme friendliness and their overt social behaviour (Doyle, Bellugi, Korenberg, & Graham, 2004; Jones et al., 2001). Although individuals with WS have an excessive desire towards social contact, they have little contact with peers (Howlin, Davies, & Udwin, 1998) and they have difficulty in making and sustaining friendships (Einfeld, Tonge, & Florio, 1997). In addition, individuals with WS show difficulties in pragmatics (Annaz et al., 2009), especially with conversational skills such as turn taking, conversational coherence and appreciation of conversational context (Laws & Bishop, 2004).

It has been suggested that these difficulties with social relationships and pragmatic abilities are caused by deficits in social understanding and cognition (Sullivan & Tager-Flusberg, 1999). However, evidence has been mixed with some claiming that social understanding is at a level expected for general intellectual abilities in WS (Karmiloff-Smith, Klima, Bellugi, Grant, & Baron-Cohen, 1995), while others have found that ToM abilities are impaired in this population (Sullivan & Tager-Flusberg, 1999; Tager-Flusberg & Sullivan, 2000; Tager-Flusberg, Sullivan, & Boshart, 1997). Several reasons have been proposed to explain these discrepancies. Tager-Flusberg and Sullivan (2000) suggested that ToM comprises of two different components: a social perceptual component that develops early in development and uses facial and bodily expressions to make judgements about people's mental states, and a social cognitive component that builds on the social perceptual component and involves more complex inferences about mental states. It has been suggested that the social perceptual component (e.g., the eyes task in Tager-Flusberg, Boshart, & Baron-Cohen, 1998) is at the expected developmental level in WS, but not the social cognitive component. Thus, studies that used tasks that rely on the social perceptual component would not report any delays or impairments for ToM, while those that employed a more cognitive demanding task would find impaired ToM abilities in WS. However, Tager-Flusberg and Sullivan (2000) acknowledge that it is difficult to find tasks that completely separate these two components. Other discrepancies between studies might be caused by differences in task demands and comparison groups. Although recent studies have investigated these issues (Porter, Coltheart, & Langdon, 2008), further exploration of task demands and the use of a developmental approach is required in order to obtain a complete understanding of ToM abilities in WS. These issues will be discussed below.

Most previous studies investigating ToM abilities in developmental disorders, including WS, have used the Sally–Anne false belief task (Baron-Cohen et al., 1985). This task involves children to understand a narrative that is acted out using props and dolls, after which they answer some questions about this narrative. Thus, failing to understand the narrative could explain why children fail this task. Indeed, several studies have identified that ToM abilities depend on language abilities (de Villiers & de Villiers, 2000; de Villiers & Pyers, 2002; Lohmann & Tomasello, 2003). For example, studies in autism have shown that those children who passed false belief tasks had higher verbal mental abilities (Happé, 1995). Thus, the poor performance in WS on verbal ToM tasks might be caused by difficulties in comprehension of narratives and language rather than ToM abilities per se, since language development is generally delayed, as well as atypical in WS (Brock, 2007). In order to explore the fact that the language abilities in WS might hinder performance on ToM tasks, low-verbal ToM tasks¹ need to be administered.

Using a low-verbal ToM task, Tager-Flusberg et al. (1998) compared 13 adults with WS to age matched TD adults and 13 adults with Prader–Willi Syndrome (PWS) on a task in which participants had to select the mental state that matched the expression of the eyes in 25 photographs. The results showed that both the TD and the WS group performed significantly above chance (at least 17 out of 25 correct), while participants with PWS did not, and thus ToM abilities are not impaired in

¹ The term low-verbal task is used rather than non-verbal task as most tasks labelled as non-verbal in previous studies still included verbal instructions, testing, and control questions.

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