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Nonspecificity and theory of mind: New evidence from a nonverbal false-sign task and children with autism spectrum disorders



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ABSTRACT

Understanding of false belief has long been considered to be a crucial aspect of “theory of mind” that can be explained by a domain-specific mechanism. We argue against this claim using new evidence from a nonverbal false representation task (false-sign task) with typically developing children and children with autism spectrum disorders (ASD). Experiments 1 and 2 showed that typically developing children (mean age = 62.67 months) were equivalent in their performance across nonverbal and verbal forms of both the false-belief and false-sign tasks. Results for these two misrepresentation tasks differed from the results of an outdated representation task (“false”-photograph task). Experiment 3 showed that children with ASD had difficulties with the false representation tasks, and this could not be explained by executive functioning or language impairments. These findings support the view that children with ASD might not have a specific theory-of-mind deficit.

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Introduction

It has long been claimed that there is a domain-specific cognitive mechanism that supports mental-related processing such as understanding of false beliefs (e.g., Baron-Cohen, 1995; Leslie, Friedman, & German, 2004). In contrast to this claim, the domain-general hypothesis proposes a general conceptual development that accounts for both mental and nonmental processing as children come

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to understand false beliefs as representations of the world (e.g., [Perner, 1991](#); [Wellman, 1990](#)). Others have argued that more general executive or language processing may explain children's false-belief performance (e.g., [de Villiers, 2000](#); [Russell, 1999](#)). To date, the debate between domain specificity and domain generality of false-belief understanding is still ongoing (e.g., [Cohen & German, 2010](#); [Iao, Leekam, Perner, & McConachie, 2011](#)). More importantly, false-belief performance continues to remain one of the key cognitive discriminators of autism spectrum disorders (ASD; e.g., [Begeer, Bernstein, van Wijhe, Scheeren, & Koot, 2012](#)). Although there is still a common assumption, even currently (e.g., [Senju, Southgate, White, & Frith, 2009](#); [Senju et al., 2010](#)), that “mentalizing” or “theory of mind” is the main problem in ASD, there are also suggestions that the problem for individuals with ASD may lie in executive and language processing (e.g., [Paynter & Peterson, 2010](#); [Pellicano, 2010](#)). The current study critically tested these accounts regarding ASD and speaks to the long-standing debate concerning false-belief understanding.

Until recently, the debate has been tested empirically by comparing false-belief (FB) tasks (e.g., [Wimmer & Perner, 1983](#)) with nonmental tasks that share similar structural features, for example, the “false”-photograph (FP) task ([Apperly, Samson, Chiavarino, Bickerton, & Humphreys, 2007](#); [Leekam & Perner, 1991](#); [Leslie & Thaiss, 1992](#); [Zaitchik, 1990](#)). The FB task itself involves a protagonist observing an object being placed in Location A and subsequently moved to Location B in the protagonist's absence. Children are then asked where the protagonist thinks the object is. In the FP task, the experimenter takes a photograph of an object in Location A with a Polaroid camera, but then the object is moved to Location B. Children are then asked where the object in the photograph is.

Although the FP and FB tasks appear to show structural similarity and equivalent performance in typically developing children, children with ASD failed the FB task but passed the FP task ([Leekam & Perner, 1991](#); [Leslie & Thaiss, 1992](#); see also [Charman & Baron-Cohen, 1992](#)). These results furthered [Baron-Cohen, Leslie, and Frith's \(1985\)](#) original proposal of a theory-of-mind deficit in individuals with ASD, attributing specific difficulties to the processing of mental-related information, and offered evidence against the domain-general hypothesis. However, some researchers argued that these tasks present different conceptual demands. This is because a photograph is a *true* representation of the situation at the time the photograph was taken, whereas a false belief is a misrepresentation of whatever it is supposed to represent (e.g., [Leekam & Perner, 1991](#)). Thus, the FP task might not be an appropriate nonmental comparison to the FB task, and whether individuals with ASD have a specific deficit in processing mental-related information needs further investigation.

To adequately test the domain specificity debate, the false-sign (FS) task was subsequently devised to replace the FP task ([Bowler, Briskman, Gurvidi, & Fornells-Ambrojo, 2005](#); see also [Parkin, 1994](#), for an unpublished thesis). The logic behind this is that a sign, like a belief, represents what it is supposed to represent. In the FS task, children are shown a signpost that shows an object in Location A, but then the object is moved to Location B. Hence, the signpost becomes a false sign. Children are then asked where the signpost shows that the object is. It has been proposed that the FS task, relative to the FP task, is more comparable to the FB task in both behavioral studies with children ([Leekam, Perner, Healey, & Sewell, 2008](#); [Sabbagh, Moses, & Shiverick, 2006](#)) and brain imaging studies with adults ([Aichhorn et al., 2009](#); [Perner, Aichhorn, Kronbichler, Staffen, & Ladurner, 2006](#)). Training studies with children have also demonstrated that the FS and FB tasks are potentially transferable ([Iao et al., 2011](#)), whereas the FP and FB tasks are not ([Slaughter, 1998](#)). Furthermore, children with ASD showed similar and associated performance on the FB and FS tasks ([Bowler et al., 2005](#)). These findings suggest that the FB and FS tasks share a developmental factor that is not shared by the FP task and that the suggestion that individuals with ASD are specifically impaired in mental-related processing might not be valid.

Yet although conceptual understanding of false representations might explain the correspondence between performance on the FB and FS tasks, it could be argued that the relation between them might be better explained by a third variable, notably other cognitive skills such as executive function and language demands. In terms of the inhibitory aspect of executive control, for example, these tasks involve several requirements. There is a requirement to disengage from knowledge about the salient reality and attend to the representation in question (cognitive inhibition) and to inhibit a prepotent response of pointing to the true location of the object (response inhibition). In terms of working memory, there is also a requirement to maintain and process information in mind simultaneously.

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