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## Social orienting predicts implicit false belief understanding in preschoolers

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### ABSTRACT

According to the social motivation theory, orienting toward social elements of the environment should be related to sociocognitive abilities, such as theory of mind (ToM), in both typically developing children and children with autism spectrum disorder. The objective of the current study was to assess whether social orienting skills predict ToM abilities in preschoolers by using two social orienting tasks (biological motion and face preference) and an implicit false belief task. A total of 38 children, aged 2–4 years, participated in this study. As expected, participants showed a social preference on both tasks measuring social orienting. More importantly, children's performance on the face preference task predicted their performance on the false belief task, providing the first evidence for a link between social motivation and ToM in preschoolers.

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### Introduction

The term *social motivation* has been coined to describe children's psychological dispositions to preferentially orient to the social world (social orienting), to seek and take pleasure in social interactions (social reward), and to invest in maintaining social bonds (social maintaining) (Chevallier, Kohls, Troiani, Brodtkin, & Schultz, 2012; Klin, Jones, Schultz, Volkmar, & Cohen, 2002; Klin, Lin, Gorrindo, Ramsay, & Jones, 2009). Social motivation has important impacts within atypical populations, such as autism spectrum disorder (ASD), given that deficits in social communication and social interaction are key diagnostic features among individuals with ASD (American Psychiatric Association, 2013).

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Chevallier et al. (2012) recently suggested a social motivation theory to explain the presence of sociocognitive deficits, such as theory of mind (ToM), observed in ASD. They argued that deficits in ToM among individuals with ASD are the result of impairments in social motivation (Chevallier et al., 2012). Theory of mind is defined as the understanding that others have beliefs and thoughts that may be different from one's own (Wellman, 2014). In other words, social motivation theory posits that individuals with ASD fail to attend to and learn from socially relevant information in their environment, and this has downstream effects on their sociocognitive development (Broekhof et al., 2015; Chevallier et al., 2012; Senju & Johnson, 2009). This theory also applies to the natural variance in social motivation and ToM abilities in the neurotypical population. Thus, individual differences in social motivation should be reflected in differences in sociocognitive abilities. The main objective of the current study was to determine whether social orienting skills predict ToM abilities in typically developing preschoolers. To our knowledge, only one study has investigated the relation between social orienting and ToM abilities in young children (Burnside, Wright, & Poulin-Dubois, 2017). This study compared children with ASD with a matched group of neurotypical children on these constructs and found that children with ASD oriented less to social stimuli than did neurotypical children. As expected, children with ASD did not pass an implicit false belief task. However, no link was observed between the preference scores on the social motivation tasks and performance on the ToM task in either group, most likely due to the small sample size in each group.

One way to assess social motivation is by measuring social orienting. This is typically done using the preferential looking paradigm, wherein both social and nonsocial stimuli are simultaneously presented and the proportion of looking time on each picture is measured. If a child looks longer at the social stimulus, then the child is considered to have a social preference. Typical social stimuli include human faces, human motion, and voices, whereas nonsocial stimuli are selected to match the auditory or visual medium used to present the social stimuli (e.g., pictures of objects, scrambled motion, non-speech sounds) (Annaz, Campbell, Coleman, Milne, & Swettenham, 2012; Curtin & Vouloumanos, 2013; Sasson, Turner-Brown, Holtzclaw, Lam, & Bodfish, 2008). For example, Sasson et al. (2008) presented pictures of human faces and objects in visual arrays to measure the visual exploration of both typically developing children and children with ASD and found that children with ASD explored fewer social images when these images were paired with objects that were of high interest to them (i.e., electronics, trains) as compared with objects that were of low interest to them (i.e., furniture, plants). Other researchers have examined the attentional bias for faces in children with and without a diagnosis of ASD and observed that children without a diagnosis took longer to disengage from the pictures with faces than did children with ASD (Chawarska, Volkmar, & Klin, 2010). These data suggest that typically developing children are more attracted to social stimuli containing human faces. Another goal of the current study was to investigate children's looking behavior when pairs of social and nonsocial images are presented on a split screen, rather than as an array, to measure whether children exhibit a social preference.

Another method used to assess social orienting includes the presentation of biological motion such as a point-light display of a human walking (Johansson, 1973; Pavlova, 2012). This social stimulus is usually contrasted on a split screen with phase-scrambled or random motion (Annaz et al., 2012; Falck-Ytter, Rehnberg, & Bölte, 2013; Klin & Jones, 2008). Annaz et al. (2012) demonstrated that children with ASD fail to show a preference for the biological motion stimulus, whereas typically developing children look significantly longer at the human walking point-light display. In fact, even newborns show a similar preference (Simion, Regolin, & Bulf, 2008). Nevertheless, typically developing children's looking patterns are not consistent across studies; in some cases, they do not show a social preference when biological motion is paired with mechanical motion (e.g., truck or bicycle) (Wright, Kelley, & Poulin-Dubois, 2016). Thus, another goal was to investigate children's social preference with a task contrasting a low-level, abstract social stimulus, a human walking point-light display, with scrambled motion (i.e., phase-scrambled motion of a human walking). Furthermore, because there are no studies comparing different measures of social orienting (e.g., human faces and biological motion) within the same group of children, the current study aimed to assess the construct validity of social orienting through different types of assessment. Inter-task convergence would be expected if both tasks tap into the same construct.

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