Original Articles

The relationship between parental mental-state language and 2.5-year-olds' performance on a nontraditional false-belief task

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ARTICLE INFO

ABSTRACT

A growing body of evidence suggests that children succeed in nontraditional false-belief tasks in the first years of life. However, few studies have examined individual differences in infants' and toddlers' performance on these tasks. Here we investigated whether parental use of mental-state language (i.e. *think, understand*), which predicts children's performance on elicited-response false-belief tasks at older ages, also predicts toddlers' performance on a nontraditional task. We tested 2.5-year-old children in a verbal nontraditional false-belief task that included two looking time measures, anticipatory looking and preferential looking, and measured parents' use of mental-state language during a picture-book task. Parents' use of mental-state language positively predicted children's performance on the anticipatory-looking measure of the nontraditional task. These results provide the first evidence that social factors relate to children's false-belief understanding prior to age 3 and that this association extends to performance on nontraditional tasks. These findings add to a growing number of studies suggesting that mental-state language supports mental-state understanding across the lifespan.

1. Introduction

The ability to predict and interpret the behavior of other individuals in terms of their unobservable mental states (e.g., goals, preferences, beliefs) is essential for navigating the social world. Researchers have long been interested in when and how this critical psychological reasoning ability develops. In particular, considerable research has focused on when children understand that others can be mistaken, or hold false beliefs, about the world. Early investigations into this question relied on traditional elicited-response false-belief tasks, which require children to answer direct questions about the likely behavior of a mistaken agent (e.g., Baron-Cohen, Leslie, & Frith, 1985; Wimmer & Perner, 1983). Children's performance on such tasks led to the conclusion that the capacity to represent false beliefs does not emerge until at least age 4 (e.g., Wellman, Cross, & Watson, 2001).

However, this conclusion has been challenged by recent evidence from alternative, nontraditional tasks that do not require children to answer direct questions about a mistaken agent. In these tasks, researchers instead measure a variety of other responses that children produce as they observe or interact with a mistaken agent, including their looking behavior (e.g., Onishi & Baillargeon, 2005; Southgate,

Senju, & Csbra, 2007), emotional expressions (e.g., Moll, Kane, & McGowan, 2016), neurological activity (e.g., Hyde, Simon, Ting, & Nikolaeva, 2018; Kampis, Parise, Csibra, & Kovács, 2015; Southgate & Vernetti, 2014), and helping responses (e.g., Buttelmann, Carpenter, & Tomasello, 2009; Southgate, Chevallier & Csibra, 2010). Over 30 published studies using nontraditional false-belief tasks have now reported positive results with children between 6 months and 3 years of age (Scott & Baillargeon, 2017; Scott, Roby, & Smith, 2017). These findings have led many researchers to conclude that the capacity to represent false beliefs emerges in the first year of life (e.g., Barrett et al., 2013; Buttelmann et al., 2009; Carruthers, 2013; Kovács, Téglás, & Endress, 2010; Luo, 2011; Scott, 2017; Southgate et al., 2007; Surian, Caldi, & Sperber, 2007).[1]

Despite the growing body of research using nontraditional false-belief paradigms, very few studies have examined individual variation in infants' and toddlers' performance on these tasks. Thus, little is known about individual differences in early false-belief understanding and what factors might be responsible for such differences. In particular, it is an open question whether the same factors that predict preschoolers' performance on traditional elicited-response tasks also predict younger children's performance on nontraditional false-belief

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[1] Several researchers have questioned whether nontraditional false-belief tasks assess the same capacity as elicited-response tasks (e.g., Butterfill & Apperly, 2013; Heyes, 2014; Ruffman, 2014), as well as whether the results from nontraditional tasks are robust (Crivello & Poulin-Dubois, in press; Dörrenberg, Rakoczy & Liszkowski, in press; Powell, Hibbs, Bardis, Carey & Saxe, in press). We return to both of these issues in the General Discussion.

tasks.

Here we addressed this issue by examining whether toddlers' performance on a verbal nontraditional false-belief task was related to aspects of their social environment. Several decades of research have shown that a number of social factors predict preschool-aged children's performance on elicited-response false-belief tasks (e.g., Cutting & Dunn, 1999; Devine & Hughes, 2018; McAlister & Peterson, 2013; Meins et al., 2003; Perner, Ruffman, & Leekam, 1994; Ruffman, Slade, & Crow, 2002; Symons & Clark, 2000). In particular, there is a well-established positive relationship between parental use of mental-state language, terms that refer to psychological states such as *think*, *know*, and *remember*, and preschoolers' elicited-response performance (e.g., Adrián, Clemente, Villanueva & Rieffe, 2005; Brown, Donelan-McCall & Dunn, 1996; Devine & Hughes, 2018; Ensor & Hughes, 2008; Howard, Mayeux & Naigles, 2008; Nielsen & Dissanayake, 2000; Ruffman et al., 2002). Parental mental-state language predicts their preschoolers' performance on elicited-response tasks both concurrently (e.g., Howard et al., 2008; LaBounty, Wellman, Olson, Lagattuta, & Liu, 2008; Peterson & Slaughter, 2003) and longitudinally (e.g., Adrián, Clemente, & Villanueva, 2007; Ensor & Hughes, 2008; Meins et al., 2003; Ruffman et al., 2002), and this association is evident when mental-state language is assessed in naturalistic (Howard et al., 2008) and laboratory settings (Ruffman et al., 2002).

Additional evidence for the relationship between parental mental-state language and elicited-response performance comes from three sets of findings. First, preschoolers whose parents were trained to engage in elaborative reminiscing, a style of discussing past events that involves rich memory cues and references to mental states (e.g., *remember*), performed better on elicited-response tasks than children whose parents had not received training (Taumoepeau & Reese, 2013). Second, deaf children raised by hearing parents, who hear fewer references to mental states than their hearing counterparts, exhibit deficits in performance on elicited-response tasks (Gale, de Villiers, de Villiers, & Pyers, 1996; Meristo et al., 2007; Moeller & Schick, 2006). Finally, in cultures where parents do not typically discuss mental states with their children (e.g., Taumoepeau, 2015), children pass elicited-response tasks at later ages (Mayer & Träuble, 2013). Together, these findings show a strong relationship between parental use of mental-state language and preschool children's performance on elicited-response false-belief tasks.

Could social factors such as parental use of mental-state language also be related to younger children's performance on nontraditional false-belief tasks? This depends on the causal mechanism underlying the relationship between social factors and performance on elicited-response tasks. One possibility is that social factors specifically facilitate children's ability to answer the direct questions used in elicited-response tasks. For instance, in one common false-belief scenario, an agent places an object in one of two locations; the object is then moved to the other location in her absence. In elicited-response tasks, children are asked a direct question such as "Where will she look for the toy?" It has been argued that pragmatic factors might cause children to misinterpret this question as asking something else, such as where the agent ought to look for the object or where the object is actually located (e.g., Hansen, 2010; Helming, Strickland, & Jacob, 2016; Siegal & Beattie, 1991; Westra & Carruthers, 2017; Yazdi, German, Defeyter, & Siegal, 2006). Frequently engaging in social interactions that involve discussions of mental states might help children overcome this pragmatic ambiguity, enabling them to interpret the question correctly and produce the appropriate response. If social factors specifically improve children's ability to answer direct questions about others' behavior, then we would not expect to see relationships between these social factors and performance on nontraditional tasks because they do not involve such questions.

An alternative possibility, however, is that the relationship between social factors and false-belief performance extends beyond facilitating children's ability to answer direct questions about the behavior of mistaken agents. In the scenario described above, several processes

contribute to children's ability to understand where the mistaken agent will search for the object (e.g., Kampis, Fogd, & Kovács, 2017; Roby & Scott, 2016b). Children must attend to the agent and mental-state relevant information within the scene, such as which events the agent has or has not witnessed, and use this information to infer the agent's mental states (e.g., the agent holds a false belief about the object's location). When the agent returns to the scene, they must retrieve the agent's mental states and use them to infer the agent's likely actions. Critically, these processes are required regardless of whether children's understanding is ultimately assessed via their answers to direct questions, or alternative responses such as which of the two locations children look toward in anticipation of the agent's search for the object (e.g., anticipatory-looking; Southgate et al., 2007).

Children's social experiences could plausibly influence each of these processes (Roby & Scott, 2016b). For instance, social interactions that involve talk about others' mental states may heighten interest in agents and their mental states, increasing children's tendency to attend to agents over other aspects of a scene. Beyond drawing attention to agents, discussions involving others' mental states might help children learn how particular behaviors or situational cues are linked to particular mental states (e.g., Christensen & Michael, 2016; Scott et al., 2017), thereby improving children's ability to infer others' mental states and predict their subsequent actions in a range of situations. Finally, conversations involving mental-state language provide scaffolded practice remembering events and the mental states of those involved. Learning and using mental-state language also provides children with a useful tool for retrieving and holding in mind belief-relevant information (e.g., San Juan & Astington, 2012). Thus, social experiences could improve children's ability to retrieve mental-state relevant information when needed.

If the preceding analysis is correct, then we might see relationships between parental use of mental-state language and young children's performance on nontraditional false-belief tasks. Although no studies have directly examined this relationship, two sets of findings provide indirect support for this possibility. First, there is growing evidence that parental mental-state talk is related to infants' and toddlers' performance on a variety of social reasoning tasks (e.g., Drummond, Paul, Waugh, Hammond, & Brownell, 2014; Newton, Thompson, & Goodman, 2016; Taumoepeau & Ruffman, 2008). For instance, mothers' use of mental-state language, in particular their use of the terms *think* and *know*, with their 24-month-old children predicts children's emotion understanding at 33 months (Taumoepeau & Ruffman, 2008). In addition, maternal sensitivity and mother's use of mental-state language predicts 18-month-olds' tendency to engage in prosocial helping across a variety of contexts (Newton et al., 2016). These findings suggest that rather than being specifically related to preschool children's ability to answer direct questions about the behavior of mistaken agents, parental use of mental-state language is related to a range of social-cognitive skills even before the preschool years.

Second, recent evidence suggests that deaf children of hearing parents, who have difficulty with traditional false-belief tasks, also exhibit deficits on nontraditional false-belief tasks (e.g., Meristo et al., 2012; Meristo, Strid, & Hjelmquist, 2016). For instance, Meristo et al. (2012) found that when tested in a nonverbal anticipatory-looking false-belief task, hearing 23-month-old infants successfully anticipated the actions of a mistaken agent, but the deaf infants of hearing parents did not. Although Meristo et al. (2012) did not directly assess the mental-state talk of the parents of the infants in their study, other investigations have shown that deaf toddlers of hearing parents hear significantly fewer references to mental states than same-aged hearing peers raised with hearing parents (Morgan et al., 2014). This raises the possibility that the deaf infants performed worse on the anticipatory-looking task in part due to a lack of exposure to mental-state talk. These findings thus provide suggestive, albeit indirect, evidence that parental mental-state talk might be related to children's performance on nontraditional false-belief tasks prior to the preschool years.