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Brief Report

Eighteen-month-olds understand false beliefs in an unexpected-contents task

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ABSTRACT

Recent studies suggest that infants understand that others can have false beliefs. However, most of these studies have used looking time measures, and the few that have used behavioral measures are all based on the change-of-location paradigm, leading to claims that infants might use behavioral rules instead of mental state understanding to pass these tests. We investigated infants' false-belief reasoning using a different paradigm. In this unexpected-contents helping task, 18-month-olds were familiarized with boxes for blocks that contained blocks. When an experimenter subsequently reached for a box for blocks that now contained a spoon, infants based their choice of whether to give her a spoon or a block on her true or false belief about which object the block box contained. These results help to demonstrate the flexibility of infants' false-belief understanding.

Introduction

"Theory of mind" is about predicting and explaining the actions of others by invoking their mental states such as goals and beliefs (Premack & Woodruff, 1978). For decades, it was thought that children first begin to understand that others can sometimes hold false beliefs at around 4 or 5 years of age (see

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Wellman, Cross, & Watson, 2001, for a review). This conclusion was based on studies using two different types of false-belief tests: (a) the change-of-location test, in which an object is moved in the absence of a story character (e.g., the "Sally–Anne" test; Baron-Cohen, Leslie, & Frith, 1985; Wimmer & Perner, 1983), and (b) the unexpected-contents test, in which a box does not contain what it is supposed to contain (the "Smarties" test; Hogrefe, Wimmer, & Perner, 1986; Perner, Leekam, & Wimmer, 1987). However, several recent studies have claimed false-belief understanding in 1-year-olds or even younger infants (see Baillargeon, Scott, & He, 2010, for a review).

The primary reason for the difference between these two sets of findings might be the explicit versus implicit methods used; the classic tests passed by preschoolers are explicit verbal tests, whereas the tests passed by infants use implicit measures such as looking time (e.g., Kovács, Téglás, & Endress, 2010; Onishi & Baillargeon, 2005; Surian, Caldi, & Sperber, 2007) and anticipatory looking (Clements & Perner, 1994; Southgate, Senju, & Csibra, 2007; Surian & Geraci, 2012; see Sodian, 2011, for a review). Researchers have also designed studies in which infants are asked to *act* based on their understanding of a protagonist's beliefs. For example, Buttelmann, Carpenter, and Tomasello (2009) presented 16- and 18-month-olds with an experimenter who put a toy into one of two boxes and left the room. In his absence, an assistant "sneakily" transferred the toy to the other box and locked both boxes. When the experimenter returned and tried to open the first box, infants helped him by going to the box that now contained the toy—inferring that because the experimenter believed the toy to be in the first box, he wanted his toy. In contrast, in a true-belief condition, in which the experimenter watched the switch of the toy but nevertheless then tried to open the empty box, infants went to the empty box and showed him how to open it—inferring that, because the experimenter knew the current location of the toy, he wanted to open the empty box for some other reason. Thus, infants interpreted the experimenter's goal differently depending on whether he believed his toy to be in the box he tried to open or not (see also Knudsen & Liszkowski, 2012a, and Southgate, Chevallier, & Csibra, 2010, for other behavioral tasks with 1-year-olds).

The literature on infants' understanding of false belief, however, has proved to be deeply controversial. Some researchers have argued that, in many of the implicit tests, infants do not necessarily need to attribute beliefs to the protagonist but might instead solve the tasks by matching observed test events to associations built during the familiarization phase or by using behavioral rules rather than mentalistic understanding (Apperly & Butterfill, 2009; Perner & Roessler, 2012; Perner & Ruffman, 2005; Rakoczy, 2012; Ruffman & Perner, 2005). One possible rule infants could employ is that *people look for objects where they last saw them.* Explanations such as this apply primarily to change-of-location tasks. For this reason, it is important to test infants in a variety of tasks, scenarios, and paradigms (Perner, 2010). If infants are able to pass multiple different tasks, an explanation based on belief understanding gains increased plausibility.

There are a few studies that are not based on the change-of-location paradigm, and still 1-year-olds show differences between conditions. For example, 18-month-olds seem to attribute false beliefs about an object's identity or properties (Scott & Baillargeon, 2009; Scott, Baillargeon, Song, & Leslie, 2010). Most relevant for the current study, Song and Baillargeon (2008) presented 14.5-month-olds with two objects: a stuffed skunk and a doll with blue pigtails. After familiarizing infants with the experimenter reaching for the doll, both objects were put into opaque boxes without the experimenter watching. Importantly, there was a tuft of blue hair protruding from the box containing the skunk. When the experimenter returned, infants looked significantly longer when she reached for the box containing the doll than when she reached for the box containing the skunk, demonstrating their expectation about the experimenter wanting the doll and being deceived by the tuft of blue hair. Although these studies do not use the change-of-location paradigm, they all use the same measure: looking time. Whereas looking time differences can clearly indicate, for example, a discrimination, an expectation, or a preference, behavioral measures go beyond this by showing that infants can translate their understanding into appropriate action. This is important because in real-world social interactions, children often need to actually respond to their partners (e.g., help or warn them about something; Buttelmann et al., 2009; Knudsen & Liszkowski, 2012a) based on the partners' false belief rather than just understand that they have one.

So far, all behavioral studies of infants' false-belief understanding have used change-of-location tests; thus, other types of tasks are needed. A further potential issue is that in most of the behavioral