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Do action-based tasks evidence false-belief understanding in young children?

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ABSTRACT

Recent research suggests that action-based tasks with nonverbal response formats evidence false-belief understanding at an age at which children usually fail classical verbal tasks. If this were true, it would have important consequences for developmental theories on the origins and emergence of social-cognitive abilities. Yet, it is not clear how robust and reliable these tasks are. Here we report two experiments (overall n = 191) trying to replicate a finding by Rubio-Fernandez and Geurts (2013, Psychological Science). We were not able to replicate the pattern reported by the original study. Our results demonstrate that 3-year-old children do not reliably pass an action-based task. Above chance performance was only found by the age of 4.

1. Introduction

The emergence of false-belief understanding is widely seen as a hallmark in the development of social understanding (e.g., Moore, 2006; Perner, 1991). For many years, it was universally accepted that an understanding of false beliefs, usually assessed by means of explicit reasoning about another person's knowledge state, develops around 4–5 years (e.g., Astington & Jenkins, 1999; Flavell, 2004; Peterson & Slaughter, 2003; Ruffman, Slade, & Crowe, 2002; Wellman, Cross, & Watson, 2001). Yet, in recent years this conception has faced a major change. Using implicit measures such as violation-of-expectation or visual anticipation, some studies have claimed evidence for false belief (FB) understanding already in the infant and toddler years (e.g., Onishi & Baillargeon, 2005; Southgate, Senju, & Csibra, 2007; for review see Sodian, 2011). These findings have led to an intense debate on the nature of young children's competencies in these tasks. Novel theoretical models have been devised to account for the existence of an early developing implicit ToM and a later developing explicit ToM (e.g., Apperly & Butterfill, 2009).

However, some authors have pointed out that children's performance in these tasks (most of them using measures of visual attention as a dependent variable) could be more parsimoniously explained by associative learning, novelty effects and/or the understanding of behavioral regularities (e.g., Heyes, 2014; Perner & Ruffman, 2005; Uithol & Paulus, 2014). Given this potential ambiguity of assessments of visual attention, behavioral paradigms have been developed that are supposed to be less susceptible to low-level explanations. Indeed, studies using nonverbal or action-based tasks indicated FB understanding in 3-year-old or even younger children (e.g., Buttelmann, Carpenter, & Tomasello, 2009; Rubio-Fernandez & Geurts, 2013). For example, Rubio-Fernandez and Geurts (2013) compared 3-year-old children's performance in a classical unexpected content FB task, i.e. the Smarties task – with their performance in their novel Duplo task. In this task, participants are presented with an action-based and partly nonverbal version of a change of location scenario. More precisely, an experimenter played with a Duplo girl figure that is told to eat one banana for breakfast every morning. Children were told that the girl has already eaten her banana today. They observed how the girl put a bunch of bananas in one of two fridges and then left for a walk. Then, the experimenter secretly put the object into the other fridge

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while the Duplo girl remained in sight of the participants but with her back to the scene so that she could not "observe" the change of location. Participants were then asked to play with the figure themselves to show what will happen next. According to the authors, the fact that the Duplo figure is still present in the scene and the fact that participants were presented with an open question instead of a standard false-belief question (e.g., "Where will the girl look for the bananas?") should facilitate participants' ability to track the girl's perspective. Rubio-Fernandez and Geurts (2013) results showed that up to 80% of the 3-year-old children passed the Duplo task, whereas only 23% passed the unexpected content task. These findings are interpreted as strong support for theoretical claims on an early emerging understanding of others' false beliefs, which can be more readily assessed by acting-out procedures.

However, before drawing strong conclusions from these findings, which would lead to a change of our understanding of the development of social-cognitive competencies in young children, it would be important to ascertain the strength and replicability of these findings. First, replication attempts of early false-belief competencies in young children have not always been successful (e.g., Yott & Poulin-Dubois, 2016). Second, recent meta-theoretical work on reproducibility in psychological research raised awareness of the need to test the strength and replicability of empirical findings before drawing theoretical conclusions (Open Science Collaboration, 2015). Given the theoretical significance of nonverbal and action-based tasks for our understanding of ToM development, it would thus be highly desirable to assess their replicability.

The current study was designed to contribute to this debate and investigate whether young children indeed pass an action based FB task. We decided to focus on the Duplo task by Rubio-Fernandez and Geurts (2013, Experiment 1) for two reasons. First, it appears to be an elegant task whose characteristics (e.g., transfer of location) match a classical FB scenario. Thus, children's performance in the action-based version can be compared to their performance in an explicit version. Second, the findings by Rubio-Fernandez and Geurts (2013) have been used to support theoretical claims about the presence and nature of an early, implicit form of FB understanding in young children (e.g., Roby & Scott, 2016; Scott & Baillargeon, 2014), and have stimulated further theoretical endeavors (e.g., Helming, Strickland, & Jacob, 2014). Knowledge about the replicability of this finding would thus be valuable for a number of theoretical efforts.

In the following, we report two studies that attempted to replicate the Duplo task. Study 1 focused exclusively on the Duplo task and examined 3-, 4-, and 5-year-old children. In an attempt to replicate the finding by Rubio-Fernandez and Geurts (2013) with 3-year-old children, this study also aimed to examine potential developmental differences. If children indeed show an early understanding of false beliefs, we would expect above chance performance already in 3-year-old children that should not be different from the other age groups. Study 2 aimed at replicating the entire protocol of Experiment 1 of Rubio-Fernandez and Geurts (2013) by assessing not only children's performance in the Duplo task, but also − for the sake of direct comparisons − their performance in a traditional, unexpected content task, i.e. the Smarties task (Hogrefe, Wimmer, & Perner, 1986). In addition, given that the logic of Duplo task is based on a false location task rather than a false content task, we included the location FB task described by Wellman and Liu (2004) as an additional explicit measure for direct comparison with the Duplo task. Given that the location FB task was administered at the end of the protocol, it could not affect children's performance in the other two tasks (i.e., Duplo task and unexpected content task) and could therefore not interfere with our replication attempt.

Next to our attempt to replicate RFG, we also decided to more closely consider children's different answer patterns. In the original study some children showed ambiguous responses (i.e. they first led the figure to the empty fridge and then to the fridge with the bananas). Due to the open question format it is not clear how to interpret such ambiguous answers or other idiosyncratic responses (which do not include any of the target locations or objects). In the classical explicit ToM tasks, the control questions help to disambiguate this problem. Yet, there were no control questions asked in the Duplo task and therefore there is no independent external criterion to decide if a child understood the task correctly. Since only children's behavior can be observed but not the reason for it, there is a large ambiguity of how to interpret children's responses. It is clear that children who give ambiguous responses do conceive of the task very different than it is intended by the authors. Yet, the same is true for the participants who guide the puppet to one of the two locations. We do not know whether they do it for the originally intended reasons (i.e. because they conceive it as dealing with the puppet's false belief) and not for any other reason.

As our main objective was the replication of the original study, for the main analyses of this paper we applied the same exclusion criteria as reported by Rubio-Fernandez and Geurts (2013), i.e. for the Duplo task we excluded children who gave ambiguous or no responses and for the unexpected content task we excluded children who did not give an answer. However, in line with our considerations above, we decided to analyze our data in an additional way with data of all children included. In these analyses children's different/ambiguous responses were coded as incorrect, given that they did not move the puppet to the correct target. We report these additional analyses at the end of the result sections of our studies.

2. Study 1

In study 1 we focused on the Duplo task and used the materials and exact same procedure as described by Rubio-Fernandez and Geurts (2013).

2.1. Method

2.1.1. Participants

The sample consisted of 84 children: 28 3-year-olds (M = 42.0 months, SD = 3.5; 14 boys), 28 4-year-olds (M = 53.9 months, SD = 3.6; 15 boys) and 28 5-year-olds (M = 65.4 months, SD = 2.9; 15 boys). All participants were typically developing children from a rural area in southern Germany and were of mixed socioeconomic status. Informed consent for participation was given by the