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Interpreting failed replications of early false-belief findings: Methodological and theoretical considerations☆

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ABSTRACT

There are now over 30 published reports, spanning 11 different methods, providing convergent evidence for false-belief understanding in children ages 6–36 months (for a review, see Scott & Baillargeon, 2017). The negative findings reported in this special issue of *Cognitive Development* are inconsistent with this body of data, and the aim of this commentary is to try to shed some light on the discrepancies between studies. We examine the negative findings reported with violation-of-expectation tasks (written by R. Baillargeon), interactive tasks (written by D. Buttelmann), and anticipatory-looking tasks (written by V. Southgate). In many cases, procedural differences between studies may explain failures to replicate. In other cases, apparent participant motivation and attention differences may be important in explaining failures, raising doubts about the utility of some paradigms to elicit the behaviors on which they rely. Our hope is that this commentary will provide a useful analysis that will inform the design of future studies in order that a higher level of replication can be achieved.

1. Introduction

There are now over 30 published reports with evidence of some capacity for false-belief understanding in children ages 6–36 months (for a review, see Scott & Baillargeon, 2017). These reports have used 10 different methods, including (a) behavioral spontaneous-response tasks (violation-of-expectation, anticipatory-looking, preferential-looking, anticipatory-pointing, and affective-response tasks); (b) interactive or elicited-intervention tasks (helping and referential-communication tasks); (c) traditional or elicited-prediction tasks with reduced processing demands; and (d) neural spontaneous-response tasks (neural action-prediction and neural sustained-representation tasks). To this last group, we must now add one more method, neural belief-processing tasks: Using functional near-infrared spectroscopy, Hyde and colleagues recently found that like adults, 7-month-olds tested with transfer-of-location scenarios showed more activation in a region corresponding to the temporal-parietal junction when the agent did not witness a toy's transfer than when she either did witness it or could infer it (Hyde, Aparicio Betancourt, & Simon, 2015; Hyde, Simon, Ting, & Nikolaeva, 2018). Together, these reports contradict claims that the evidence for early false-belief understanding is minimal or lacking in convergent validity.

However, in this special issue of *Cognitive Development* and beyond, negative findings have recently been reported with some of these same false-belief tasks. In the following sections, we examine the negative findings with violation-of-expectation tasks (written

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by R. Baillargeon), interactive tasks (written by D. Buttelmann), and anticipatory-looking tasks (written by V. Southgate). In some cases, we identify procedural differences that might have contributed to the observed negative findings. In other cases, we concede that some tasks may provide less sensitive assessments of false-belief understanding, and we discuss possible reasons for why that might be the case. We hope that our comments will support constructive investigations of the nature of early false-belief understanding and the conditions under which it can best be observed.

2. Violation-of-expectation tasks

2.1. Negative findings with children

The violation-of-expectation (VOE) method takes advantage of young children's natural tendency to look longer at events that contradict, as opposed to confirm, their expectations. Thus, a positive result in a VOE task typically involves longer looking at an unexpected than at an expected event, whereas a negative result involves equal looking at the events. To date, over 15 VOE reports of early false-belief understanding have been published (Scott & Baillargeon, 2017). Several of these reports included internal replications, with positive results in two or more conditions. In addition, several reports contrasted false-belief and ignorance conditions, making it unlikely that children were merely tracking whether an agent was ignorant, as opposed to mistaken, about some aspect of a scene.

In light of this substantial positive evidence, how can we make sense of the negative VOE false-belief findings reported in this issue (Dörrenberg, Rakoczy, & Liskowski, 2018; Powell, Hobbs, Bardis, Carey, & Saxe, 2018) and elsewhere (Poulin-Dubois, Polonia, & Yott, 2013; Yott & Poulin-Dubois, 2016)? As is the case with most methods, seemingly small procedural differences can lead to negative results. Below are examples of four such differences.

2.1.1. No clear basis for expectation

Because VOE false-belief tasks depend on children's tendency to look longer at events that contradict their expectations about an agent's actions, it follows that negative findings will be obtained when the scene is ambiguous or confusing and does not support the formation of a clear expectation about these actions (i.e., where there is no expectation, there is nothing that can be contradicted).

In the task of Onishi and Baillargeon (2005), which was the first VOE task to demonstrate early false-belief understanding, children received three familiarization trials that supported a simple expectation. In the first trial, an agent played with a toy, hid it in box-A, and then paused with her hand inside the box; in the next two trials, she reached and paused inside box-A, as though wanting the toy she had placed there. Yott and Poulin-Dubois (2012) conducted a close replication of this task, and they obtained the same positive results. However, Poulin-Dubois et al. (2013) introduced several changes, with negative results. These changes included making the boxes transparent and adding a fourth familiarization trial in which the agent ignored the toy and put on a blindfold (she also wore the blindfold in test). One factor that might have contributed to this task's negative results is that this fourth trial created an ambiguous scene (e.g., was the agent no longer interested in the toy, and was she now playing a new game with the blindfold?), making it difficult for children to form a clear expectation about what the blindfolded agent would do next.

A similar argument could be made for the negative results of Powell et al. (2018), who attempted conceptual replications of Onishi and Baillargeon (2005) in two VOE tasks. Subjects received two familiarization trials, each with a complex sequence of events. In the first trial, the agent picked up a toy at the center of the apparatus floor, hid it in box-A, withdrew behind a curtain (task-2) or door (task-3) at the back of the apparatus for about 12 s, returned, retrieved the toy from box-A, hid it in box-B, and paused with her hand inside the box. In the second trial, the toy was back at the center of the apparatus, and the agent performed the same sequence of actions except that she first hid the toy in box-B. One factor that might have contributed to the tasks' negative results is that these events were somewhat confusing (e.g., why did the agent switch the toy to the opposite box when she returned?) and made it difficult for children to form a clear expectation about what the agent sought to accomplish.

2.1.2. No time to form an expectation

Negative findings will also be obtained in VOE false-belief tasks when children cannot form an expectation about an agent's actions because they are not given sufficient time to do so (Schulze & Buttelmann, 2017). This may be especially true when the agent's false belief is brought about by a novel event in the scene; children must have sufficient time to process this new information and work out its implications for the agent's actions.

In the task of Onishi and Baillargeon (2005), the familiarization trials were followed by a belief-induction trial. In one condition, for example, the toy moved in the agent's absence from box-A to box-B, and this event was followed by a paused scene that ended when children looked away and the trial ended. Because the toy moved for the first time in a self-propelled manner, children likely needed some time to process this information and work out its implications for the agent's actions. In their close replication of Onishi and Baillargeon (2005), Yott and Poulin-Dubois (2012) also used a belief-induction trial and obtained positive results. However, Powell et al. (2018) did not use a separate belief-induction trial; test trials were identical to the familiarization trials except that while the agent was briefly out of sight, the toy either moved from one box to the other on its own (task-2) or was moved by a bystander (task-3). In either case, the agent reached for a box immediately after she returned. Thus, one factor that might have contributed to these tasks' negative results is that children did not have sufficient time to process the novel information they had received and to form an expectation about what the agent would do before she completed her actions.