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# Sins of omission: Children selectively explore when teachers are under-informative



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## ABSTRACT

Do children know when people tell the truth but not the whole truth? Here we show that children accurately evaluate informants who omit information and adjust their exploratory behavior to compensate for under-informative pedagogy. Experiment 1 shows that given identical demonstrations of a toy, children (6- and 7-year-olds) rate an informant lower if the toy also had non-demonstrated functions. Experiment 2 shows that given identical demonstrations, six-year-olds explore a toy more broadly if the informant previously committed a sin of omission. These results suggest that children consider both accuracy and informativeness in evaluating others' credibility and adjust their exploratory behavior to compensate for under-informative testimony when an informant's credibility is in doubt.

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## 1. Introduction

Much of what we know about the world comes from what others tell us. However, informants can be ignorant, mistaken, withholding, or even deceptive. Rather than indiscriminately accepting all socially communicated information, learners need to know whom to trust.

Detecting unreliable informants may be relatively easy when they are obviously wrong. Previous research shows that even young children distinguish informants who provide false information from those who provide accurate information, and preferentially learn from previously accurate informants (Birch, Vauthier, & Bloom, 2008; Jaswal & Neely, 2006; Koenig, Clément, & Harris, 2004; Koenig & Harris, 2005; Pasquini, Corriveau, Koenig, & Harris, 2007). For instance, preschoolers are more likely to accept a label for a novel object from an informant who previously labeled a familiar object correctly (e.g. calling a ball a ball)

than from someone who labeled the familiar object incorrectly (e.g., calling a ball a shoe; Koenig & Harris, 2005). Children are also sensitive to indirect cues to informant reliability, including verbal and non-verbal cues suggesting ignorance or doubt (Birch, Akmal, & Frampton, 2010; Koenig & Harris, 2005; Sabbagh & Baldwin, 2001), differences in informants' expertise or specialized knowledge (Lutz & Keil, 2002; Sobel & Corriveau, 2010), and descriptions of informants' benevolent or malevolent intent (Dunfield, Kuhlmeier, & Murphy, 2013; Landrum, Mills, & Johnston, 2013).

However, in typical communicative contexts, outright lies are rare; nor do informants usually convey ignorance, uncertainty, or malice. Instead, there are more subtle forms of misinformation that may be harder to detect. Imagine, for instance, someone who says, "I have a sister" when he has four sisters. Although the testimony is logically true, the implication is that he has only one sister. Providing logically true testimony that induces a false belief in others is a *sin of omission*.

Recent work on inductive inferences in social contexts provides a formal account of how under-informative testimony can be actively misleading. When an informant is

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assumed to be knowledgeable and helpful, the learner expects the informant to choose evidence that is most likely to increase the learner's belief in the correct hypothesis. Thus pedagogically transmitted information imposes strong constraints on the learner's inference (Shafto & Goodman, 2008; Shafto, Goodman, & Frank, 2012). For instance, when a teacher demonstrates that a toy squeaks, the absence of evidence for additional functions strongly implies the absence of additional functions; otherwise, the teacher would have demonstrated them. Consistent with this account, when preschoolers saw a teacher who showed that a toy squeaks, children rationally inferred that it was the toy's only function and spent most of their time squeaking the toy, discovering few of its other functions (Bonawitz et al., 2011). By omitting information about additional functions of the toy, the teacher induced a false belief in the learner.

Do children know when people tell the truth, but not the whole truth? To evaluate under-informative testimony, one must recover the pragmatic meaning of what is conveyed and understand that it induces a false belief in the listener. Therefore, even though young children can successfully evaluate sins of commission (false testimony), the ability to recognize the misleading nature of omitted information may not emerge until later.

In this study, we ask whether children can evaluate, and even compensate for, under-informative pedagogy. In Experiment 1, we ask whether children rate teachers who omit relevant information about a toy lower than those who do not omit such information. In Experiment 2, we look at whether children track others' past history of informativeness and engage in compensatory exploration when a teacher's informativeness is in doubt. Because previous work suggested that children might not be sensitive to the pragmatics of omitted information before the age of six (Noveck & Reboul, 2008; Papafragou & Musolino, 2003), and because pilot testing suggested that children younger than six had difficulty using the rating scale, we focused on ages 6–7.

## 2. Experiment 1

### 2.1. Methods

#### 2.1.1. Participants

Forty-two children between ages 6 and 7 were recruited from a local children's museum and were randomly assigned to either "Teach 1/1" ( $N = 22$ ,  $M_{\text{age}}(\text{SD}) = 6.9$  (0.61)) or "Teach 1/4" ( $N = 20$ ,  $M_{\text{age}}(\text{SD}) = 7.0$  (0.64)) conditions. Fifteen additional children were dropped for failing to meet the inclusion criteria (see Results).

#### 2.1.2. Materials

Two yellow, pyramid-shaped novel toys were constructed using foam board and electronic parts (see Fig. 1). One toy (henceforth One-Function Toy) had only one functional affordance (twisting a purple knob activated a wind-up mechanism) and the rest of the parts did not depress nor function as buttons. The other toy (Four-Function Toy) looked almost identical, but in

addition to the purple knob, the toy had one button that activated LED lights, one that activated a spinning globe, and one that activated music. Hand puppets were used as the naïve learner and teachers. Children rated the teachers using a rating scale, which had a knob that slid horizontally along tick marks from 1 to 20. Five color-coded faces (from frowny to smiley) served as additional anchor points along the scale.

#### 2.1.3. Procedure

All children were tested individually in a quiet room inside the museum. The experimenter first introduced the children to Elmo, a silly monster who does not know much about toys. She said, "We will watch some teachers as they teach Elmo about their toys. Then we will tell them how helpful they were in teaching Elmo, so that they can do a better job next time". She briefly explained the rating scale, and asked children to indicate where they'd place the knob on the scale if the teacher did a "very good job", "just okay", and "not a good job". All children were able to use the rating scale to provide the appropriate rank order for the three evaluations.

The experimenter then gave the children either the One-Function Toy (Teach 1/1 condition) or Four-Function Toy (Teach 1/4 condition) to play with. Children were allowed to explore the toy until they tried all parts of the toy. Thus all participants entered the study knowing whether the toy had one or four functions.

Children then saw the Toy Teacher puppet teach Elmo about the toy. The Toy Teacher's action was identical in both conditions: he said, "This is my toy. I am going to show you how my toy works", and turned the purple knob on the toy to activate the wind-up mechanism. The puppet maintained a neutral tone of voice throughout and his facial expression did not change throughout the experiment (see Fig. 2 for the puppet used as the Toy Teacher). After two demonstrations of the wind-up part, the participant was asked to rate the teacher on the rating scale. Then children saw two more teachers who taught about names of their toys. The Correct Teacher puppet called a plastic carrot "a carrot" and a rubber duck "a duck". The Incorrect Teacher puppet called a stuffed rabbit "a cow" and a plastic corn "a cup". The order of Correct and Incorrect teachers were counterbalanced. These additional ratings allowed us to (1) identify children who failed to understand the rating scale, and (2) calculate an adjusted score for the Toy Teacher calibrated to the child's own ratings of the Correct and Incorrect Teachers (see Results).

### 2.2. Results and discussion

Five children rated the Incorrect teacher the same as or higher than the Correct Teacher, suggesting that they did not understand the task instructions. Additionally, ten children primarily enjoyed sliding the knob on the scale and gave a 0 or 20 to all the teachers. These children were also excluded from the analysis.<sup>1</sup>

<sup>1</sup> All results remain significant even when these children are included ( $N = 24$  in Teach 1/1,  $N = 28$  in Teach 1/4).

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