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Rapid Communication

Show *or* tell: Testimony is sufficient to induce the curse of knowledge in three- and four-year-olds

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Because much of what children learn extends beyond their first-hand experience, they are reliant upon the testimony of others to acquire information about aspects of the world they have not experienced directly. Here we asked whether testimony alone would be sufficient to induce cognitive biases in knowledge attribution that have been observed when children acquire information through direct observation. A total of 80 three- and four-year-old children were tested on a "curse of knowledge" task to assess their inability to override their own knowledge when asked to assess the knowledge of a naïve other. In the present study, we tested children's ability to override knowledge gained through testimony rather than knowledge gained through visual experience. Testimony alone was sufficient to induce the curse of knowledge in three- and four-year-olds. Knowledge obtained through the testimony of others is apparently subject to some of the same cognitive biases that are present when children learn through observation.

Keywords: Social cognition; Cognitive development; Testimony.

Though children learn extensively from their own observation of the world, much of the knowledge they acquire comes from the testimony of others. Information from social partners is not passively received even by very young children, however (for recent reviews, see Gelman, 2009; Heyman, 2008). Three- and four-year-olds are sensitive to both explicit and implicit cues to source credibility. They prefer to learn new words from speakers who state that they are knowledgeable about the referents of those words (Sabbagh & Baldwin, 2001), and they selectively trust the testimony of a speaker with a history of accuracy over a speaker with a history of inaccuracy when learning new object names (Koenig, Clement, & Harris, 2004; Koenig & Harris, 2005, 2007; Jaswal & Neely, 2006; Nurmsoo & Robinson, 2009) or functions (Birch, Vauthier, & Bloom, 2008).

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These preferences for the testimony of previously accurate speakers are not fleeting: Even three-year-olds spontaneously preferred the testimony of a previously accurate informant up to one week after learning of that informant's accuracy (Corriveau & Harris, 2009). Some four-year-olds even make use of testimony in a flexible manner, reversing an initial pattern of trust after observing a previously reliable speaker become unreliable (Scofield & Behrend, 2008). Four-year-olds also appear to track the relative frequency of speaker error, forgiving incorrect responses if the speaker is correct a majority of the time. Three-year-olds, on the other hand, do not demonstrate this statistical monitoring strategy, mistrusting informants who make even a single error (Pasquini, Corriveau, Koenig, & Harris, 2007).

For young children, does knowledge acquired through testimony hold the same status as knowledge acquired through first-hand experience with the world? Knowledge gained through testimony may be more fragile than knowledge gained directly (Perner, 1991; Robinson, Mitchell, & Nye, 1995; Zaitchik, 1991). Preschool children show less confidence in knowledge of a toy's identity when it is gained indirectly (Robinson, Haigh, & Nurmsoo, 2008), and some evidence suggests that infants "never treat language . . . as akin to first-hand experience" (Koenig & Harris, 2007, p. 270). On the other hand, by the age of two years, children make inferences about ambiguous entities based on adults' unexpected verbal labels, even when those labels conflict with their own perceptual classifications (Jaswal & Markman, 2007). Even at 22 months (but not 19 months), children readily update their mental representations of unseen objects based only on the testimony of others (Ganea, Shutts, Spelke, & DeLoache, 2007).

Here we investigate the status of knowledge that children gain through testimony by asking specifically whether such knowledge is subject to a cognitive bias that has been shown to apply to knowledge gained through perceptual access: the "curse-of-knowledge" effect. The curse of knowledge is the tendency to be biased by one's own knowledge when attempting to judge the perspective of a less knowledgeable other (Camerer, Lowenstein, & Weber, 1989). Both adults and children are subject to this bias, and younger children are more susceptible than older children, leading some researchers to propose that the curse of knowledge, rather than a more specific difficulty with mental state attribution, underlies young preschoolers' great difficulty with traditional verbal false-belief tasks (Birch & Bloom, 2003, 2007).

In the knowledge attribution task of Birch and Bloom (2003), children saw two sets of toys. One set was familiar to a puppet, Percy, and one set was not. Children were told that each toy had an object hidden inside. For half of the trials, the children were shown the object hidden inside, and for the other half they were not shown the object. The children were asked whether Percy knew what was hidden inside the toys. When three- and four-year-olds (but not five-year-olds) were knowledgeable about the toy's contents, they attributed more knowledge to Percy than was warranted, even when questioned about a toy with which he was unfamiliar. This curse-of-knowledge effect may be distinguished from a more general tendency toward egocentrism in childhood: The bias arose only when children were more knowledgeable about the toys' contents than Percy, not when they were less knowledgeable (Birch & Bloom, 2003).

Is the testimony of a social partner sufficient to induce the curse of knowledge, or is knowledge gained through first-hand observation required to induce this bias? We conducted a variant of the study described above with a key alteration: Children were told what the toys held, rather than being shown. We tested three- and four-year-old children in this task in order to determine whether or not preschool children exhibit biases in knowledge attribution after learning from testimony rather than visual experience.

Method

Participants

A total of 40 three-year-olds (19 females; mean 3 years 6 months; range 3 years 0 months to 3 years 11 months) and 40 four-year-olds (17 females;

mean 4 years 5 months; range 4 years 0 months to 4 years 11 months) contributed data to the study. Four additional three-year-olds completed the task, but their data were excluded due to documented language delays. Children were recruited from preschools in central Connecticut. A range of ethnicities and socio-economic statuses was represented in the sample; approximately 15% of the participants were nonwhite.

Materials

A total of 12 opaque green egg-shaped containers and 12 opaque blue egg-shaped containers served as toys. Each held a different plastic animal. All green containers were placed in one bag and all blue containers in another identical bag. A hand puppet was also used.

Procedure

Children were tested individually in a quiet room at the laboratory facility or a childcare centre. The procedure was adapted from Birch and Bloom (2003), with three main modifications. First, in the present study children were told what each toy contained rather than being shown. Second, the child knowledgeable versus child ignorant conditions (see below for details) were presented between subjects rather than within, due to the verbal complexity of the procedure. Third, we tested only three- and four-year-olds, not five-year-olds, who were previously found not to exhibit a significant curse-of-knowledge bias (Birch & Bloom, 2003).

The experimenter sat facing the child at a table and introduced the task by saying, "Today we're going to play a game with my puppet friend." The experimenter then held up two identical bags, one at a time, directing the child's attention to the 12 opaque containers in each bag by opening the bags and allowing the child to peer inside. The experimenter then said: "These toys are special. Do you know why they are special? These toys are special because each one has a different little thing inside." The experimenter pulled a container from one of the two bags to demonstrate that the container had a small object inside, while saying, "See this toy? This one has a sheep inside." The experimenter then gestured to both bags and all of the toys and said "Each one of these toys has a different little thing inside. That's what makes them special. Each one has something different inside."

The experimenter then brought the hand puppet from behind her back, introducing it to the child as her puppet friend Percy. The puppet was again hidden behind the experimenter, and the child was told that when Percy was out of sight he could not see or hear what was happening. The experimenter then held up one bag filled with opaque toys (either the green toys or the blue toys) and held it open for the child to see inside. The experimenter told the child that Percy *had* played with all the toys in that bag (familiar toys). The second bag was then shown to the child, who was told that Percy had *never* seen or played with any of the toys in that bag (unfamiliar toys). To ensure that the child understood the distinction, the experimenter pulled out some of the containers from the "familiar toys" bag and pointed out again that all the toys Percy *had* played with were green (for half of the children; blue for the other half) and that Percy had picked them out himself. The experimenter did the same for the toys from the other bag and again emphasized that Percy had *never* played with the blue toys (for half of the children; this was true of the green toys for the other half). All containers were then replaced in their corresponding bags.

Each child was then presented with 12 test trials. In each trial, the experimenter removed one toy from each bag and placed it in front of the child. In the *child knowledgeable* condition, the experimenter opened the familiar toy and the unfamiliar toy (with order counterbalanced), looked inside, and told the child what was inside each toy without visually displaying the toy's contents. Upon opening a toy, the experimenter said: "What's inside here? Oh, it's a _____." The procedure for the *child ignorant* condition was identical, except that the experimenter opened each toy and looked inside without telling the child what it contained. Each child was either in the child knowledgeable or in the child ignorant condition, and each child was presented with both puppet familiar and puppet unfamiliar toys.

After the presentation of both toys, the experimenter brought the puppet Percy into view again, saying, "Let's show Percy the toys. Here comes Percy." Percy picked up the familiar toy and said "Hey, I have played with this toy before." Percy then picked up the unfamiliar toy and said "Hey, I've never even seen this toy before." The order in which the puppet picked up the toys was counterbalanced, and Percy never opened the toys. Percy then left the scene and the experimenter pointed to one toy at a time, in counterbalanced order, asking the child "Does Percy know what is inside this toy?" Children responded yes or no for each container, producing a total of two responses for each test trial (one for the familiar toy and one for the unfamiliar toy). This procedure was repeated for all 24 containers, 2 at a time, for a total of 12 test trials. The child was either knowledgeable about or ignorant of the contents of the toys for all 12 trials.

Results

Mean "yes" responses to the question, "Does Percy know what is inside this toy?" for all conditions and for both age groups are shown in Figure 1. The top panel of Figure 1 depicts the results for child knowledgeable and child ignorant conditions for puppet familiar trials, in which Percy was familiar with the contents of the toys. The bottom panel of Figure 1 depicts the results for child knowledgeable and child ignorant conditions for puppet unfamiliar trials, in which Percy was not familiar with the contents of the toys. The critical finding is the difference between the child knowledgeable and child ignorant conditions for toys unfamiliar to the puppet, but not for toys familiar to the puppet: Children expect a puppet who is familiar with the toys to know their contents regardless of the child's own state of knowledge, but they overattribute knowledge to the puppet when the puppet is unfamiliar, and the child is knowledgeable.

A $2 \times 2 \times 2$ analysis of variance (ANOVA) with between-subjects factors age and child knowledge (child knowledgeable or child ignorant) and within-subjects factor puppet familiarity (puppet familiar or puppet unfamiliar) was performed, with the child's number of "yes" responses (out of 12) to the question "does Percy know what is inside this toy?" as the dependent measure. There was a main effect of puppet familiarity, $F(1, 76) = 81.50$, $p < .0005$; children were more likely to say that Percy had knowledge of the toy's contents when Percy was familiar with the toy ($M = 10.29$) than when he was unfamiliar

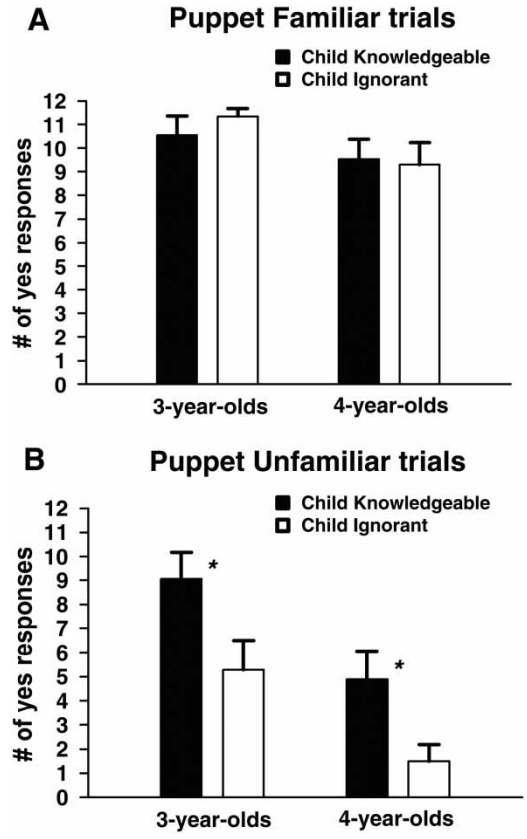

Figure 1. *A. Three- and four-year-olds' assessments of the knowledge of a knowledgeable social partner. The plot depicts the mean number of "yes" responses to the question "Does Percy know what is inside this toy?" when Percy was familiar with the contents of the toy. B. Three- and four-year-olds' assessments of the knowledge of an ignorant social partner. The plot depicts the mean number of "yes" responses to the question "Does Percy know what is inside this toy?" when Percy was unfamiliar with the contents of the toy. Asterisks indicate a significant difference ($p < .05$).*

($M = 5.24$). This was true for both three-year-olds ($M = 10.95$ for familiar toys, and $M = 7.18$ for unfamiliar toys), $t(39) = 4.53$, $p < .0001$, and four-year-olds ($M = 9.63$ for familiar toys, and $M = 3.3$ for unfamiliar toys), $t(39) = 7.25$, $p < .0001$. There was also a significant interaction of Puppet Familiarity × Age, $F(1, 76) = 5.47$, $p < .05$; older children were more sensitive to puppet familiarity when attributing knowledge to Percy than were younger children. A main effect of between-subjects factor child knowledge was also revealed, $F(1, 76) = 4.31$, $p < .05$; overall, children were more likely to say that Percy had knowledge of the toy's contents when they knew what the toys contained ($M = 8.48$) than when they did not ($M = 7.01$).

The "curse of knowledge" predicts specifically that children should be biased toward attributing knowledge to the puppet when they are knowledgeable, and the puppet is ignorant. They should not, however, show a symmetrical "curse of ignorance": Children should not be biased against attributing knowledge to the puppet when they are ignorant, and the puppet is knowledgeable (Birch & Bloom, 2003). Therefore we should observe a difference between the child knowledgeable and child ignorant conditions for the toys unfamiliar to the puppet, but not for the toys familiar to the puppet. Accordingly, there was a significant interaction of child knowledge and puppet familiarity, $F(1, 76) = 13.01$, $p < .001$. Neither age group demonstrated a curse-of-ignorance effect, as predicted: When the puppet was familiar with the toys' contents, the child knowledgeable and child ignorant conditions did not differ for three-year-olds (knowledgeable, $M = 10.55$; ignorant, $M = 11.35$), $t(38) = 0.92$, *ns*, or for four-year-olds (knowledgeable, $M = 9.52$; ignorant, $M = 9.74$), $t(38) = 0.17$, *ns*. A curse-of-knowledge effect was observed for both age groups: When the puppet was unfamiliar with the toys' contents, the child knowledgeable and child ignorant conditions did differ significantly for both three-year-olds (knowledgeable, $M = 9.05$; ignorant, $M = 5.3$), $t(38) = 2.29$, $p < .05$, and four-year-olds (knowledgeable, $M = 4.9$; ignorant, $M = 1.53$), $t(38) = 2.43$, $p < .05$.

Discussion

This finding demonstrates that three- and four-year-old children are subject to cognitive biases produced by knowledge they acquire indirectly from others, just as they are biased by knowledge they acquire through direct observation. Testimony alone is apparently sufficient to induce the curse-of-knowledge effect in preschool children, at least in the present knowledge attribution paradigm. When preschool children were told about a toy's contents, they incorrectly attributed knowledge of the toy's contents to a less knowledgeable other. These findings of bias produced by knowledge gained through testimony parallel previous findings of bias produced by knowledge gained through visual experience (Birch & Bloom, 2003).

Children in the current study did not exhibit a curse-of-ignorance effect, again paralleling previous work assessing cognitive biases produced by direct visual experience. When children were not told of the toy's contents, they correctly attributed knowledge to a more knowledgeable other, showing no tendency to attribute ignorance to the more knowledgeable other when they themselves were ignorant. This asymmetry demonstrates that the curse-of-knowledge effect is more than a simple case of childhood egocentrism: It is difficult for children to override their own knowledge when dealing with a less knowledgeable other, but not to override their own ignorance when dealing with a more knowledgeable other (Birch & Bloom, 2003).

Because we did not examine children's performance in a direct observation condition in the present study, it remains to be seen whether the magnitude of the testimony-derived curse-of-knowledge effect declines in parallel with the effect's magnitude when children's knowledge is acquired through visual experience. In previous studies using a similar paradigm (Birch & Bloom, 2003), five-year-olds were able to inhibit their own knowledge when assessing the knowledge of a less knowledgeable other, but three- and four-year-olds were not (when more sensitive measures were used, even adults were susceptible to this bias; Birch & Bloom, 2007). The present

findings do establish that the curse-of-knowledge effect is present both in three-year-olds and in four-year-olds in this testimony-based paradigm, as it was in children of the same age in the previous direct observation paradigm.

We found no evidence of a distinction between children's treatment of testimony and direct observation in this context. Why should this be, given previous evidence of children's sensitivity to testimony as a potentially less reliable source of knowledge than perceptual experience? A large body of research has investigated the factors that lead children to believe or disbelieve an utterance when it is first heard, but we know relatively less about how this knowledge is treated later (Robinson et al., 2008). In our procedure, children should have had an initial tendency to believe the experimenter's utterances. Children had reason to think that the experimenter was well-informed about the toys' contents, because they observed the experimenter looking inside the toy before reporting its contents. By age three, children are sensitive to the difference between utterances of well-informed and uninformed speakers, preferring to update their own beliefs based on testimony from well-informed speakers (Robinson, Champion, & Mitchell, 1999). It is likely that the use of a well-informed speaker contributed to our finding of a testimony-based curse of knowledge effect. An uninformed testimony condition (with experimenter reporting on toys' contents without perceptual access) might prove more likely to produce differential treatments of testimony versus direct observation by decreasing the initial likelihood that children would accept the speaker's claims (Robinson et al., 1999; Robinson & Whitcombe, 2003).

Because our procedure should have encouraged children to believe the experimenter's testimony initially, our findings suggest that in this paradigm, children either did not track the source of their knowledge about the toy's content, or did track the source but did not treat testimonial knowledge as potentially unreliable. Preschool children, especially three-year-olds, are often unable to report knowledge sources (Gopnik & Graf, 1988; O'Neill & Gopnik, 1991). They may also fail to track knowledge sources more implicitly, such that knowledge gained by testimony (like that gained by direct observation) is readily available to produce later cognitive biases in knowledge attribution. Further explorations of children's performance in a testimony-based curse of knowledge paradigm incorporating manipulation of experimenter doubt (as in Robinson et al., 2008), may help to distinguish between these possibilities.

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