The Curse of Knowledge in Reasoning about False Beliefs

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Abstract

Young children have problems reasoning about false beliefs. We propose that these problems arise, at least in part, because children possess an exaggerated version of the same bias that exists in adults - the 'curse of knowledge', which is a tendency to be swayed by one’s own knowledge when trying to appreciate a more naïve knowledge state. If the ‘curse of knowledge’ can interfere with false belief reasoning, then adults should also be biased by their own knowledge when reasoning about false beliefs, if tested using sufficiently sensitive measures. This prediction was supported in two experiments using a modified false belief task. We also found that adults' privileged knowledge only led to biased false belief reasoning in the presence of a perceived justification for their response (Experiment 1) and that the curse of knowledge bias cannot be explained by salience alone (Experiment 2). This research supports the more general claim that there is a fundamental similarity in children's and adult's abilities, and limitations, in reasoning about the mind.

Word Count: 168
The Curse of Knowledge in Reasoning about False Beliefs

Over the last two decades, a wealth of research has explored the development of false belief reasoning in young children (see Wellman, Cross, & Watson, 2001 for a review). As Dennett (1978) pointed out, it is possible to correctly predict the action of another individual without any understanding of mental states, by simply observing the true state of the world—as long as the other individual’s belief of the world is consistent with reality. A more valid test of whether someone appreciates mental states involves predicting actions when the other individual’s mental state is inconsistent with reality—thus, the interest in children’s ability to reason about false beliefs.

Most research on false belief reasoning has utilized some variant of the ‘displacement task’ (e.g. Wimmer & Perner, 1983; Baron-Cohen, Leslie, & Frith, 1985). For example, participants are told a story about Sally who puts her candy in a basket and leaves. In her absence, another character moves the candy to a box. When Sally returns, where will she look for her candy? The right answer, the basket, requires attributing a false belief to Sally. Another method is the ‘Smarties task’, developed by Perner, Leekam, and Wimmer (1987). Children are shown a closed Smarties container and asked what is inside. When they give the answer, “Smarties”, the experimenter opens the container to reveal that there are actually pencils inside. The box is then closed and the child is asked what someone else, who was absent when the pencils were revealed, will think is inside. The child is also asked what he or she originally said was inside. Again, getting these questions right requires attributing a false belief, either to oneself or to someone else.

Four-year-olds tend to do fairly well at these tasks, but younger children tend to fail (see Wellman et. al’s, 2001 meta-analysis of 178 studies). The younger children do not answer randomly; instead, they tend to answer in accord with their own knowledge, saying that Sally will
think the candy is in the box, that the other person will think that there are pencils in the container, and that they themselves had originally said the container held pencils.

The source of this difficulty is a matter of considerable debate. Some researchers interpret children’s difficulties on these tasks as reflecting a qualitative and conceptual difference in the way young children understand the mind compared to older children and adults. For instance, young children are sometimes said to lack a concept of belief or a concept of mental representation more generally (e.g. Gopnik, 1993; Perner et al., 1987; Perner, 1991; Wellman, 1990; Wellman et al., 2001; Wimmer, Hogrefe, & Sodian, 1988). An alternative view is that young children's problems in reasoning about false beliefs might be due to more general factors such as memory load, assumptions of rationality, conflicting representations, processing limitations, among others, and thus not necessarily indicative of a different concept of belief (e.g. Fodor, 1992; Leslie, 1987; Friedman & Leslie, 2004; German & Leslie, 2000; Koos, Gergely, Csibra, & Biro, 1997; Moses, 1993; Roth & Leslie, 1998; Zaitchik, 1990; 1991; for a discussion, see Bloom & German, 2000).

We propose that children are more susceptible to a cognitive bias found in adults in which one overextends one’s current knowledge state when trying to appreciate a more naïve state. As a result of younger children’s greater susceptibility to this bias, they experience greater difficulties with false belief reasoning when they themselves have specific knowledge that the other person does not share. That is, we propose that children’s difficulties with false belief reasoning might be accounted for, at least in part, by an exaggerated bias referred to in the adult literature as the ‘curse of knowledge’ (Camerer, Weber, & Loewensteins, 1989). This proposal is not inconsistent with the notion of some conceptual change across development in understanding mental states. However, it is most consistent with the views emphasizing limitations in general processing factors because it points to the commonalities between children’s and adult’s abilities to reason about mental states.
Economists and social psychologists have pointed out that adults suffer from the curse of knowledge (Camerer et al., 1989); a tendency to be biased by one’s own knowledge when attempting to take a more naïve perspective. This bias has received different names in different disciplines; such as ‘hindsight bias’ or ‘creeping determinism’ (e.g. Fischhoff, 1975), the knew-it-all-along effect (e.g. Taylor, Esbenson, Bennett, 1994), ‘realist bias’ (e.g. Taylor & Mitchell, 1997), ‘adult egocentrism’ (e.g. Kelley & Jacoby, 1996); and ‘epistemic egocentrism’ (e.g. Royzman, et al., 2003) but the phenomenon is the same—a tendency to overextend one’s current knowledge state when attempting to appreciate a more naïve state (whether that naïve state is someone else’s or an earlier state of one’s own). Once we know the solution to a problem, we tend to overestimate how easy it is for someone else to solve (Kelley & Jacoby, 1996). Similarly, if we know a company's earnings (Camerer, et. al., 1989), the meaning of an idiom (Keysar & Bly, 1995), or whether a statement is sarcastic (Keysar, 1994), our assessments of the judgments of a naïve person are biased in the direction of what we know (see also Blank, Fischer, & Erdfelder, 2003; Fischhoff, 1975; Heine & Lehman, 1996; Keysar, Ginzel, & Bazerman, 1995; Nickerson, 1999; Sanna & Schwarz, 2003; see Hawkins & Hastie, 1990 for a review).

Not surprisingly, children are also susceptible to this bias (Bernstein et al., 2004; Birch & Bloom, 2003; Taylor, Esbenson, and Bennett, 1994; Pohl & Haracic, 2005; Mitchell & Taylor, 1999). In Birch & Bloom (2003), 3- to 5-year-old children were presented with novel toys and were told that each contained “something special” inside. One toy was presented as familiar to the experimenter’s puppet friend Percy (i.e., he said: “I’ve played with that one before”). The other
was presented as unfamiliar to Percy (i.e., he said: “I’ve never ever seen that one before”). The key manipulation was whether the children *themselves* knew what was inside the toys. For half of the trials, the children were ‘cursed’ by showing them what was inside the toys prior to Percy’s appearance. For the other half of the trials, the children were not shown what was inside the toys. The results revealed a significant curse of knowledge bias: When the children themselves knew what was inside they were more likely to over-attribute knowledge to Percy. Importantly, the opposite is not true, however: when the children were ignorant about what was inside they were *not* more likely to under-attribute knowledge to Percy. That is, there is not an equivalent ‘curse of ignorance’, suggesting that the results cannot be accounted for by a more general egocentric bias (see Birch, 2005 and Birch & Bloom, 2003; 2004 for discussions).

Applying the same logic to false belief tasks, it should be particularly hard to appreciate that someone has a different perspective than your own (e.g., they hold a false belief) when you possess specific knowledge of the actual state of affairs. Traditional false beliefs tasks are ‘cursed’—participants know the outcome and are asked to judge how a more naïve other (or themselves in a previously naïve state) would think or act. Indeed, there are many parallels between curse-of-knowledge studies with adults and the different kinds of false belief tasks given to children.

First, Fischhoff (1975) provided adult participants with descriptions of events and told them that these descriptions were also presented to other students. Participants who were told the outcome of the events estimated that naïve students would predict higher probabilities to that outcome than participants who were ignorant of the outcome. In other words, like children in the displacement task who responded as if naïve Sally shared their outcome-knowledge, adults in
Fischhoff’s (1975) task who were told the event outcome also responded as if naïve others shared their knowledge, though notably to a lesser magnitude.

Second, Fischhoff and Beyth (1975)’s asked participants on the eve of former President Nixon’s trips to China and the USSR to estimate the probability of various possible outcomes of the visits. After the trip’s completion, the same participants were asked to recall their original predictions. Like children in the Smarties task who tended to report their new knowledge of what was in the box instead of their original predictions, participants’ recollections were biased in the direction of their knowledge of what had actually taken place. Again, adults and children experience similar limitations but to differing degrees.

Note finally that Birch & Bloom (2003) found that the magnitude of the bias significantly declined from age 3 to age 5—the same developmental period in which you see shifts in children’s false belief performance. Thus, any difficulty that adults have in appreciating false beliefs when they are knowledgeable would likely be exaggerated in younger children.

The studies below explored these parallels in a more direct fashion and tested whether adults, who undoubtedly are able to represent and conceive of false beliefs, will find reasoning about false beliefs harder when they have specific knowledge about the outcome than when they do not have specific knowledge. We gave adults a displacement task that differed from standard tasks in three important ways. First, we used a more sensitive measure than the categorical response that is typically obtained with children. Participants were asked to report the probability that the protagonist would look in each of the containers when she returned. Second, instead of two containers, we used four, to enable us to manipulate the participants’ knowledge of the outcome. Either participants were told that the target object (a violin) was moved to a specific container (i.e. the ‘Knowledgeable’ conditions); or told that the violin was moved to another container but were
not told which one (i.e. the ‘Ignorant’ condition). We predicted that knowledge of the outcome in a false belief task like that used with children would compromise even adults’ ability to reason about false beliefs.

Third, the containers were rearranged following displacement to allow us to manipulate the plausibility that the protagonist would look in each of the containers. This manipulation was included because previous research has demonstrated that plausibility can mediate the magnitude of the curse of knowledge (see Pohl, 1998). For instance, adults are more biased in the direction of the outcome that they know about when the outcome is brought about because of a plausibly foreseeable reason. Wasserman, Lempert, and Hastie (1990) told subjects that the British-Gurka war was won by the British because of the superior discipline of the troops (i.e. what we will call ‘plausibly foreseeable’), whereas other subjects were given the same outcome, but were told that a sudden unseasonal rainstorm was responsible for the victory (i.e. not likely foreseeable). The magnitude of the hindsight bias (i.e. subjects’ estimates of the probability they would have assigned to the outcome had they not heard the report on the British victory) was greatest in the plausibly foreseeable condition. We believe the reason for the heightened magnitude in the plausibly foreseeable condition is because it allows subjects to perceive that they could have predicted the answer without knowing it, even if the actual possibility of them predicting it is not increased. That is, it allows subjects to justify or rationalize their biased predictions.

Here, we manipulated the perceived plausibility of the outcome by creating a knowledgeable condition in which the violin was moved to a location that would allow subjects to generate a plausible explanation for why the protagonist would look there for her violin. In a ‘Knowledge – Plausible’ condition, participants were told that the violin was moved to a container that, following rearrangement, was in the same physical location (different container) as the violin
The Curse of Knowledge was originally—thus, it would be reasonable to assume that the character might look there by mistake. In a ‘Knowledge – Implausible’ condition, participants were told that the violin was moved to a container that following rearrangement was in a different location than where the violin was originally. A ‘True Belief’ condition in which the violin was not moved was also included. We predicted that the curse of knowledge would be stronger for adults if subjects could conceive of a plausible rationale for their biased response.

Experiment 1

Method

Participants. Two hundred ten students enrolled in an Introductory Psychology course at Yale University in New Haven, CT participated. Subjects completed the single-page questionnaire as part of a larger packet of questionnaires and received course credit for their participation. Ninety-three were male, 112 were female, and 5 opted not to specify their gender. An additional 17 participants (7.5%) were excluded because their percentage totals did not equal 100%.

Materials and Procedure. Participants were randomly assigned to one of four conditions: True Belief, Ignorant, Knowledge – Plausible, and Knowledge – Implausible. All participants received the same stimuli—a color version of Figure 1 (without the color word labels) depicting a girl holding a violin by a sofa and four containers. Each container was a different color: blue, purple, red, and green. Beneath the first picture was an image of a different girl holding a violin and the same four containers rearranged: red, green, purple, blue.

Figure 1: The Knowledge – Plausible Version of the Stimuli

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1 Subjects had a limited amount of time to complete the package of questionnaires in both Experiments 1 and 2. It is an open question whether the same results reported here would obtain without time pressure.
Participants in all four conditions read, “This is Vicki. She finishes playing her violin and puts it in the blue container. Then she goes outside to play. While Vicki is outside playing, her sister, Denise…” At this point, the conditions differed:

*True Belief*: “comes into the room.”

*Ignorant*: “moves the violin to another container.”
Knowledge – Plausible: “moves the violin to the red container.”

Knowledge – Implausible: “moves the violin to the purple container.”

All participants then read, “Then, Denise rearranges the containers in the room until it looks like the picture below.” This was followed by, “When Vicki returns she wants to play her violin. What are the chances Vicki will first look for her violin in each of the above containers? Write your answers in percentages in the spaces provided under each container.”

Results and Discussion

In the True Belief condition participants gave a mean probability rating of 68% to the blue container where Vicki placed the violin and a mean probability rating of 28% to the red container (that following rearrangement occupied the location that the blue container previously occupied). That is, most of the time they thought Vicki would look in the original container, but often they thought she would look in a different container that was in the same location as the violin was originally. They gave the other two containers, not the container that held the violin, and not the same location either, a combined probability rating of just over 3%. Thus, this True Belief condition serves as a baseline of how plausible subjects think it is for Vicki to look in each of the 4 containers after they have been rearranged. Subjects judged that it was quite plausible for her to look in the red container and quite implausible for her to look in the purple container. See Table 1.
Table 1  Mean Probability Judgments that Vicki Will Look in Each of the Containers

<table>
<thead>
<tr>
<th>Condition</th>
<th>Blue Container (Where the violin was originally)</th>
<th>Red Container (Now occupies the location where the violin was originally)</th>
<th>Purple Container (Now occupies a different location than where the violin was originally)</th>
<th>Green Container (Now occupies a different location than where the violin was originally)</th>
</tr>
</thead>
<tbody>
<tr>
<td>True Belief (Violin “not moved”)</td>
<td>68% (SD= 26%)</td>
<td>28% (SD=24%)</td>
<td>1% (SD = 2%)</td>
<td>2% (SD = 6%)</td>
</tr>
<tr>
<td>Ignorant (Violin moved to “another container.”)</td>
<td>71% (SD = 26%)</td>
<td>23% (SD = 22%)</td>
<td>2% (SD = 5%)</td>
<td>3% (SD = 7%)</td>
</tr>
<tr>
<td>Knowledge – Plausible (Violin moved to “the red container.”)</td>
<td>59% (SD = 27%)</td>
<td>34% (SD = 25%)</td>
<td>3% (SD = 5%)</td>
<td>4% (SD = 7%)</td>
</tr>
<tr>
<td>Knowledge – Implausible (Violin moved to “the purple container.”)</td>
<td>73% (SD = 29%)</td>
<td>19% (SD = 21%)</td>
<td>6% (SD = 16%)</td>
<td>3% (SD = 5%)</td>
</tr>
</tbody>
</table>

In the Ignorant condition, probability ratings that Vicki would look for her violin in the blue container where she left it, did not differ from that of the True Belief condition, t (104) = -0.59, p = .56, NS (two-tailed). That is, participants who knew that the violin was moved but did not know where it was moved, predicted that it was as likely that Vicki would act based on a false belief, as participants who knew the violin had never been moved.

In contrast, consider the Knowledge – Plausible condition in which participants were told that the violin was moved to the red container, a container in a location that Vicki might plausibly look. Here, participants reported significantly higher probabilities to the red container, than participants in the Ignorant condition, t (105) = - 2.42, p < .05 (one-tailed). In addition, participants in the Knowledge – Plausible condition reported significantly lower probabilities that Vicki would look in the blue container, than participants in the Ignorant condition, t (105) = 2.35,
p < .05 (one-tailed). In other words, participant’s own knowledge of the outcome interfered with their ability to reason about another’s false belief.

However, in the Knowledge – Implausible condition in which participants knew that the container was moved to the purple container, an improbable container for Vicki to look in, their probability judgments that Vicki would look in that container were not significantly higher than in the Ignorant condition, t (97) = -1.44, p = .154, NS (two-tailed). Also, participants’ knowledge that the violin was in the purple container did not lead them to decrease their probability judgments that Vicki would possess, or act on, a false belief. In other words, participants reported similar probabilities for the blue container in both the Knowledge – Implausible and Ignorant conditions, t (97) = -0.21, p = .42, NS (one-tailed). 2

To sum up, our findings demonstrate that a person’s own knowledge can interfere with their ability to reason about another’s false belief. However, in the false belief task we explored, the participants’ knowledge only led to biased responses when there was a seemingly justifiable reason to support such a biased response. Note that the fact the violin occupied the same location in space (different container) as it originally had was not sufficient to lead to these biased responses (i.e. this was true in all conditions). Rather, it was only when the subject themselves knew that the violin was in this location that they increased their predictions that Vicki would look there.

Experiment 2

What role does salience play in the previous findings? Does the participant have to believe that the violin is in a specific container, or is merely drawing attention to that container enough to increase participant’s probability judgments for that container? One could argue that simply by
mentioning the red container, and thus drawing attention to it, participants would be more likely to provide higher probabilities to that container. Alternatively, it is not the salience of the red container per se that matters but the knowledge that the red container is where the object is hidden. We predicted that merely mentioning the red container would not be sufficient to significantly increase participants’ assessments of the likelihood Vicki would look there, nor would it significantly bias their false belief reasoning.

Method

Participants. One hundred ten students enrolled in an Introductory Psychology course at Yale University in New Haven, CT participated. Subjects completed the single-page questionnaire as part of a larger packet of questionnaires and received course credit for their participation. Fifty were male, 59 were female, and 1 person opted not to specify his or her gender. An additional 12 participants (9.8%) were excluded because their percentage totals did not equal 100%.

Materials and Procedure. Participants were given the same pictorial representation of the displacement task utilized in Experiment 1. Participants were randomly assigned to one of three conditions: Knowledge (Plausible), Ignorant, and Salience. The task was the exact same as in Experiment 1 except after reading, “This is Vicki. She finishes playing her violin and puts it in the blue container. Then she goes outside to play. While Vicki is outside playing, her sister, Denise…” the conditions differed as follows:

- **Knowledge (Plausible):** “moves the violin to another container—the red one.”
- **Ignorant:** “moves the violin to another container.”
- **Salience:** “moves the violin to another container—not the red one.”

2 There was a significant difference between the ratings for the purple container in the True Belief and Ignorant conditions, t (104) = -2.103, p < .05, two-tailed). We did not predict this finding, nor do we have a good explanation
Results and Discussion

Replicating our main finding from Experiment 1, we found that participants in the Knowledge condition reported significantly higher probabilities that Vicki would look in the container that they knew held the violin, compared to participants in the Ignorant condition who did not have specific knowledge about the violin’s whereabouts, $t(68) = -2.52, p < .05$ (one-tailed). These ‘cursed’ participants also reported significantly lower probabilities that Vicki would look in the container she should falsely believe held her violin, compared to participants in the Ignorant condition, $t(68) = 2.13, p < .05$ (one-tailed). Thus, reproducing our finding that a person’s own knowledge can interfere with their ability to appreciate someone else’s false belief, even on a seemingly simple task like that used with children. See Table 2.
Table 2  Mean Probability Judgments that Vicki Will Look in Each of the Containers

<table>
<thead>
<tr>
<th>Condition</th>
<th>Blue Container (Where the violin was originally)</th>
<th>Red Container (Now occupies the location where the violin was originally)</th>
<th>Purple Container (Now occupies a different location than where the violin was originally)</th>
<th>Green Container (Now occupies a different location than where the violin was originally)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge (Plausible) (Violin moved to “the red container”)</td>
<td>60% (SD = 26%)</td>
<td>34% (SD = 24%)</td>
<td>3% (SD = 6%)</td>
<td>3% (SD = 6%)</td>
</tr>
<tr>
<td>Ignorant (Violin moved to “another container”)</td>
<td>74% (SD = 28%)</td>
<td>19% (SD = 22%)</td>
<td>3% (SD = 5%)</td>
<td>3% (SD = 5%)</td>
</tr>
<tr>
<td>Salience (Violin moved to “another container—not the red one.”)</td>
<td>68% (SD = 24%)</td>
<td>25% (SD = 22%)</td>
<td>4% (SD = 4%)</td>
<td>4% (SD = 5%)</td>
</tr>
</tbody>
</table>

The main question of interest in Experiment 2 concerns the salience condition. Participants’ probability judgments that Vicki would look in the blue container in the Salience condition were not significantly different from either the Knowledge, t (77) = -1.30, p = .10, NS (one-tailed) or Ignorant conditions, t (69) = .30 NS (two-tailed). However, participants in the Salience condition reported significantly lower probabilities that Vicki would look in the red container, than participants in the Knowledge condition, t (77) = 1.67, p < .05 (one-tailed). Furthermore, participants in the Salience condition did not report significantly higher probabilities that Vicki would look in the red container, compared to participants in the Ignorant condition, t (69) = -1.05, p = .30, NS (two-tailed). These data suggest that salience cannot account for the bias in adults’ false belief reasoning in its entirety.
General Discussion

Our findings reveal that a person’s own knowledge can contaminate his or her ability to reason about false beliefs. In Experiment 1, we demonstrated that the subjects’ own knowledge biased their ability to predict another’s behavior based on her false belief and that this bias is affected by the plausibility of the outcome. When subjects knew exactly where Vicki’s violin was moved, they significantly reduced their predictions that she would act on a false belief, compared to subjects who did not know where the violin was moved. However, the ease with which subjects could generate a plausible rationale for their (biased) response served to mediate the potency of the curse of knowledge. That is, subjects’ knowledge of the outcome proved only to interfere with their false belief reasoning if the outcome allowed for a plausible justification for their biased responses. If a potential explanation was available to subjects for why Vicki might act in accord with the subjects’ own knowledge, rather than her own, subjects were biased in their false belief reasoning. Note that this potential explanation that subjects could use to justify their responses (i.e. that the violin was in the same location in space as it was before) was true in all conditions. Thus, it was the combination of this fact with the subjects’ own knowledge of the violin’s true location that led to their biased responses.

In Experiment 2, we replicated the finding that adults’ ability to attribute false beliefs can be biased by their own knowledge. Adults who knew exactly where Vicki’s violin was moved reported significantly lower probabilities that Vicki would act according to a false belief, than adults who did not possess such knowledge. Experiment 2 also demonstrated that simply drawing attention to the container is not sufficient to increase participants’ probability judgments to that container or to interfere with their false belief reasoning. Salience may contribute to the biasing effects of knowledge but cannot account for the bias in and of itself.
This research supports the general claim that there is a fundamental similarity in children’s and adult's abilities, and limitations, in reasoning about the mind. The data are consistent with a growing body of literature that shows that adults’ own knowledge and belief states can bias their mental state reasoning or ‘theory of mind’ (e.g. Bernstein, et. al., 2004; Harvey, 1992; Keysar, 1994; Keysar et. al., 2003). This research is also akin to research demonstrating that adults make similar errors to those made by children on executive-functioning tasks, just to a lesser degree (e.g. Diamond & Kirkham, 2005). Indeed, we posit that developmental changes in executive functioning skills (see Moses, Carlson, & Sabbagh, 2005) may be one mechanism underlying developmental changes in the curse of knowledge (Birch, 2005; Birch & Bloom, 2004).

Consider also the work of German & Hehman (in press), who find that elderly adults (mean age of 80) experience difficulties with false belief reasoning similar to those of younger children. This is likely to be due, not to a conceptual deficit, but to problems with inhibitory control, the same problems that lead to poorer performance by the elderly on tests such as the Stroop task. More specifically, we would suggest that these problems in executive functioning make it difficult for the elderly to override the curse of knowledge bias. Empirical support for the relationship between inhibitory control and the curse of knowledge comes from research by Bayen, Erdfelder, & Auer (2005) who found that elderly individuals showed an exaggerated curse of knowledge bias compared to younger adults and that this deficit was due to inhibitory factors rather than other factors associated with aging. These findings suggest this bias does not simply follow a declining trend with age and experience, but more closely fits a U-shaped curve that parallels developmental changes in processing abilities.

The findings from Experiment 1 are consistent with our proposal that the curse of knowledge bias is mediated by an ability to provide a rationalization or justification (even if only
implicitly) for someone else sharing one’s knowledge, or acting as if they do. These findings have implications for the study of adult social cognition and for cognitive development. Due to the nature of the tasks that have typically been used in the adult literature, participants have usually been 'cursed' with plausible or reasonable knowledge (e.g. the outcomes of Nixon's visits, whether or not statements are sarcastic, solutions to problems, etc.). The data from such studies might be substantively different if the participants were told about event outcomes that were less plausible (see Pohl, 1998). Our findings suggest that knowledge is a more potent curse when it is in conjunction with a potential rationale for inflating one's estimates of what others know. All knowledge is not created equal.

The findings on the role of plausibility also suggest that manipulating the plausibility of the various outcomes in children’s tasks could prove fruitful in furthering our understanding of children’s developing ‘theory of mind’. If younger children have a less sophisticated understanding of what is, and is not, plausible than older children and adults than this may contribute to their greater susceptibility to the curse of knowledge and exacerbate their difficulties with mental state reasoning. Indeed, young children are often noted to be more gullible and accepting of certain impossibilities, such as those presented in magic tricks, than adults.

In the course of exploring other hypotheses, other researchers have somewhat reduced the ‘curse of knowledge’ in false belief tasks (Wimmer & Perner, 1983, Koos et. al., 1997, April). For example, the experimenter ate the candy, or the antagonist in the story baked it into a cake. Consistent with our findings, children did significantly better under these conditions than in the standard task. However, the youngest children’s performance was still not significantly above chance (Wellman et. al., 2001).
There are two possible explanations for why young children’s performance improved under such conditions but still did not exceed chance. First, it may be that even if the curse of knowledge were completely removed young children would still experience difficulty with false belief tasks; either because of other problems posed by the task such as mnemonic and linguistic demands (see Bloom & German, 2001; Fodor, 1992, Leslie, 1994, Zaitchik, 1990) or due to a genuine inability to reason about false beliefs (see Gopnik, 1993; Perner, 1991; Wellman et. al., 2001). Alternatively, it may be that in these studies the ‘curse of knowledge’ was not adequately removed—it was simply reduced. Knowledge, after all, is graded. Knowing that the candy has been moved to one of four containers, but not knowing which one, is less specific than knowing that it has been eaten, but more specific than knowing it was moved to one of seven possible containers, for example.

We propose that the more specific the knowledge, the more potent the curse. In these types of studies analyzed in Wellman et al’s (2001) meta-analysis, knowing that the candy has been eaten or baked may still be enough of a curse to contaminate children’s false belief reasoning. Indeed, the present results demonstrate that the bias is the most strong when it is in conjunction with a plausible explanation—perhaps for young children it didn’t seem so implausible that the other person would have known they ate the candy or used the chocolate to bake a cake. Perhaps children would have performed better had the outcome seemed more implausible or surprising (see Edgar & Birch, 2005; see also Pezzo, 2003 for a discussion of the mediating role of surprise).

Our claim that more specific knowledge creates a greater ‘curse’, or is harder to put aside, than less specific knowledge is reminiscent of research by Zaitchik (1991) in which she found that children participating in a displacement task that had seen the object being moved in the protagonist’s absence were more likely to err in reasoning about false beliefs than those that had
only been told that the object had been moved. Three-year-olds who had only been told about the object’s true location, and had not seen the object in its true location were successful at attributing false beliefs. Zaitchik (1991) proposed that seeing the object moved makes the information more salient and harder to ignore than simply hearing about the object being moved. We suspect that a similar process occurs with more specific knowledge—the more specific and detailed the subject’s knowledge, the harder it is to fully put aside.

Are young children always more vulnerable to this bias than adults? Perhaps not -- Mitchell et al. (1996) presented adults with stories about a character who heard a message from someone else. In some cases, the message contradicted what the character had previously observed. The subject’s task was to judge whether the character would believe or disbelieve the message. Not surprisingly, adults said that the character would be less likely to believe the message if it conflicted with prior experience. In addition, consistent with the literature reviewed above, and with our own results, adult subjects made judgments that were contaminated by their own knowledge. That is, when they knew the message was true they were more likely to assume that the character would believe this information than if they knew the message was false. But although the children that they tested (one group with a mean age of 5;9, another with a mean age of 8;9) also took into account the character’s prior experience, they differed in that they showed no such effect of curse of knowledge. As Mitchell et al. (1996) suggest, these older children might be answering their questions by rigidly applying a rule about the effects of informational access and subsequent belief state. Adults, in contrast, solve the task in a less mechanical way, and hence are more vulnerable to the curse of knowledge (see also Wilson and Brekke, 1994). In other tasks, where applying a simple ‘seeing = knowing’ rule might not have been very useful, school-aged children did reveal a greater bias than adults (Pohl & Haracic, 2005).
The findings from both the present experiments have implications for research on children’s and adults’ ability to reason about the mental states of others. Anytime someone is more knowledgeable than the person whose perspective they are trying to take, they may be subject to the curse of knowledge. In light of research demonstrating that the curse of knowledge is stronger earlier in development (e.g. Birch & Bloom, 2003; Pohl & Haracic, 2005), younger children’s performance on false belief tasks would be even more compromised than older children and adults. Thus, traditional false belief tasks are likely unfair assessments of any developmental differences in false belief reasoning because they will either mask young children’s true competencies or exacerbate their difficulties. It is important to note that although we only tested adults’ curse of knowledge bias on displacement tasks (one of the most commonly used tasks to assess children’s ability to reason about false beliefs) we believe the same logic can be applied to a number of difficulties in children’s mental state reasoning and perspective-taking such as ‘unexpected contents’ or ‘Smarties’ tasks (e.g. Perner, Leekam, and Wimmer, 1987), the appearance-reality tasks (e.g. Gopnik & Astington, 1988); and source of information tasks (e.g. Taylor et. al, 1994).

In sum, these data demonstrate that one’s ability to reason about a more naïve mental state can be influenced by the subject’s own knowledge state and the ease with which they can generate a potential justification for a biased response. This research supports the claim that there is a fundamental consistency between children's and adults' ability to reason about the mind. For children, the heightened potency of the curse typically leads to more blatant errors in mental state attribution. But even for adults, their own knowledge can substantially contaminate their ability to make sense of how others will think and act.
References


