Developmental Psychology

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Online First Publication, May 20, 2013. doi: 10.1037/a0032970

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0012-1649/13/$12.00 DOI: 10.1037/a0032970

When Will Little Red Riding Hood Become Scared? Children's Attribution of Mental States to a Story Character

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As children listen to a simple action-based narrative, they construct a dynamic representation of the protagonist's movements, visual perspective, and goal-directed thoughts. We examined children's representations of more complex narratives in which the protagonist will encounter an unexpected outcome upon reaching his or her goal. Three studies involving 105 children between 3 and 6 years of age showed that children shifted in the mental states they attributed depending on the distance of the protagonist from the unexpected outcome. Even though children consistently recognized that the protagonist did not know about the surprise at any point, they increasingly attributed feelings and thoughts consistent with the surprise. The studies highlight the degree to which children's mental state attributions are dynamic rather than fixed by their current theory of mind.

Keywords: preschoolers, mental/situation models, simulation, emotion, narrative comprehension

Research on young children's mental representations of oral narratives suggests that they create a rich and dynamic mental model of the unfolding story events in their imagination (Harris, 2000). This model simulates the location and actions of the main character (Fecica & O'Neil, 2010), and it reflects the visual (Rall & Harris, 2000; Ziegler, Mitchell, & Currie, 2005) and mental (O'Neill & Shultis, 2007) perspective of that character. We first review the findings that have emerged when children listen to the unfolding of relatively simple stories in which the protagonist always has access to the same information as the listener. We then consider how children's model building might proceed in the context of more complex stories, notably those in which the listener knows that an unexpected outcome lies in store but the protagonist does not.

In an initial study investigating children's mental representations of story events, Rall and Harris (2000) asked 3- and 4-year-old children to recall target sentences from stories that included deictic verbs of motion, for example, "Little Red Riding Hood got up from her chair in her bedroom and *went* (*came*) to the kitchen to fill a basket for her grandmother." Children were likely to accurately recall verbs of motion that were consistent with the protagonist's perspective (i.e., *went* in the above example) but to make substitution errors when the verbs of motion were inconsistent (i.e., *came*). This finding suggested that children spontaneously adopted a point of view within the narrated event consistent with the location and visual field of the main character. Thus, in the story about Little Red Riding Hood, they started off by imagining themselves in the same location as her (i.e., in the bedroom) and then imagined her going (not coming) to the kitchen.

Ziegler et al. (2005) replicated these findings with children ranging from 4–9 years. They found that all age groups tended to accurately recall verbs of motion that were consistent with the character's perspective but to produce substitutions for verbs that were inconsistent. Moreover, children showed the same recall pattern whether the protagonist was good (a prince) or bad (a ghost). Taken together, these two studies suggest that children represent the location and visual perspective of the main character, and they do so whatever his or her attributes.

O'Neill and Shultis (2007) asked whether 3- to 5-year-olds also track the current target of a character's goal-directed thoughts, especially when those thoughts do not concern the current physical location of the character. With the help of suitable props, they told children short stories in which the character was in one location but thinking about a goal in another location, for example,

> This is Sally's farm. This is the field. This is the barn beside the field. Right now, Sally is in the field. She wants to feed a cow. She is thinking of feeding the cow in the barn because the cow in the field is not hungry.

Children were then asked a potentially ambiguous question: "Can you point to the cow?" Four- and 5-year-olds pointed to the appropriate cow (i.e., the cow in the barn that Sally was thinking about rather than the cow in the field) at rates significantly above chance. These findings show that in addition to being able to represent the location and visual perspective of the main character, preschoolers also acknowledge her cognitive perspective, notably her ongoing, goal-directed thoughts.

Fecica and O'Neill (2010) went on to ask if young children also represent the progress of a protagonist toward a goal. They measured the speed with which 3- to 5-year-olds pressed a mouse to hear each new sentence of recorded stories in order to assess whether children would process description of scenes or events

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We thank all of the preschool pupils and staff who participated in the study. We also thank the Discovery Center at the Boston Museum of Science.

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more or less quickly depending on the character's rate of movement (walking vs. being driven) and psychological state (eager vs. not eager). They found that children processed sentences describing what the character saw en route more quickly when the character was being driven than when the character was walking. Similarly, children processed sentences about the character preparing to go out more quickly when the character was described as eager as opposed to not eager to go out. Finally, they found that children processed sentences faster when the character was eager and walking as compared to not eager and walking, whereas the eagerness of the character did not affect processing time when the character was being driven (presumably because children assumed that the character had no control over his or her speed). Thus, children can understand that a character is on a journey and update their mental representation of the character's progress at a rate consistent with the character' motivation and mode of transportation (walking vs. being driven).

Taken together, these four studies make a number of important points. When children process a simple story about the actions or movements of a protagonist, they represent the location and visual perspective of that protagonist (Rall & Harris, 2000) irrespective of whether he or she is good or bad (Ziegler et al., 2005). By 4- or 5-years of age children also take note of the ongoing thoughts of a protagonist—they recognize that the protagonist's current thoughts may be directed toward a future goal location (O'Neill & Shultis, 2007). Finally, children use their knowledge about different types of movement (e.g., walking as compared to driving) as well as motivational factors (e.g., eagerness to reach a destination) in order to model the pace of a character's journey (Fecica & O'Neill, 2010). Taken together, the findings show that young children's processing of a story is dynamic—it shifts in keeping with the actions of the protagonist. Indeed, in the course of such dynamic processing, children represent not just the "landscape of action" (Bruner, 1986) but also the mental life of the protagonist, notably the protagonist's visual perspective, goal-directed thoughts, and motivation.

Thus far, research on children's dynamic story processing has focused on simple action narratives, in which the main character and the child listening to the story share the same information. However, many children's stories include situations in which the main character—unlike the listener—does not realize that an unexpected outcome is in store. For example, in the classic story of Little Red Riding Hood, she does not realize that the wolf is lying in wait for her at her grandmother's cottage, whereas listeners do know. To accurately represent what Little Red Riding Hood is thinking and feeling, children need to understand that she will only think about and feel afraid of the wolf when she enters her grandmother's cottage. Thus, throughout her journey to the cottage, she will misconstrue what lies in wait for her. Below, we first describe what research on children's theory of mind has revealed about such misconstruals. We then describe a set of studies in which we examine the possibility that children's attributions to a story character will change in a dynamic fashion as the character approaches an unexpected outcome.

Research on children's theory of mind has revealed a stable developmental sequence with respect to children's understanding of the cognitions and emotions of protagonists who misconstrue the situation they face. Three-year-old children typically fail to attribute false beliefs to the protagonist, whereas most 4- and 5-year-olds succeed (Wellman, Cross, & Watson, 2001). However, 4- and 5-year-olds typically fail to correctly attribute emotions to a protagonist holding a false belief (Harris, 2008). For example, Bradmetz and Schneider (1999) found that many 4- and 5-year-olds described Little Red Riding Hood as scared even after they had correctly stated that Little Red Riding Hood thought that her grandmother was in the bed rather than the wolf. This gap between children's ability to understand a protagonist's misconstrual and their difficulty in attributing the emotions that would flow from such a misconstrual is gradually resolved between the ages of 5 and 7 years of age (Bender, Harris, Pons, & de Rosnay, 2011; Bradmetz & Schneider, 1999; Hadwin & Perner, 1991).

As described earlier, in the course of processing simple action stories, children adjust their representation of a story character's mental state depending on the current visual perspective, goals, and motivation of the character. In the present studies, we examine how children process more complex stories, such as Little Red Riding Hood, in which the main character moves toward a goal location but does not know what lies in store at that location—unlike story listeners. We anticipated that children's knowledge of what lay in store would lead them to make inappropriate attributions to the story character. Thus, consistent with the above findings on children's theory-of-mind, we anticipated that children would attribute fear to Little Red Riding Hood even before she could know about the presence of the wolf in her grandmother's cottage. However, our central and novel prediction was that such misattributions would be dynamic in nature and would vary as the story unfolds. More specifically, we predicted that children would be especially prone to incorrect attributions of emotion as Little Red Riding Hood moves closer to her goal. We based this prediction on two considerations. First, as reviewed above, research on children's story processing shows that children represent the goal-directed thoughts of a protagonist. Second, theory-of-mind research indicates that if a goal is less immediate or less salient, children are less prone to misunderstand a protagonist's thoughts about that goal. Thus, in their meta-analysis, Wellman et al. (2001) reported that children performed better on false belief tasks when the goal object sought by a protagonist no longer existed (e.g., the chocolate being sought by the protagonist had been eaten rather than moved to a new location). Accordingly, to the extent that a goal, and more specifically the frightening surprise in store at that goal, becomes increasingly salient to listeners as the protagonist moves closer to it, we predicted that misattributions of fear would steadily increase in the course of Little Red Riding Hood's journey.

We used the story of Little Red Riding Hood because it has been used in previous research on children's attribution of emotion (Bradmetz & Schneider, 1999) and also because the presence of the wolf is likely to be readily associated with strong emotion, namely fear. We asked children between the ages of 3 and 6 years about Little Red Riding Hood's emotion at four equidistant points on her journey toward her grandmother's cottage. At each point, we also included a question about Little Red Riding Hood's knowledge of the wolf as a comprehension check. Note that there is evidence that questions concerning knowledge that depends on visual access are easy even for 3-year-olds (Pratt & Bryant, 1990). Hence, we anticipated that children would answer this question correctly, irrespective of Little Red Riding Hood's distance from her grandmother's cottage. Indeed, if children can represent the visual perspective of the main character (Rall & Harris, 2000; Ziegler et al., 2005), they should acknowledge that she has no knowledge of the wolf at any of the four locations.

In Experiment 1, forty-five children (20 girls and 25 boys) between the ages of 3 and 6 years listened to a synopsis of the story of Little Red Riding Hood. They were then asked whether Little Red Riding knew about the wolf, whether she was happy or scared, and why she felt that way, at four equidistant points on her journey to her grandmother's cottage. In the second experiment, we asked children whether Little Red Riding Hood was thinking about the wolf or the grandmother and whether she was happy or scared at four equidistant points on her journey. In the third experiment, we asked children about an impending positive event as opposed to an impending negative event.

In the discussion, we report an analysis of children's attributions of emotion at each of the four locations across Experiments 1–3. We also report a parallel analysis for children's attributions of thinking across Experiments 2–3. These omnibus analyses provided a check on the analyses conducted within each experiment.

Experiment 1

Method

Participants. The sample consisted of 45 children ranging from 3 to 6 years of age ($N = 45$, 20 girls and 25 boys, $M = 4$ years and 7 months, $SD = 8$ months). The children were recruited from three preschools in the Cambridge, MA, area serving middle to high socioeconomic status (SES) families. The sample was divided into three age groups for analytic purposes: youngest ($n = 15$, 10 girls and 5 boys, $M = 3$ years and 11 months, $SD = 6$ months), middle ($n = 15$, 6 girls and 9 boys, $M = 4$ years and 9 months, $SD = 1$ month), and oldest ($n = 15$, 4 girls and 11 boys, $M = 5$ years and 4 months, $SD = 5$ months).

Procedure. Children were read the following synopsis of the Little Red Riding Hood story:

> Once upon a time, Little Red Riding Hood was preparing to visit her grandmother. While this was happening, a wolf tricked the grandmother into opening her door and the wolf ate the grandmother. The wolf put on the grandmother's clothes and waited for Little Red Riding Hood to arrive so he could eat her too. When Little Red Riding Hood opened the door and walked into the house, the wolf ate her. Later in the day, a hunter killed the wolf and rescued Little Red Riding Hood and her grandmother. They lived happily ever after.

After listening to the story, children were shown a board that had Little Red Riding Hood's house on one side and the Grandmother's house on the other side. They were told, "This is Little Red Riding Hood's house and this is her Grandmother's house." A path connected the two houses. Children were given a Little Red Riding Hood figurine and asked to move the figurine to four equidistant points: Little Red Riding Hood's house, a third of the way to Grandmother's house in the middle of a forest (the forest was represented by a popsicle stick with a picture of a tree), two thirds of the way to Grandmother's house and finally to a point immediately in front of Grandmother's house. Children were asked three questions at each point, a knowledge question, an emotion question, and an emotion justification question. Thus, children were asked (1) When she is here, does Little Red Riding Hood know that the wolf is hiding in Grandma's house? (2) When she is here, does Little Red Riding Hood feel happy or scared? (3) Why does she feel happy/scared?

Results

Children were scored as responding correctly to the knowledge question if they claimed that Little Red Riding Hood did not know about the wolf. They were scored as responding correctly to the emotion question if they claimed that Little Red Riding Hood felt happy. To facilitate an initial parametric analysis of children's replies, judgments at the two far points were combined, as were judgments at the two near points. Thus, for both the knowledge and emotion questions children's scores could range from 0–2 at the far distance and at the near distance. A $3 \times 2 \times 2$ analysis of variance (ANOVA) examining the between subjects factor of age (youngest, middle, oldest), and the within subject factors of question (knowledge vs. emotion) and distance (far vs. vs. near) revealed a significant effect of age, $F(2, 42) = 5.89$, $p < .01$, $\eta_p^2 = 0.22$: youngest ($M = .96$, $SD = 0.88$); middle ($M = 1.33$, $SD = .77$); oldest ($M = 1.66$, $SD = .67$). There were also main effects of question, $F(1, 42) = 42.89$, $p < .001$, $\eta_p^2 = 0.50$, and distance, $F(1, 42) = 7.84$, $p < .01$, $\eta_p^2 = 0.16$, and a marginally significant interaction between question and distance, $F(1, 42) = 3.77$, $p = .059$, $\eta_p^2 = 0.08$. This interaction is depicted in Figure 1. Inspection of Figure 1 shows that distance had no impact on children's assessment of Little Red Riding Hood's knowledge, but it did influence their assessment of her emotion.

To check these conclusions, we examined the simple effects of distance and question. The simple effect of distance was not significant for the knowledge question: $F(1, 42) = .86$, $p = .36$, but was significant for the emotion question: $F(1, 42) = 11.54$, $p < .001$. Children were less accurate in answering the emotion question at the near distance. Children were significantly better at answering the knowledge question than the emotion question at the far distance: $F(1, 42) = 26.58$, $p < .001$, but especially at the near distance: $F(1, 42) = 43.27$, $p < .0001$.

To examine the effect of distance on children's replies using non-parametric analyses, we compared individual children's far

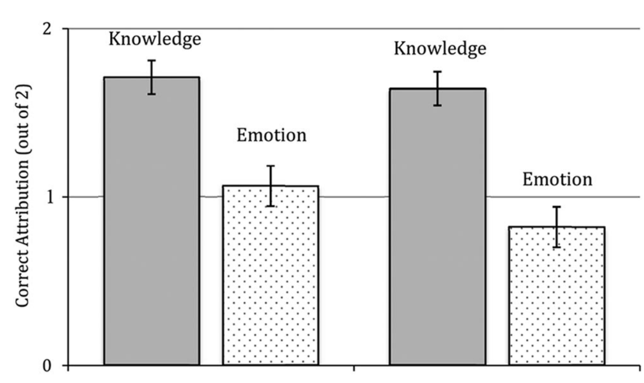

Figure 1. Mean number of correct replies as a function of question type (knowledge versus emotion) and distance (far versus near; $N = 45$) for Experiment 1. Solid bars represent children's responses to the knowledge question, and dotted bars represent children's responses to the emotion question. Error bars represent standard errors.

and near distance scores for emotion: 2 children improved, 14 children got worse, and 29 children did not change their answers. Among children who changed their answers, a Sign test confirmed that more children got worse at the near distance than got better ($p < .05$). In a parallel analysis, we compared the far distance scores for knowledge with the near distance scores for knowledge: 2 children improved, 5 children got worse, and 38 children did not change their answers. A Sign test confirmed that among children who changed their answers, there was no significant tendency for children to get worse at the near distance ($p = .45$).

We also assessed whether children's replies deviated from chance at the far and near distances for each question. *T* tests showed that children's replies to the knowledge question were above chance at both the far, $t(44) = 7.21$, $p < .001$, and near distance, $t(44) = 6.36$, $p < .001$. A paired sample *t* test confirmed that children's replies to the knowledge question were not significantly less accurate as Little Red Riding Hood approached her grandmother's cottage, $t(44) = 1.14$, $p = .26$. By contrast, children's replies to the emotion question were non-significantly above chance at the far distance, $t(44) = .55$, $p = .58$, but non-significantly below chance at the near distance, $t(44) = -1.48$, $p = .15$. A paired sample *t* test confirmed that children's replies to the emotion question were significantly less accurate as Little Red Riding Hood approached her grandmother's cottage, $t(44) = 2.87$, $p < .01$.

Finally, we analyzed children's replies to the why question that was posed after each of the emotion attribution questions. Children's responses were divided into three categories: wolf, grandmother, and other. Responses that mentioned the wolf as the source of Little Red Riding Hood's emotion or talked about her thinking about something scary (implicitly the wolf) were assigned to the wolf category (e.g., "because the wolf ate the grandmother," "she's thinking about the wolf," "she's afraid about something scary," or simply "the wolf"). Responses that mentioned the grandmother were assigned to the grandmother category (e.g., "she thinks the grandmother is in the grandmother's house"). Finally, responses in which children either provided no answer or provided unrelated answers were coded as other (e.g., "she's at home," "she's in the forest," "I don't know," "she's walking"). At the far distance, 17% of the responses were coded as "wolf," 44% as "grandmother," and 39% as "other." At the near distance, 29% of responses were coded as "wolf," 37% as "grandmother," and 34% as "other." Thus, the proportion of references to the grandmother declined, whereas the proportion of references to the wolf increased as Little Red Riding Hood progressed toward the cottage. Paradoxically, 7 children said that Little Red Riding Hood was thinking about the wolf to explain why she was scared despite having just claimed that she did not know about the wolf.

Discussion

In Experiment 1, distance significantly affected children's correct attribution of emotion to Little Red Riding Hood. Children were more accurate in attributing the correct emotion (feeling happy) at the two farther distances than at the two closer distances. Among those children who shifted in their attributions of emotion, 14 out of 16 (88%) made more incorrect attributions at the near distance. By contrast, children's answers to the knowledge question "does Little Red Riding Hood know that the wolf is in the house?" were not influenced by distance.

Before discussing these results, we first address a potential threat to their validity. Arguably, children changed their answers to the emotion question at the nearer distances because of repeated questioning. However, the fact that children did not change their answers to the knowledge question despite the fact that this question was also repeated at each distance suggests that the pattern observed for the emotion question is unlikely to be a result of repeated questioning. In addition, in their meta-analysis, Wellman et al. (2001) found that across 52 reports of trials where children were asked false belief questions at least two consecutive times, children's answers were consistent 84% of the time. Therefore, an influence of repeated questioning on our results appears unlikely.

The pattern of findings for the emotion question provides strong support for the hypothesis set out in the introduction. The distance effect implies that children actively process the successive episodes in the story, anticipating Little Red Riding Hood's goal as she progresses on her journey. To the extent that children increasingly consider what lies in store for Little Red Riding Hood once she reaches her destination, they are increasingly prone to misattribute fear to her. The justification data lend support to this analysis. Although children often failed to answer the why question, they referred to the grandmother more at far distances than at near distances and to the wolf more at near distances than at far distances.

At all distances, children appropriately judged that Little Red Riding Hood did not know about the wolf. As noted in the introduction, such knowledge questions can ordinarily be correctly answered by 3- and 4-year-olds. However, we may reasonably ask why children's own knowledge of the presence of the wolf did not infect their assessment of what Little Red Riding Hood knew—just as it infected their assessments of what she felt—especially as she approached her destination where the wolf laid in wait for her. Two different explanations seem feasible. One possibility is that the distance effect observed in Experiment 1 is confined to emotion attributions. Arguably, children find it increasingly difficult to ignore the affective valence of the wolf as Little Red Riding Hood approaches the cottage, and this affective knowledge influences their assessment of what she feels. By contrast, children might find it relatively easy to keep in mind the physical location of the wolf—and more precisely his invisibility to Little Red Riding Hood throughout the course of her journey. This is especially likely to be the case if children base their attribution of ignorance on Little Red Riding Hood's lack of visual access to the wolf. Thus, according to this argument the affective implications of an upcoming surprise are an especially potent source of misattribution.

A different possibility is that feeling an emotion is a qualitatively different type of mental state from ignorance. More specifically, ignorance is ordinarily a dispositional rather than an occurrent mental state (Ryle, 1949). When questioned, we may be disposed to acknowledge our ignorance but the mental state of ignorance typically lacks a specific trigger or onset. By contrast, feeling an emotion is ordinarily an occurrent mental state—it is a mental event with a specific trigger or onset. Moreover, many of our emotional states become more intense as we approach a given intentional object. A snake phobic is more inclined to experience fear as he or she approaches a snake. On this analysis, children make a distinction, however tacit, between the dispositional mental state of ignorance and the occurrent mental state of feeling fear. They grasp that occurrent emotions are triggered and intensified by increasing proximity, whereas ignorance remains stable.

One way to test these competing interpretations is to ask children about an occurrent cognitive state such as thinking. Note that thinking a particular thought, unlike ignorance, is a mental state that typically has an onset in much the same way that feeling a particular emotion typically has an onset. Thus, it is possible to ask children what Little Red Riding Hood is thinking about at the various stages of her journey. According to the first interpretation, which emphasizes the intrusive effect of children's affective knowledge, a distance effect on a purely cognitive activity such as thinking is unlikely. However, according to the second interpretation, which emphasizes the occurrent nature of feeling afraid, an occurrent cognitive state like thinking should also be prone to a distance effect. Thus, to the extent that a goal, and the wolf waiting at that goal, becomes increasingly salient to children as the protagonist moves closer to it, we may predict that misattributions of thinking about the wolf will increase in frequency in the course of Little Red Riding Hood's journey. Accordingly, in Experiment 2, we sought to replicate the effect of distance on the attribution of emotions. In addition, we probed for a possible effect of distance on children's attribution of thoughts to Little Red Riding Hood. An effect of distance on children's attribution of thinking to Little Red Riding Hood would be consistent with the research presented in the introduction concerning the link between the salience of an object and false belief attribution (Wellman et al., 2001).

In Experiment 2, we also introduced three minor changes. First, we removed the forest from the board because it added an unnecessary element to the design and might have influenced children's answers. In some versions of the classic story, the wolf meets Little Red Riding Hood in the forest—but this was not true of the story we read to the children. Second, given the difficulty displayed by a considerable proportion of children in answering the repeated why questions in Experiment 1, these were not included in Experiment 2. Finally, we varied the order of mention of the response alternatives when asking both the emotion and the thinking questions in order to minimize the possibility that children's answers changed with distance to "please" the experimenter.

Experiment 2

Method

Participants. The sample consisted of 30 children ranging from 3 to 6 years ($N = 30$, 17 girls and 14 boys, $M = 4$ years and 6 months, $SD = 8$ months). The children were recruited from a preschool in Newton, MA, and from the Discovery Center at the Boston Museum of Science. The preschool typically serves middle to high SES families. The museum's population is somewhat more diverse. The sample was divided into two groups for analytic purposes: younger ($N = 15$, 10 girls and 5 boys, $M = 4$ years and 5 months, $SD = 8$ months), and older ($N = 15$, 7 girls and 8 boys, $M = 5$ years, $SD = 6$ months).

Procedure. The procedure was the same as in Experiment 1. Children were read a synopsis of the Little Red Riding Hood story. They were then shown a board that had Little Red Riding Hood's house on one side and the Grandmother's house on the other side. They were told, "This is Little Red Riding Hood's house and this is her Grandmother's house." Children were then given a Little Red Riding Hood figurine, invited to move the figurine to four equidistant points and asked two questions at each location: (1) "When she is here, is Little Red Riding Hood thinking about the wolf or is Little Red Riding Hood thinking about her grandma?" and (2) "When she is here, does Little Red Riding Hood feel happy or scared?"

Across locations, the order of mention of the two response alternatives was systematically alternated (e.g., thinking about the wolf or her grandma vs. thinking about her grandma or the wolf) but not the order of the two questions (the question about thinking always came before the question about emotion). Because we asked each question four times, children heard each version of the question twice—once at the far distance and once at the near distance.

Results

As in Experiment 1, children's replies were combined for the two far points and for the two near points to yield scores ranging from 0–2 for each question at both the far and near distance.

To investigate the effect of distance on children's attribution of thinking and emotion, a 3-way ANOVA examining the between subjects factor of age (younger, older), and the within subject factors of question (thinking vs. emotion) and distance (far vs. near) was calculated. This analysis produced main effects of question and distance. Children were more accurate on the thinking questions than on the emotion questions, $F(1, 28) = 6.574$, $p < .05$, $\eta_p^2 = 0.19$, and more accurate at the far distance than the near distance, $F(1, 28) = 11.972$, $p < .01$, $\eta_p^2 = 0.30$. These two effects are illustrated in Figure 2.

As in Experiment 1, we checked these conclusions with nonparametric tests. We compared individual children's far distance scores with their near distance scores for each question. With respect to the thinking question, 0 children improved, 8 children got worse, and 22 children did not change their answers. A Sign test confirmed that more children got worse at the near distance

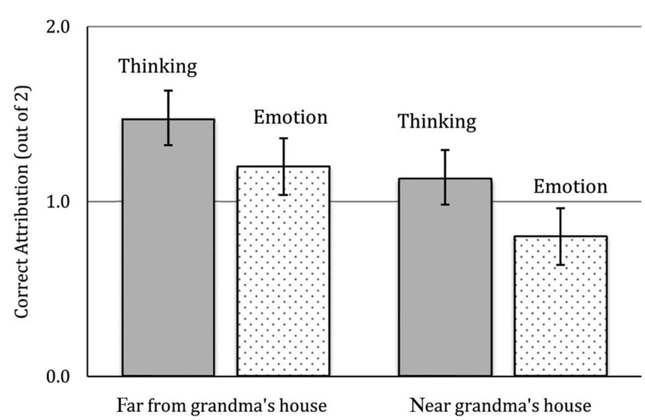

Figure 2. Mean number of correct replies as a function of question type (thinking versus emotion) and distance (far versus near; $N = 30$) for Experiment 2. Solid bars represent children's responses to the thinking question, and dotted bars represent children's responses to the emotion question. Error bars represent standard errors.

than improved ($p < .008$). With respect to the emotion question, 0 children improved, 10 children got worse, and 20 children did not change their answers. A Sign test confirmed that more children got worse at the near distance than improved ($p < .002$). Seven of the eight children who got worse with respect to the thinking question also got worse with respect to the emotion question.

We also assessed whether children's replies deviated from chance. *T* tests showed that children's replies to the thinking question were above chance at the far distance, $t(29) = 3.12$, $p < .01$, but no better than chance at the near distance, $t(29) = 0.89$, $p = .380$. A paired sample *t* test confirmed that children's replies to the thinking question were significantly less accurate as Little Red Riding Hood approached her grandmother's cottage, $t(29) = 3.01$, $p < .01$. Children's replies to the emotion question were at chance at both the far distance, $t(29) = -1.21$, $p = .206$, and the near distance, $t(29) = 1.24$, $p = .227$. Nevertheless, a paired sample *t* test confirmed that children's replies to the emotion questions were significantly less accurate as Little Red Riding Hood approached her grandmother's cottage, $t(29) = 3.53$, $p < .001$.

Discussion

In Experiment 2, we replicated the effect of distance on children's attribution of emotions. Children gave significantly fewer correct replies at the near distance. We also found an effect of distance on children's attribution of thoughts to Little Red Riding Hood. As for the Emotion question, children gave significantly fewer correct replies at the near distance. No effect of age was observed. However, it should be noted that the age range was narrower in Experiment 2 than in Experiment 1. The mean age of the younger and older group differed by only 7 months in Experiment 2, whereas it differed by 1 year and 5 months in Experiment 1.

The findings of Experiment 2 lend support to the proposal that children are sensitive to the effect of distance on occurrent mental states—thinking as well as feeling emotion. They undermine the proposal that the distance effect for misattributions is due to children's increasing rehearsal of the affective implications of an upcoming story event. Such distance effects appear to be pervasive rather than confined to emotional states; they are apparent in children's diagnosis of the cognitive as well as the emotional states of the protagonist.

In Experiment 3, we sought to replicate the effect of distance on the attribution of thinking and feeling emotion using a story that was unfamiliar to children. We also changed the valence of the emotion experienced by the character on reaching his destination (i.e., the character experienced a very positive emotion as opposed to a very negative emotion).

Experiment 3

Method

Participants. The sample consisted of 30 children ranging from 3 years to 6 years ($N = 30$, 18 girls and 12 boys, $M = 4$ years and 7 months, $SD = 11$ months). The children were recruited from the Discovery Center at the Boston Museum of Science. The sample was divided into two groups for analytic purposes: younger ($N = 15$, 10 girls and 5 boys, $M = 3$ years and 9 months, $SD = 5$ months), and older ($N = 15$, 8 girls and 7 boys, $M = 5$ years and 5 months, $SD = 5$ months).

Procedure. Children were read the following short story:

> Todd the Turtle really wants his friends to come over and play but all of his friends said that they could not come over today. He goes for a walk. When he is walking, his friends decide to play a good trick on him. They come over and hide in his house and wait for him to return home. When he opens the door, his friends say "surprise," and they all play together.

After listening to the story, children were then shown a board that had Todd the Turtle's house on one side of the board. A path went from Todd's house to the end of the board. Children were told, "This is Todd the Turtle's House." Children were then given a Turtle figurine and asked to move the figurine from the end of the board where the path started to a third of the way to the house, to another point two thirds of the way to Todd's house, and finally to a point right in front of Todd's house. Children were asked two questions at each point: (1) When he is here is Todd thinking that his friends are in the house or is Todd thinking that his friends are not in the house? (2) When he is here, does Todd feel happy or does Todd feel sad?

Across locations, the order of the thinking and emotion questions as well as the order of the two response alternatives for each question was systematically alternated (e.g., does Todd feel sad or does Todd feel happy vs. does Todd feel happy or does Todd feel sad). Because each question was asked four times, children heard each question pair (emotion/thinking and thinking/emotion) and each version of each question twice—once at the far distance and once at the near distance.

Results

Children were scored as responding correctly to the thinking question if they claimed that Todd the Turtle thought that his friends were not in the house. They were scored as responding correctly to the emotion question if they claimed that Todd the Turtle felt sad. As in Experiments 1 and 2, children's replies were combined for the two far points and for the two near points to yield scores ranging from 0–2 for each question at both the far and near distance.

A 3-way ANOVA examining the between subjects factor of age (younger, older) and the within subject factors of question (thinking vs. emotion) and distance (far vs. near) revealed a main effect of age, $F(1, 28) = 7.296$, $p < .05$, $\eta_p^2 = .21$: younger ($M = .42$, $SD = 0.72$); older ($M = 1.08$, $SD = .90$). There were also main effects of question, $F(1, 28) = 10.731$, $p < .01$, $\eta_p^2 = .27$, and distance, $F(1, 28) = 10.811$, $p < .01$, $\eta_p^2 = .28$. Children were more accurate on the thinking question than on the emotion question. In addition, children were less accurate on both the thinking and emotion question as the character approached the impending positive surprise. The main effects of question and distance are illustrated in Figure 3.

As in Experiments 1 and 2, we compared the far and near distance scores for thinking: 0 children improved, 8 children got worse, and 22 children did not change their answers. A Sign test confirmed that among children who changed their answers, more children got worse than improved at the near distance ($p < .004$).

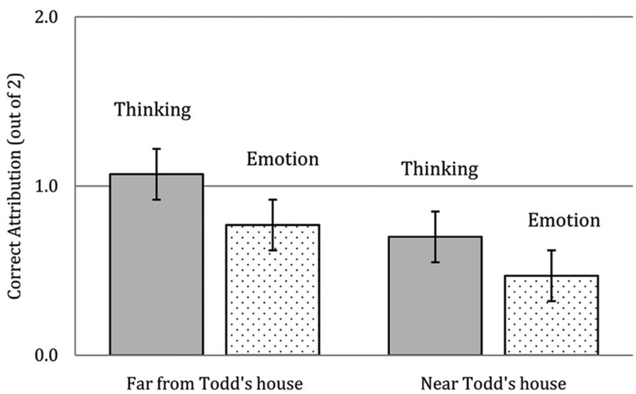

Figure 3. Mean number of correct replies as a function of question type (thinking versus emotion) and distance (far versus near; $N = 30$) for Experiment 3. Solid bars represent children's responses to the thinking question, and dotted bars represent children's responses to the emotion question. Error bars represent standard errors.

In a parallel analysis, we compared the far and near distance scores for emotion: 1 child improved, 8 children got worse, and 21 children did not change their answers. A Sign test confirmed that more children got worse at the near distance than improved ($p <$ .039). Five of the 8 children who got worse on the emotion question at the near distance also got worse on the thinking question.

We also assessed whether children's replies deviated from chance. *T* tests showed that children's replies to the thinking question were at chance at both the far, $t(29) = .40$, $p = .69$, and near distance, $t(29) = -1.87$, $p = .071$. However, a paired sample *t* test showed that children's replies to the thinking question were significantly less accurate as the main character approached his house, $t(29) = 3.00$, $p < .01$. Children's replies to the emotion question were also at chance at the near distance, $t(29) = -1.49$, $p = .147$, but were significantly below chance at the far distance, $t(29) = -4.00$, $p < .001$. Again, however, a paired sample *t* test showed that children's replies to the emotion question were significantly less accurate at the near distance, $t(29) = 2.52$, $p < .05$.

Discussion

In Experiment 3, we examined the effect of distance on children's attributions of thoughts and emotions in a context where the story character was approaching a happy rather than a frightening surprise. We also tested children with a novel story rather than a story likely to be already familiar to them. The findings for distance replicated those obtained in Experiments 1 and 2. Children got significantly worse at attributing the appropriate thoughts and emotions as the story character approached his destination. The results of Experiment 3 confirm that the distance effect is not confined to negative outcomes. It applies to positive outcomes—and also to a novel story.

General Discussion

Taken together, the three experiments yielded four main conclusions. First, as revealed in Experiment 1, children have a firm grasp of what the main character does not know. This understanding was shown at both the far distance and the near distance. Second, children's attributions of emotion in Experiment 1 frequently did not match their attributions of ignorance. Third, children did better on the thinking question than on the emotion question (at all distances). This difference was clearly apparent in Experiments 2 and 3. Fourth, and most importantly, children are prone to a distance effect in their attribution of both thinking and emotion to the protagonist. This distance effect was robust. It was revealed by parametric analyses in all three experiments. It was also consistently confirmed by non-parametric analysis of individual patterns of responding within each experiment. Below, we examine each of these conclusions before turning to omnibus analyses of the emotion and thinking questions across experiments.

The children in Experiment 1 demonstrated a firm grasp of what the character did and did not know. They accurately answered the knowledge question at both the far and near distance. Indeed, neither in the overall analysis nor in the analysis of individual patterns of responding was there any indication of a distance effect for the knowledge question. Because 3- and 4-year-olds understand that a lack of visual access can lead to ignorance (Pratt & Bryant, 1990), it is likely that children's monitoring of Little Red Riding Hood's visual perspective facilitated their initial inference about her ignorance of the wolf's presence. Even as children moved Little Red Riding Hood closer to her grandmother's house, she still could not see inside the house. Hence, children could maintain their initial judgment about her lack of knowledge of the wolf. More generally, the lack of an effect of distance on children's attribution of ignorance to the character is consistent with the proposal that children think of ignorance based on lack of visual access as a stable dispositional state and not as an occurrent state that can be reduced by increasing proximity.

In Experiment 1, children's attributions of emotion frequently did not match their attributions of ignorance. For example, children correctly attributed ignorance on 151 out of 180 trials (84%). Yet 68 of these 151 correct attributions (45%) were followed by an incorrect attribution of fear. Indeed, a total of 32 out of 45 children (71%) stated at all four locations that Little Red Riding Hood did not know about the wolf. Yet, a considerable number (21 out of 32) of these consistent responders (66%) still went on to say that Little Red Riding Hood was scared at some point, especially as she moved nearer to the cottage. These findings confirm that children do not systematically take the role of appraisal processes into account when attributing an emotion. Even though children consistently judged that the protagonist remained ignorant of the surprise, their own growing awareness of the immanence of that surprise increasingly led them to attribute fear to Little Red Riding Hood.

Consistent with prior research on children's theory of mind (Bender et al., 2011; Bradmetz & Schneider, 1999; Hadwin & Perner, 1991), children showed a further limitation in their appreciation of the key role of appraisal processes in eliciting emotion: In Experiment 2, children displayed a more accurate understanding of Little Red Riding Hood's thoughts (thinking about the grandmother rather than the wolf) than of the feelings connected to those thoughts (feeling happy rather than scared). Moreover, this gap in children's attributions emerged irrespective of her distance from her grandmother's cottage. Overall, children correctly attributed thoughts about her grandmother to Little Red Riding Hood on 78 out of 120 trials (65%). Yet 19 of these 78 correct attributions

(24%) were followed by incorrect attributions of fear. Similarly, in Experiment 3, children displayed a more accurate understanding of Todd the Turtle's thoughts (thinking the friends are not in house rather than thinking that they are in the house) than of the feelings connected to those thoughts (feeling sad rather than happy). Again, this gap was maintained irrespective of his distance from his home. Overall, children correctly attributed thoughts about his friends' absence to Todd on 52 out of 120 trials (43%). Yet 15 of these 52 correct attributions (29%) were followed by incorrect attributions of happiness.

A plausible explanation for this gap between thinking and feeling is that children only gradually appreciate the tight causal connection between the two processes. A study of children's insight into the way that reminders provoke emotion provides support for this interpretation. Lagattuta and Wellman (2001) introduced children to a story character who had experienced a negative emotion in response to a past event and who a few days later felt the same emotion when encountering a situation that served as a reminder of that past event. In some stories, the character's emotion upon encountering the reminder also matched his or her current circumstances, whereas in other stories the character's emotions did not match the current circumstances. Lagattuta and Wellman (2001) found that it was not until children were 7-years old that they resembled adults in their ability to explain a character's current negative emotion based on the character's active thinking about a past negative experience. Thus, even in situations where the character's current negative emotions could, in principle, be explained by the current context alone, 7-year-olds resembled adults by consistently invoking the character's thoughts about past events (in addition to present events) to explain the character's emotion, for example, "Mark's mad because the girl knocked down his tower AND because she makes him think about when his teddy bear was stolen." Thus, the gap between children's attribution of thinking and their attribution of emotion in Experiments 2 and 3 can be plausibly ascribed to their failure to appreciate that emotions are triggered by and constrained by thoughts. Even when children appropriately attributed a misconstrual of the situation to the protagonist (e.g., thinking that the grandmother was in the cottage or thinking that the friends were not in the house) they often ignored that misconstrual and attributed emotions to the character based on their knowledge of the actual situation (e.g., their knowledge that the wolf was in the cottage or that the friends were in the house). This difference is consistent with the findings of a lag between children's performance on false belief tasks and their performance on belief-based emotion tasks (Bender et al., 2011; Bradmetz & Schneider, 1999; de Rosnay, Pons, Harris, & Morrell, 2004).

The final conclusion that can be drawn from our studies is that children are prone to a distance effect in their attribution of both thoughts and emotions to a story protagonist when the protagonist is approaching either a positive or a nasty surprise. This effect was observed in Experiments 1 and 2 when children were asked questions about a familiar story (Little Red Riding Hood) in which the protagonist was approaching a frightening surprise and also in Experiment 3 when children were asked about an unfamiliar story (Todd the Turtle) in which the protagonist was approaching a positive surprise. In Experiment 1, children were increasingly likely to say that Little Red Riding Hood was scared as she moved closer to her grandmother's cottage. In Experiments 2 and 3, children were increasingly likely to misattribute particular thoughts and emotions to the story character as she or he approached the negative or positive surprise.

How should we explain this distance effect? First, as argued in the introduction it is plausible that when children listen to a story they create a mental model that represents the protagonist's current location and visual perspective (Rall & Harris, 2000; Ziegler et al., 2005), ongoing movement (Fecica & O'Neill, 2010), and goal or destination (O'Neill & Shultis, 2007). The same representational process is likely to have operated when children answered questions in Experiments 1–3. Thus, when children moved the figurine representing the protagonist they represented the protagonist's current location, visual perspective, ongoing movement, and final destination. Furthermore, it is plausible that the final destination became more and more salient as children moved the figurine closer to it. This upcoming surprise cannot be the object of the protagonist's thoughts or emotions because the protagonist knows nothing about it. Thus, in order to provide correct answers to the thinking and emotion questions, children should, in principle, inhibit or quarantine their growing awareness of the surprise awaiting the protagonist at the destination. We assume that this inhibition process becomes more and more difficult as the imminent reality of the surprise becomes increasingly salient. As a result, children become less accurate in their attribution of

Table 1
Taxonomy of Multilevel Logistic Models for Thinking

Parameters	Model 1	Model 2	Model 3	Model 4
Fixed effects				
Intercept	0.19 (0.34)	−0.67 (0.43)	-1.04^{*} (0.44)	−0.80 (0.46)
Distance		0.58^{***} (0.16)	0.58^{***} (0.16)	0.42^{*} (0.18)
Age			1.06^{*} (0.45)	0.39 (0.61)
Age × Distance				0.53 (0.34)
Random effects				
Intercept	1.62^{***} (0.37)	1.80^{***} (0.40)	1.58^{***} (0.38)	1.60^{***} (0.38)
−2 Log likelihood	290.92	275.20	269.60	267.08

Note. Taxonomy of multilevel logistic models for the effect of distance (coded 0–3 where 0 represents the closest distance while 3 represents the farthest distance) on the probability of correctly answering the thinking question for 3- and 4-year-olds ($N = 38$; age = 0) and 5- and 6-year-olds ($N = 22$). Coefficients are log-odds. Standard errors are in parentheses.
* $p < .05$. *** $p < .001$.

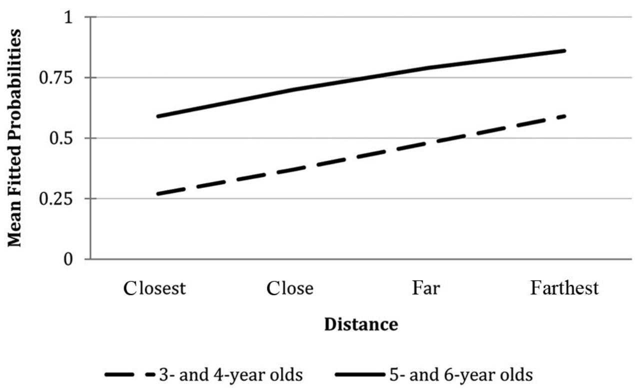

Figure 4. Mean fitted probabilities of correctly answering the thinking question for 3- and 4-year-olds (N = 38) and 5- and 6-year-olds (N = 22) as a function of distance.

thoughts and emotions to the character as the character gets closer to discovering the surprise.

Two lines of evidence in the theory-of-mind literature support this interpretation. First, as noted in the introduction, the meta-analysis of false belief experiments conducted by Wellman et al. (2001) highlights the role of reality salience. Preschoolers are less likely to correctly attribute a false belief if the object that is the target of the false belief (e.g., chocolate) is present, albeit concealed in a container, as opposed to no longer present (e.g., by virtue of having been eaten). Moreover, this effect of reality salience is stable throughout the preschool period—it does not disappear among older preschoolers. Second, children's performance on assessments of inhibitory control is systematically correlated with their performance on standard theory-of-mind tasks, even when factors such as age, gender, and verbal ability are partialled out (Carlson & Moses, 2001). This relationship has been established in Chinese preschoolers as well as U.S. preschoolers (Sabbagh, Xu, Carlson, Moses, & Lee, 2006). The plausible implication of these two lines of evidence is that correct performance calls for the ability to inhibit information about reality, a task that is increasingly difficult as reality becomes more salient. In future research, it will be informative to probe the role of inhibition not just via the manipulation of salience as in the present studies but also via individual differences in inhibitory control.

As a check on the analyses conducted within each experiment, we conducted omnibus analyses of children's answers to the emotion and thinking questions. We used multi-level logistic modeling to examine children's replies at each of the four locations for the thinking and emotion questions separately. For the thinking questions, we combined children's dichotomous answers at each distance across Experiments 2 and 3. We divided our sample into two age groups: 3- and 4-year-olds ($N = 38$, $M = 4$ years and 1 month, $SD = 6$ months) and 5- and 6-year-olds ($N = 22$, $M = 5$ years and 7 month, $SD = 5$ months). In Table 1, we present the taxonomy of fitted multi-level logistic models. Distance had a significant effect on the probability that children correctly attributed thoughts to story characters, $\beta = 0.58$, 95% CI [0.28, 0.89], $z = 3.75$, $p < 0.001$. The odds of correctly answering the thinking question are 5.7 times greater at the farthest distance than at the closest distance, controlling for the effect of age. Age also had a significant effect on the probability that children correctly attributed thoughts to story characters, $\beta = 1.06$, 95% CI [0.19, 1.93], $z = 2.38$, $p < 0.05$. The odds of correctly answering the thinking question are 2.89 times greater for 5- and 6-year-olds than for 3- and 4-year-olds, controlling for the effect of distance. Using this model, we obtained the fitted probabilities of correctly answering the thinking question for each distance for each child. In Figure 4, we plot the mean predicted probability of correctly answering the thinking question at each distance for younger children (3- and 4-year-olds) and older children (5- and 6-year-olds). Inspection of Figure 4 confirms that a distance effect was present at both ages.

We used the same modeling strategy for children's answers to the emotion question. Children's answers to the emotion question were combined across all three experiments. The sample was again divided into two age groups: 3- and 4-year-olds ($N = 71$, $M = 4$ years and 3 month, $SD = 6$ months) and 5- and 6-year-olds ($N = 34$, $M = 5$ years and 6 month, $SD = 5$ months). In Table 2, we present the taxonomy of fitted multi-level logistic models. Distance had a significant effect on the probability that children correctly attributed emotions to story characters, $\beta = 0.41$, 95% CI [0.21,0.62], $z = 3.94$, $p < 0.001$. The odds of correctly answering the emotion question are 3.45 times greater at the farthest distance than at the closest distance, controlling for the effect of age. Age also had a significant effect on the probability that children correctly attributed emotions to story characters, $\beta = 1.20$, 95% CI [0.63,1.78], $z = 4.11$, $p < 0.001$. The odds of correctly answering

Table 2
Taxonomy of Multilevel Logistic Models for Emotion

Parameters	Model 1	Model 2	Model 3	Model 4
Fixed effects				
Intercept	−0.15 (0.22)	-0.77^{**} (0.28)	-1.23^{***} (0.28)	-1.16^{***} (0.30)
Distance		0.41^{***} (0.10)	0.41^{***} (0.10)	0.37^{**} (0.13)
Age			1.20^{***} (0.29)	0.99^{*} (0.43)
Age × Distance				0.14 (0.22)
Random effects				
Intercept	1.20^{***} (0.23)	1.28^{***} (0.24)	1.02^{***} (0.22)	1.02^{***} (0.22)
−2 Log likelihood	536.94	520.66	504.28	503.86

Note. Taxonomy of multilevel logistic models for the effect of distance (coded 0 to 3 where 0 represents the closest distance while 3 represents the farthest distance) on the probability of correctly answering the emotion question for 3- and 4-year-olds ($N = 71$; age = 0) and 5- and 6-year-olds ($N = 34$). Coefficients are log-odds. Standard errors in parentheses.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

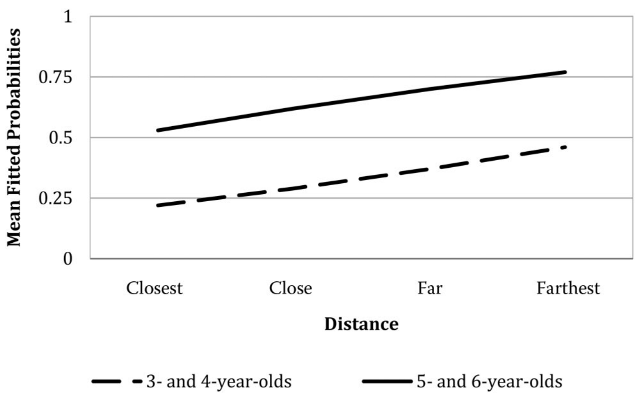

Figure 5. Mean fitted probabilities of correctly answering the emotion question for 3- and 4-year-olds ($N = 71$) and 5- and 6-year-olds ($N = 34$) as a function of distance.

the emotion question are 3.32 times greater for 5- and 6-year-olds than for 3- and 4-year-olds, controlling for the effect of distance. Using this model, we obtained the fitted probabilities of correctly answering the thinking question for each distance for each child. In Figure 5, we plot the mean predicted probability of correctly answering the emotion question at each distance for younger children (3 and 4-year-olds) as well as older children (5- and 6-year-olds). Inspection of Figure 5 confirms that a distance effect was again present at both ages.

In summary, children displayed a firm grasp of what the main character knew and did not know. Nevertheless, children frequently attributed feelings that were inconsistent with what they had claimed that the character knew, and they sometimes attributed feelings that were inconsistent with what they had claimed the character was thinking. Finally, the results make the important point that children's attributions to a story character are not a fixed and simple function of their current theory-of-mind understanding. In all three studies, a proportion of children changed their attributions from one point in the story to the next. Children more accurately attributed thoughts and feelings to the protagonist when he or she was further away from the surprise that was in store. The most plausible explanation of this dynamic pattern is that children found it increasingly difficult to inhibit their awareness of the surprise as the protagonist moved closer toward it.

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Received August 16, 2012
Revision received January 4, 2013
Accepted March 12, 2013 ■