PAPER

Three-year-olds express suspense when an agent approaches a scene with a false belief

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Abstract

Research on early false belief understanding has entirely relied on affect-neutral measures such as judgments (standard tasks), attentional allocation (looking duration, preferential looking, anticipatory looking), or active intervention. We used a novel, affective measure to test whether preschoolers affectively anticipate another's misguided acts. In two experiments, 3-year-olds showed more expressions of suspense (by, e.g. brow furrowing or lip biting) when they saw an agent approach a scene with a false as opposed to a true belief (Experiment 1) or ignorance (Experiment 2). This shows that the children anticipated the agent's surprise and disappointment when encountering reality. The findings suggest that early implicit knowledge of false beliefs includes anticipations of the affective implications of erring. This vital dimension of beliefs should no longer be ignored in research on early theory of mind.

Research highlights

- Three-year-olds' expressions of suspense were recorded while they were watching puppet shows involving false beliefs.
- Participants expressed more suspense in anticipation of an agent approaching reality with a false as opposed to a true belief or ignorance.
- Results indicate that early false belief understanding includes an awareness of the affective consequences of being wrong.

Introduction

As social agents, humans have to be aware of how others represent the world, whether these representations are accurate or not. This allows them to anticipate, correct, explain, and justify actions that are objectively misguided but make sense from the agent's epistemic viewpoint. Classic tests have uniformly shown that children younger than 4 to 5 cannot identify false assumptions in themselves or others (Wellman, Cross &

Watson, 2001). Three-year-olds of various cultures (Liu, Wellman, Tardif & Sabbagh, 2008) confidently state that a misinformed agent acts on and represents the world as it is (Ruffman, Garnham, Import & Conolly, 2001; Wimmer & Perner, 1983).

In the last couple of decades, new research techniques have emerged that dispense with the question–answer format of the classic tests and reveal a much earlier, implicit grasp of beliefs. These tests fall into three basic categories: One in which young children are observers (looking time, preferential looking, and anticipatory looking studies), a second in which they directly interact with the misinformed agent (*interactive* studies), and a third in which they adopt the role as narrators (*narrative* studies).

The first category has revealed that even infants are perceptually sensitive to belief manipulations: Seven-month-olds gaze longer at a scene that is unexpected for another agent (Kovács, Téglás & Endress, 2010) and by 1 year, they look longer when an agent acts in a way that is inconsistent with her prior observations (Onishi & Baillargeon, 2005; Surian, Caldi & Sperber, 2007; Surian & Geraci, 2012). By 2.5 years, children *visually anticipate* where a misinformed agent will look for her object

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(Clements & Perner, 1994; Southgate, Senju & Csibra, 2007; Wang, Low, Jing & Qinghua, 2012) – at least as long as they are not directly asked where she will look (Baillargeon, Scott & He, 2010; Baillargeon, He, Setoh, Scott, Sloane et al., 2013; He, Bolz & Baillargeon, 2011, 2012). At this age, they also preferentially look at pictures that match the content of a false belief story that is read to them (Scott, He, Baillargeon & Cummins, 2012).

The second class of studies has shown that at 1.5 to 3 years, toddlers interact in cooperative and helpful ways with a misguided agent by directing her towards her goal (Buttelmann, Carpenter & Tomasello, 2009), recovering the referent of her speech despite misleading indexical gestures (Southgate, Chevallier & Csibra, 2010) or warning her about aversive objects (Knudsen & Liszkowski, 2012). By age 3, they also *motorically* anticipate where a misguided agent will go by placing a mat or opening a door near the expected location (Garnham & Perner, 2001; Rhodes & Brandone, 2014).

The third class of studies suggests a narrative ability in children between 3 and 4. They can act out what the ill-informed agent will do when returning to the scene (Rubio-Fernandez & Geurts, 2013), influence the course of events by laying down deceptive trails (Hala, Chandler & Fritz, 1991) and apply mental verbs like 'think' appropriately when narrating false-belief-involving cartoons (Hansen, Fuglseth, Møller, Gregersen, van Wovern et al., 2010).

There is thus a clear progression from perceptual discriminations to cooperative interactions and interventions to a narrative competence that ultimately culminates in the correct use of the verbs 'think' and 'believe' to predict, explain, and justify human action between age 4 and 5. Which of these behaviors unequivocally evidences the possession of a theory of mind is a matter of ongoing debate (Gallagher & Povinelli, 2012; Perner & Roessler, 2012; Saxe, 2013).

But regardless at which point a lower level 'reading' of behavior reverts to a mentalistic understanding: What is striking about the entire research program is the consequential neglect of the affective dimension. The field has subscribed to the ideal of objective rationality that is untouched by emotion. But false assumptions interfere with one's motives and lead to surprise (Davidson, 1982) and often disappointment. The nexus between false belief and affect is particularly evident in the stories used with children: The agent has a goal (having his chocolate) and an expectation (finding it in the drawer), the violation of which prevents her from achieving this goal. Sally's discovery that her ball is no longer in the basket will leave her surprised and disappointed. Early theory of mind research has fixated on the belief-involving premise of the practical syllogism ('By going to and opening the basket I will get my ball'), neglecting the fact that if this premise is false, the desire remains unfulfilled.

Only few exceptional studies have examined children's understanding of the affective consequences of false belief (Hadwin & Perner, 1991; Harris, Johnson, Hutton, Andrews & Cooke, 1989; Ruffman & Keenan, 1996; Wellman & Banerjee, 1991). They have found that younger children equate 'surprise' with positive outcomes (e.g. gifts) – so when the valence of the outcome is controlled, children younger than 7 years do not know how beliefs relate to emotion (Ruffman & Keenan, 1996). But as in the standard tests, children had to predict the agent's affect in the form of a judgment. The measure was thus again affect-neutral.

Because young children are moved by what others undergo (Hobson, 2002), we considered it likely that their fledgling belief understanding includes an affective anticipation of the agent's unpleasant discovery. Toddlers' concern for others might thus not only become manifest in prosocial acts (Buttelmann et al., 2009; Knudsen & Liszkowski, 2012), but also in affective responses – especially if the child cannot directly intervene. There has thus been a dual neglect of the affective dimension: The emotional impact for the protagonist has been vastly ignored and children's own affective investment in observing misguided behavior has never been examined.

We therefore investigated facial expressions as a window into children's comprehension of beliefs. They have been recorded as manifestations of empathic concern in typically developing and autistic children (Hobson, Harris, García-Pérez & Hobson, 2009; Sigman, Kasari, Kwon & Yirmiya, 1992; Vaish, Carpenter & Tomasello, 2009), but expressions have never been assessed as indices of belief understanding. Expressions to be expected in this context are those signaling suspense. Suspense is induced in an audience by providing it with critical knowledge that the protagonist is lacking, and then have it (the audience) perceive the agent act on false assumptions – usually with unpleasant outcomes (Truffaut, 1966). Suspense is thus an emotional tension resulting from an awareness of the clash between reality and the protagonist's construal of it. If toddlers express suspense when observing an agent act on false presuppositions, it would demonstrate that they (i) are aware of the conflict between the other's belief and reality and (ii) anticipate the affective impact for the agent. Understanding the affective implications of belief is a vital aspect of human experience and might be a route through which children arrive at an explicit theory of mind.

Experiment 1

In this experiment, 3-year-olds observed a puppet show in which an agent held a true or a false belief about an object's quantity (Reduction Story), location (Relocation Story) or kind (Transformation Story). Children's anticipatory facial expressions were coded when the agent returned to the scene and, in the False but not the True Belief Condition, was about to discover something unexpected. We predicted that children will show more expressions of suspense, such as lip biting and brow furrowing, when the agent is misinformed than when her belief matches reality. If so, we will have demonstrated that 3-year-olds can affectively anticipate an ill-informed agent's surprise and disappointment when she discovers reality.

Method

Participants

Participants were 24 (12 female) 3-year-olds ($M = 39.02$, range = 36.19–42.50). They were recruited from a database of parents who volunteered to have their child take part in a study on child development. One additional child was tested but excluded because she failed to meet the inclusion criterion of understanding English. Children were tested individually in a quiet room at the university's child research laboratory (20) or at their child care center (4).

Materials

A white, wooden puppet theatre (71 cm high, 74 cm wide, 14 cm thick) with red curtains was used for the puppet show. A dowel (20.5 cm high) mounted at 0.8 cm from the left (from the participant's perspective) corner of the puppet stage functioned as the protagonist's observer position in the True Belief Condition. Two different hand puppets, a protagonist and an antagonist (all 25–36 cm in height, 14–15 cm in width, and 13–15 cm in depth) as well as several objects were used for each of the three stories. For the *Reduction Story*, a Cookie monster puppet (protagonist) and a doctor puppet (antagonist) were used. Objects were seven wooden toy cookies glued together as a stack (7 cm high, 6 cm in diameter), two individual cookies (1 cm thick each), and a cardboard cookie box (18 cm high, 7 cm in diameter). These stimuli are depicted in Figure 1. For the *Relocation Story*, a female puppet (protagonist) with a striped shirt and a zookeeper puppet (antagonist) with a khaki-colored helmet were used. Other objects in this story were a black plastic spider (2 cm long, 4 cm wide, 0.5 cm high), a pink bunny figurine (3.5 cm high, 2.5 cm wide, 1.4 cm deep) and two containers: a black metal box (2 cm high, 10 cm wide, 6 cm deep) and a round cardboard box (5 cm high, 7 cm in diameter). For the *Transformation Story*, a boy puppet (protagonist) wearing a cap and a woman puppet (antagonist) with a red shirt were used. A white/red ball (Poké Ball®, 13 cm in diameter) that changes into a colored plush teddy bear (16.5 cm high, 11 cm wide, 9 cm deep) when turned inside out and a green cylinder-shaped container (14 cm high, 13 cm in diameter) functioned as stimuli in this story.

Design and counterbalancing

The study was conducted by a single male or female experimenter (E) who performed as puppeteer. Every child was presented with all three stories (Reduction, Relocation, Transformation) and randomly assigned to one of six possible orders of stories. There was a true belief and a false belief version for each story. Children either saw the false belief version of two stories and the true belief version of the remaining story, or vice versa. Thus, half of the children received two false belief and one true belief trial while the other half received one false and two true belief trials. Children were randomly assigned to one of the following six orders of conditions: FFT, FTF, FTT, TFF, TFT, TTF.

Procedure

E played with the child with a warm-up toy until she was comfortable. If testing took place in the laboratory, parents were asked to observe the experiment on video

Figure 1 *Stimuli used for the Reduction Story: protagonist puppet (Cookie Monster), antagonist puppet (Doctor) and objects.*

from an adjacent control room – unless a child demanded that the parent be with them ($n = 3$), in which case the parent was seated outside of the child's visual field. The child was seated on a regular chair, 91 cm away from the puppet theatre which rested on a table at the child's eye level. E sat down behind the puppet theatre with the curtains closed. One camera recorded the child from the front (Camera 1), a second one recorded the puppet show (Camera 2). Figure 2 depicts a schematic aerial view of the experimental set-up.

Puppet show. E announced that the show was beginning, opened the curtains and acted out the first story on the schedule. All stories had the following structure: The protagonist entered the stage from the child's left. She briefly interacted with an object which she then placed into a container. The protagonist then either exited the stage to the left (False Belief Condition) or took an observer position on the dowel in the left corner of the stage (True Belief Condition). Four seconds later, the antagonist appeared from the right and manipulated the object by reducing its quantity, or changing its location or shape, depending on the story (see below). In the True Belief Condition, the protagonist briefly vocalized ('Hmm!') once before and once as or after the change occurred to attest that she registered the event. The antagonist placed the object back into the container and left it on the right side of the stage before exiting. The protagonist returned from the left (either from off stage or from the dowel) and announced that she would retrieve her object. This marked the beginning of the test response phase. She traversed the stage to the right, grasped the container without looking at its content, and went back across the stage. The test response phase – which lasted approximately 15 s in both conditions – ended with the protagonist saying good-bye and leaving
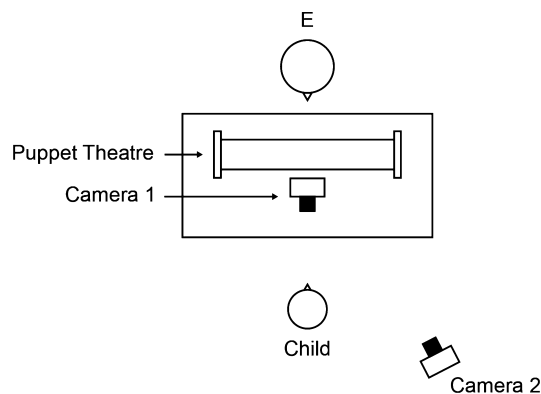
the stage with the container unopened. All stories shared this basic structure. In the following, we describe the procedural specifics of each story.

Reduction story. The protagonist, Cookie Monster, entered the stage with a box and greeted the child ('Hi, I'm Cookie Monster, how are you?'). He emptied out the contents, nine cookies, on stage. After having asked the child if she liked cookies, he placed them back in the box. In the *False Belief Condition*, Cookie Monster stated that he had to leave ('Gotta go to the bathroom!') and exited the stage. In the *True Belief Condition*, he announced, 'I'm going over here!' and walked to the corner of the stage, where he was placed on the dowel. In both conditions, the antagonist, a doctor, entered the stage and introduced himself. He emptied out the cookie box and exclaimed that these were too many for Cookie Monster. He placed the two cookies back in the box and exited the stage with the stack of cookies in his hands. Cookie Monster returned from off stage ('I'm back!', False Belief Condition) or from the corner of the stage (True Belief Condition), which marked the beginning of the test response phase. He exclaimed, 'Time to eat my cookies!', traversed the stage from left to right, picked up the box and exited with it to the left.

Relocation story. Two containers (one made out of cardboard, one metal) were present on stage when the curtain was opened. The protagonist, Lucy, appeared and greeted the child ('Hi, I'm Lucy, how are you?'). She gestured to the cardboard box and referred to it as the cage with the scary spider. She then opened the metal box and showed its content: a small bunny. She asked the child if she liked bunnies and briefly played with the bunny before placing it back into the metal box. Lucy then either claimed that she had to go ('Gotta wash my hands!') and left (False Belief Condition) or said, 'I am going over here!' and was placed on the dowel (True Belief Condition). The antagonist, a zookeeper, appeared and introduced himself, stating that he had to check on the animals. Upon opening the boxes, he noted that the animals had to be switched. He swapped the animals' locations in the child's full view. The zookeeper left. Lucy returned from off stage or the dowel, stating, 'I want to play with the bunny again!' She traversed the stage from left to right, took both boxes and exited left.

Transformation story. The protagonist, Franz, entered the stage holding a ball and introduced himself ('Hi, I'm Franz, how are you'?). Franz held up the ball, which he referred to as his 'new toy' and asked the child if she liked balls. He placed the ball in a green box located on stage and then either exclaimed, 'Gotta answer the

Figure 2 *Aerial view of the experimental set-up.*

phone!' and left (False Belief Condition) or announced, 'I'm going over here!' and took the observer position on the dowel (True Belief Condition). The antagonist, Jen, entered and introduced herself. She retrieved the ball from the container and, as she began to play with it, remarked surprisedly, 'It changes into a bear!' (*E* used the puppet's hands to turn the ball inside out). Jen placed the plush bear into the box and left. Franz returned, saying, 'I want to play with my toy again!' He traversed the stage from left to right, picked up the box, and exited with it to the left.

At the end of each story, *E* closed the curtains and announced that another show was about to start. She prepared the stimuli and acted out the next story on the schedule. The same was repeated after the second story. Note that everything in the two conditions was identical except for the moment in which the protagonist left the center of the stage. In the False Belief Condition, she stated a reason for leaving (e.g. 'Gotta go to the bathroom!') and exited, whereas in the True Belief Condition, she exclaimed, 'I'm going over here!' and remained in the corner of the stage from where she observed and vocally attested the change. The test response phase was the same for both conditions.

Importantly, the intention expressed by the protagonist at the beginning of the test response phase (e.g. 'Time to eat my cookies!', 'I want to play with my bunny again!') did not conflict with reality: There were still cookies (Reduction), a bunny (Relocation), or a toy (Transformation) on stage. These objects were reduced, moved, or altered, but remained present. In all cases, the protagonist thus expressed an intention that was still realizable in the present state of the world; with no clash between the overtly expressed intention (e.g, to eat cookies) and reality.

Scoring and reliability

The videotaped trials were scored by the first author who was unaware of the experimental condition. She watched the recording of the child's face (Camera 1) with the sound turned off. For each test response phase, she judged if an expression of suspense was present (1) or absent (0). Because we did not look for expressions of a particular emotion, e.g. fear or surprise, none of the existing coding schemes (e.g. Baby-FACS, Oster, 1978) was applicable. Hence, a coding scheme was developed based on a literature review, discussions with experts on expressions (Oster, personal communication, February 2014) and pilot data showing various ways in which toddlers expressed tension. The coding scheme lists and describes behaviors like brow furrowing, brow raising, mouth opening, sudden shutting of mouth,

biting the lip, tensely protruding/curling the upper lip, placing the fingers/hand over or inside the mouth, and a smirky smile or laughter. For a behavior to be coded, it had to reflect tension from observing the puppet show. *Any* change in expressions was not sufficient: If a child licked her lips, gradually opened or closed her mouth as part of a yawn, showed chewing movements, or wiped her face with her hand without tension, this behavior was not coded. Besides expressing tension, the behaviors had to originate in the response phase and could not be continually present throughout the puppet show (e.g. some children watched most of the puppet show with their mouths open). The response phase of one out of 72 trials failed to be recorded, so this trial was discarded. Proportional scores are thus reported below. To assess inter-observer reliability, a second independent rater, who was unaware of the experimental condition, coded the expressions of a randomly selected sample of 8 (33%) of the children. The two raters disagreed on one trial, leading to a Cohen's Kappa of .90.

A mixed effect logistic regression model neither found effects of story, $p = .48$, trial, $p = .28$, or gender, $p = .62$, overall, nor when the analysis was limited to the False Belief Condition alone, $ps > .32$. These factors were thus disregarded in the final analyses.

Results and discussion

On average, children expressed suspense in .52 ($SD = .43$) of the trials in the False Belief Condition compared to .10 ($SD = .26$) of the trials in the True Belief Condition. Table 1 shows the number of children who received a given proportional score of suspense as a function of experimental condition. Out of the 24 children, 16 expressed more suspense in the False Belief than in the True Belief Condition, three showed the reverse pattern (more suspense in the True than in the False Belief Condition), and five showed no suspense in either condition. A signed rank Wilcoxon test revealed that children expressed suspense/tension significantly more

Table 1 *Number of children who received a given combination of scores in the two experimental conditions in Experiment 1*

False Belief	True Belief			
	0	.5	1	Total
0	5	2	1	8
.5	7	0	0	7
1	8	1	0	9
Total	20	3	1	24

often in the False Belief than in the True Belief Condition, $Z = -2.86$, $p = .004$ (two-tailed). Figure 3 shows a child's expressions in the response phase as a function of condition.

Across conditions, a total of 33 expressions were coded, the most common of which were brow raising (15%), a smirky smile or laughter (15%), tense curling or raising of the lip (12%), lip biting (12%), brow furrowing (12%), and pressing the hands on or putting the fingers in the mouth (9%). The remaining expressions were pouting, sudden mouth closing, mouth opening, and two non-facial ones: shrugging the shoulders, and hand pressing.

In this experiment, 39-month-olds saw a puppet show in which an agent held a false or a true belief about the content of a box she was approaching. Children's facial expressions were observed *before* the agent encountered reality. In fact, the protagonist never opened the box, so that she never experienced the changed content. As predicted, children expressed suspense when the agent was misinformed and about to realize that her object of desire was reduced, relocated, or transformed. The same children expressed much less suspense when the agent had witnessed the change so that she was not going to make a disappointing discovery.

Importantly, the expressions were not induced by an *objective* clash between reality and the protagonist's explicitly stated intention to, e.g. eat cookies or play with a bunny. The desired object was attainable and matched the label used by the protagonist when she voiced her intention to fetch it. What was at odds with reality was the agent's *subjective* epistemic perspective. Objectively, the situation was neither disappointing nor did it conflict with the intent as it was verbally expressed in the response phase.

One might object that these expressions were more frequent in the False Belief Condition simply because an agent had just stepped on stage, which may have elicited excitement. This effect is arguably weaker in the True Belief Condition in which the protagonist remained in the corner of the stage. To control for this possibility, we compared the expressions in the beginning of the test response phase with those shown when the protagonist first came on stage at the beginning of the trial. The response window was shortened from 15 to 6 s to limit any expressions to those that shortly followed and may thus have been caused by the protagonist's appearance. An independent rater, who was unaware of the purpose of this assessment and of what children observed, looked for expressions of suspense during the first 6 s after the protagonist's first emergence on stage. While both the test and the control phase involved the protagonist's sudden arrival, only the test phase included a false belief. The results were straightforward. On average, children expressed suspense in .44 ($SD = .45$) of the cases in the truncated test phase compared to .00 ($SD = .00$) when the protagonist appeared on stage at the start of the trial. A Wilcoxon signed rank test showed that this difference is highly significant, $Z = -3.29$, $p = .001$ (two-tailed). Not a single expression of suspense was observed when the protagonist first appeared: Children showed a relaxed, open expression that signals interest (see Sullivan & Lewis, 2003), not suspense. The expressions in the False Belief Condition were thus not induced by the sudden emergence of an agent or any incisive or exciting moment in the story. Instead, they were fundamentally related to the epistemic attitude with which the agent returned.

Another concern might be that children expressed tension not in response to the agent's *false belief* but

Figure 3   *Facial expression shown by a participant in the False Belief (left) and the True Belief Condition (right).*

simply her ignorance of what the box contained. Note that for two of the stories (Reduction and Transformation), ignorance alone would not evoke suspense: Two cookies in a cookie box or a toy in a container are not surprising or disturbing for an ignorant agent – they only are for someone with conflicting or greater expectations. Also, in all stories the agent had formed specific expectations about the box's content with which he later returned to the scene. But empirical demonstration that toddlers show no suspense when a naïve agent approaches the scene would provide additional and stronger support than these arguments alone.

We therefore conducted a second experiment to confirm whether children's expressions reflect an anticipation of the surprise of an agent with misguided expectations. In this second experiment, an agent either entered the scene with false (False Belief Condition) or with no specific expectations (Ignorance Condition) after the object was altered. We also balanced the number of trials in each condition, and gave children the standard false belief (change of location) task at the end of the session to explore a possible relation between the expressions and early explicit knowledge of false beliefs.

Experiment 2

A new sample of 3-year-olds was shown stories like those in Experiment 1. An Ignorance Condition was used by having an *under*informed (Ignorance Condition$_1$) or *un*informed (Ignorance Condition$_2$) agent approach the box with the altered content. In Ignorance Condition$_1$, instead of having interacted with the object directly prior to its change, the protagonist was told what the box contained (e.g. 'cookies') at the beginning of the story. She thus expected a certain object upon her return, but was ignorant of its amount, size, or particular state. In Ignorance Condition$_2$, everything until the response phase was the same as in the False Belief Condition, but then a new (neutral) agent, who did not know what the box contained, approached it.

There were four stories. In the *Reduction* Story, the antagonist reduced the number of cookies in a box. In the *Replacement* Story, a big ball was replaced with a small, less desirable ball. In the *Deconstruction* Story, a construction made out of Lego® was taken apart into its pieces. In the *Breaking* Story, a light inside a ring was broken so that the ring no longer blinked. We predicted that children would express suspense when the protagonist returned with a false belief, but not when she or a neutral agent approached the same situation with no specific expectation.

Method

Participants

Participants were 16 (8 female) 3-year-olds ($M = 39.28$, range = 36.62–42.47). They were recruited using the same database and criteria described above. Children were tested in the same room at the university's child laboratory (7) or at preschool (9). One additional child was tested but failed to watch the puppet show and was therefore excluded.

Materials and Design

Puppet show. The same stage and puppets from Experiment 1 and six additional puppets (all between 23 cm × 12 cm × 12 cm and 33 cm × 15 × 18 cm) were used. For the *Reduction Story*, the same material as in Experiment 1 plus a female puppet, who functioned as neutral agent, were used. For the *Replacement* Story, the puppets and box from the Transformation Story from Experiment 1 and another female puppet, serving as neutral agent, were used. Further materials were a soft, colored ball (26 cm circumference) and a ping pong ball (12 cm circumference). For the *Deconstruction* Story, the zookeeper puppet from Experiment 1 was modified to look like a regular male puppet. A penguin puppet served as antagonist and a grandfather puppet as neutral agent. Further materials were a round yellow box (12 cm high, 10.5 cm circumference) and a formation (3 cm high, 3.5 cm wide, 3.5 cm deep) made from red and white Lego® blocks. In the *Breaking* Story, a female puppet served as protagonist, and an Elmo puppet and a monkey puppet were used as antagonist and neutral agent, respectively. Other materials included a round blue box (5 cm high, 6.5 cm circumference) and a yellow ring (4 cm high, 4.5 cm wide, 4.5 cm deep) with a light function that could be (de)activated by the press of a finger.

Children were shown the four stories in quasi-randomized order. They received the false belief version of two stories and either one of the ignorance versions (Ignorance Condition$_1$ or Ignorance Condition$_2$) of the other stories. Fifty percent of the children received Ignorance Condition$_1$ and 50% received Ignorance Condition$_2$. Condition order was FIIF or IFFI.

Standard false belief task. After the puppet show, each child received two trials (stories) of the change-of-location task. The stories (one revolving around a girl and a teddy, the other around a boy and a ball) were presented on slides shown to children on a laptop (MacBook Pro 15″) in counterbalanced order.

Procedure

Puppet show. The experimental set-up and structure of the False Belief Condition was the same as in Experiment 1. In Ignorance Condition$_1$, the protagonist came on stage and introduced herself. Then the neutral agent entered with the box and told the protagonist what it contained using a generic label (e.g. 'cookies', 'a ball'). The neutral agent placed the box in the right corner of the stage and exited together with the protagonist. Everything thereafter was identical to the False Belief Condition, with the antagonist manipulating the object and the protagonist returning to retrieve it. In Ignorance Condition$_2$, everything was as in the False Belief Condition until the response phase started. Then the neutral agent instead of the protagonist appeared, wondered aloud what the box contained and approached it. In all versions of each story, the protagonists (and neutral agents) entered from the left and the antagonists from the right, with a 4 s interval between the leaving of one agent and the appearance of the next. In all cases, the box was carried off stage unopened at the end of the response phase, which again lasted 17 s.

The procedure of the four stories was as follows.

Reduction story. The False Belief Condition of this story was the same as that in Experiment 1. In Ignorance Condition$_1$, after Cookie Monster introduced himself, a puppet named Twyla appeared and told Cookie Monster that she had found a box with cookies inside. She set the box down on the stage and the two puppets left to play outside. The doctor appeared and, from hereon, everything was the same as in the False Belief Condition. In Ignorance Condition$_2$, everything was identical to the False Belief Condition until the response phase began. Instead of Cookie Monster, the neutral agent, Twyla, appeared and introduced herself. She excitedly noted the cookie box and went to see if there were any inside. She crossed the stage and carried the unopened box off stage.

Replacement story. The False Belief Condition of this story was the same as that of the Transformation Story in Experiment 1, with the difference that the antagonist, Jen, replaced the large bouncy ball with a small one. Franz, the protagonist, then returned with the intent to 'play with the ball'. In Ignorance Condition$_1$, Franz entered. The neutral agent, Fiona, then came on stage with a box and told Franz that it contained a ball. She left the box on stage and the two exited to ride their bikes. Jen appeared and, from hereon, the procedure was identical to the False Belief Condition. In Ignorance Condition$_2$, everything was exactly the same as in the False Belief Condition until the response phase, in which the neutral agent Fiona appeared. She introduced herself, made reference to the box and wondered aloud what it contained. She traversed the stage and exited with the unopened box.

Deconstruction story. In the False Belief Condition, the protagonist, Max, appeared with a construction made from building blocks. He placed the construction in a box and left. The antagonist, Pengu, entered and removed the construction. He accidentally dropped it, so the blocks came apart. He put the pile of blocks back in the box and left. Finally, the protagonist returned to 'get the legos'. In Ignorance Condition$_1$, Max came on stage followed by the neutral agent, a grandfather, who held a box. The grandfather told Max that the box contained lego and set the box down. The two of them left to go the backyard. The antagonist, Pengu, appeared and the story continued in the same way as in the False Belief Condition. In Ignorance Condition$_2$, everything was as in the False Belief Condition until the response phase, in which not Max, but the neutral agent, the grandfather, entered. He wondered aloud what the box might contain, approached it, and took it off stage.

Breaking story. In the False Belief Condition the protagonist, Lucy, entered with a 'blinking' ring. (A light inside the ring made it continually light up.) She placed the ring in a box and exited. The antagonist, Elmo, then came and removed the ring from the box. While holding it, he accidentally 'broke' the light so that the ring no longer blinked. He placed the ring back in the box and left. Lucy came back to 'put on the ring'. In Ignorance Condition$_1$, Lucy entered, followed by the neutral agent, the monkey. He held a box and told Lucy that it contained a ring. He set the box down and he and Lucy left to see if Mom was home. The antagonist, Elmo, then appeared, and the story continued as in the False Belief Condition. In Ignorance Condition$_2$, everything was exactly as in the False Belief Condition until the response phase. Now the neutral agent, the monkey, came on stage and registered the box. He wondered what it contained, approached it, and took it off stage.

Scoring and reliability

The expressions in the response phase were scored by a coder who was unaware of the condition and used the same coding scheme as in Experiment 1. To assess inter-rater reliability, a second rater, also unaware of condition, coded a randomly chosen subsample of 8 (50%) children. The two raters disagreed on two trials (both false belief), leading to a Cohen's Kappa of .80. Agreement was thus substantial. Children's answers to

the standard false belief questions were scored live by E, who judged to which of the two alternative locations the child made reference (verbally or by pointing). Based on the videomaterial, an independent rater, who was ignorant of what children were asked, coded the answers of a randomly chosen 50% of the children. There was no disagreement between the raters, so Cohen's Kappa was 1.

A mixed effect logistic regression model neither showed effects of story, $p = .61$, trial, $p = .62$, or gender, $p = 1$, overall, nor when the analysis was limited to false belief trials, $ps > .39$. These factors were thus removed from the final analyses.

Results and discussion

A single expression of suspense was observed in Ignorance Condition$_1$ and none in Ignorance Condition$_2$, so the two were collapsed (and are from hereon referred to as the Ignorance Condition). On average, children expressed suspense in .41 ($SD = .33$) of the trials in the False Belief Condition compared to .03 ($SD = .13$) in the Ignorance Condition. Table 2 shows how many out of 16 children received a given combination of scores. Eleven expressed more suspense in the False Belief than in the Ignorance Condition, one child showed the reverse pattern, and four children expressed no suspense in either condition. A Wilcoxon signed rank test revealed that suspenseful expressions were significantly more frequent in the False Belief than in the Ignorance Condition, $Z = -2.81$, $p = .005$ (two-sided). The most common behaviors indexing suspense were curling or pursing the lip (23%), lip or tongue biting (19%), and suddenly shutting the mouth (14%).

To examine whether the expressions were mainly shown by children who possess an early, explicit knowledge of false beliefs, we correlated the expressions in the False Belief Condition with the answers to the standard false belief questions. There was no association between the expressions and correct responses to the questions, *Spearman's rho* = .31, $p = .25$. The performance on the standard false belief task reflected the level observed in prior studies with 3-year-olds (e.g. Perner, Mauer & Hildenbrand, 2011), with 19% of children giving correct answers on both trials.

These results show two things. First, they strongly confirm that the expressions reflect an understanding of the *clash* between the agent's expectation and reality. Only when the agent returned with a false belief about the amount (Reduction Story), size (Replacement story), or state (Deconstruction Story and Breaking Story) of an object did the children react with suspense. They did not do so when the agent had no definite expectation. An attribution of ignorance thus cannot explain the expressions. Not only is this in line with the view that surprise is a belief-based, not an ignorance-based, emotion (see Ruffman & Keenan, 1996), but it also shows that by the tender age of 3, children already have an incipient understanding of the role of belief for surprise: A couple of cookies or a ping pong ball are not surprising from an objective standpoint; they only are from the perspective of someone with different (in our case higher) expectations.

Second, the findings show that the understanding manifested in anticipatory expressions is not grounded in an explicit, articulable knowledge of beliefs. The vast majority (69%) of 3-year-olds expressed suspense on at least one false belief trial, whereas a minority (19%) answered the test questions correctly. Also, those who gave the right answers were not more prone to show expressions, as there was no correlation between the two measures. Thus, the expressions do not rely on but are independent from and emerge prior to full-blown knowledge of false beliefs.

General discussion

In the present experiments, children expressed knowledge of another's epistemic attitude by tensely anticipating her encounter with reality. Three things are remarkable about these expressions. First, they were *anticipatory*: The protagonist never opened the boxes and responded to reality – 'emotional mimicry' was thus impossible. Second, the children did *not* antedate the agent's surprise in a one-to-one correspondence by displaying surprise themselves (opened eye lids, dropped jaw, and high, curved brows; see Ekman & Friesen, 2003; Hiatt, Campos & Emde, 1979; Izard, Huebner, Risser & Dougherty, 1980). Their expressions varied, with some indexing distress or concern (furrowing the brow; see Ekman & Friesen, 2003; Demos, 1982), the anticipation of something unpleasant (curling the upper lip; Demos, 1982), *schadenfreude*, i.e. pleasure at the other's misfor-

Table 2 *Number of children who received a given combination of scores in the two experimental conditions in Experiment 2*

| False Belief | Ignorance | | | |
	0	.5	1	Total
0	4	1	0	5
.5	9	0	0	9
1	2	0	0	2
Total	15	1	0	16

tune (smiling or laughing smirkily; Cikara & Fiske, 2012; Ekman, 2003) or tension with no clear hedonic tone (placing the hands over the mouth). This shows that while being moved and emotionally invested, children still maintained an *evaluative distance* from the event. In Goldie's (2007) terms, they did not shift to the other's perspective but held an external perspective, allowing them to be aware of the clash between the other's expectation and reality. Third, the expressions were not just evoked by a 'change for the worse' such as an object's devaluation. Otherwise, they would have occurred with equal frequency across conditions. But the expressions disappeared almost entirely when the agent witnessed the change and updated her expectation accordingly (True Belief Condition, Experiment 1) or had no specific expectation in the first place (Ignorance Condition, Experiment 2). The children thus knew that the situation was only surprising and disappointing from the false epistemic viewpoint of the agent.

Our findings show that counter prior suggestion, even 3-year-olds grasp the affective and conative implications of being wrong. Before the age of 7, children can neither predict that a misinformed agent will be surprised, nor identify which of several agents (one with a false as opposed to a true or no belief) will feel surprised – which led researchers to infer that young children lack a belief-based concept of surprise and fail to comprehend the affective impact of being wrong (Hadwin & Perner, 1991; MacLaren & Olson, 1993; Ruffman & Keenan, 1996). Our study stands in stark contrast to this by showing that even 3-year-olds grasp the affective consequences of false beliefs. They foresaw that the ill-informed (but not the well-informed or ignorant) agent will make an unexpected and unpleasant discovery. What causes the wide gap between the implicit anticipation children displayed in our study and their explicit predictions needs to be explored in future work.

The experiments also revealed for first time that young children manifest their belief understanding affectively. Our novel measure shows that they are not left cold, but are touched, when witnessing others act on false presuppositions. One might suspect that this affective investment is not just another manifestation of belief understanding besides helping (Buttelmann *et al.*, 2009; Knudsen & Liszkowski, 2012), but that it underlies and drives these prosocial acts. But those actions could rely on a simpler, teleological understanding: The agent visibly diverges from her goal (of retrieving an object or avoiding aversive substance), and children correct this divergence. In the present studies, things are more complex in that there is misinformation without misguidance: The agent is going to the correct location and will find the object, but her subjective expectation regarding its state or quality is false.

Theoretically, the findings challenge the dual systems account of mind-reading (Apperly & Butterfill, 2009; Butterfill & Apperly, 2013). Given how the systems are defined, it is unclear which holds claim to the anticipatory expressions: The first, ancient one that allows humans (along with certain other animals) to track mental states automatically and effortlessly, or the human-specific second one that is grounded in reflection and discourse. Darwin (2009/1872) saw expressions as a marker of continuity between humans and animals: They are often involuntary and are not subject to the norms and truth commitments that underlie speech, and some expressions are shared with animals. But many of them, e.g. those of guilt or suspense, rely on a conceptual apprehension and rational evaluation of the situation. Equating expressions with a crude, non-rational perception of events is thus false (e.g. Bargh, Schwader, Hailey, Dyer & Boothby, 2012; Haidt, 2001). Children in our study had to understand what 'fate' beleaguered the protagonist, which is unlikely to be an automatic process. At the same time, they were not engaged in dialogue about mental states and the required reasoning is not prima facie subject to one of the known signature blind spots of system 1 (Low & Watts, 2013). Given how the lines are drawn between the systems, the theory thus cannot adequately capture the data.

The findings are in better agreement with a distinction between perspective-taking and an understanding of perspectives as perspectives (Moll & Stekeler-Weithofer, submitted). Perspective-taking ensures that toddlers' social interactions are situationally adequate when the other is misguided or misinformed. It allows toddlers to discern what a misinformed agent tries to do (Buttelmann *et al.*, 2009; Southgate *et al.*, 2010), to foresee her next moves (Clements & Perner, 1994; Knudsen & Liszkowski, 2012; Rhodes & Brandone, 2014; Rubio-Fernandez & Geurts, 2013) and, as this study shows, to tensely anticipate her affective response. But this perspective-taking is restricted to an 'online processing' of concrete events. It is participatory and performative, and precludes any theoretical discourse *about* these mental states 'from the armchair'. This latter capacity presupposes sophisticated verbal competence (Low, 2010), is probably acquired in dialogue about perspectival conflicts (Lohmann & Tomasello, 2003) and is specifically human (Tomasello & Moll, 2013). While there are similarities with the dual systems account, this view does not claim that perspective-taking is innate, automatic, or effortless.

We advocate a stronger acknowledgement of the role of affect in the context of beliefs and, more generally, of the interplay between intellectual and emotional aspects in social cognition (see Lane, Wellman, Olson, LaBounty & Kerr, 2010). Admittedly, people can feel indifferent about many of their beliefs. If I learn that George Washington died in 1799 and not in 1802, as I thought, I might revise my belief without irritation. But the beliefs that figure in theory of mind tests are different. They are directly tied to action and desire satisfaction, and might thus be better conceived as *expectations*. Here, erring has significant consequences. The fact that false beliefs in children's theory of mind stories all share this feature (of violated expectations) makes it likely that this marks the context in which the falsity of beliefs is first fully grasped.

Further investigations of the affective dimension will improve our understanding of how children come to fully grasp beliefs, especially how they proceed from perspective-taking to explicit belief attribution. Our hunch is that *literary environments*, such as fairy tales and puppet shows, facilitate this transition. In one of Grimm's famous tales, Rumpelstiltskin happily and confidently believes that only he himself knows his name (which would mean that he wins his bet against the queen), but the children know better. And when Little Red Riding Hood fearlessly speaks to whom she takes to be her grandmother, the children know whom she is really facing. The drastic clash between harsh reality and the agent's carefree attitude – coupled with the impossibility to intervene – creates a particular tension that dramatically brings out the belief's falseness.

We conjecture that these narrative contexts provide a perfect soil for a full, explicit belief understanding. The advantage of having the child be in the role of an audience rather than an intervening agent is that she has reality and the other's misconception of it in plain view in front of her. Kidd and Castano (2013) found increased theory of mind skills in adults who had read engaging ('writerly') literature, and there is evidence that immersing 3-year-olds in the narrative flow of false belief stories improves their standard task performance (Lewis, Freeman, Hagestadt & Douglas, 1994). We hypothesize that suspense-provoking puppet shows and tales advance theory of mind development. This can be tested empirically by comparing 3-year-olds' performance on standard false belief tasks before and after exposure to such stories. Inquiries along these lines will enable us to paint a much clearer picture of toddlers' false belief understanding, including the conative and affective alongside the rational dimension of belief.

References

Apperly, I., & Butterfil, S. (2009). Do humans have two systems to track beliefs and belief-like states? *Psychological Review*, **116**, 953–970.

Baillargeon, R., He, Z., Setoh, P., Scott, R.M., Sloane, S. *et al.* (2013). False-belief understanding and why it matters: the social-acting hypothesis. In M.R. Banaji & S.A. Gelman (Eds.), *Navigating the social world: What infants, children, and other species can teach us* (pp. 88–95). New York: Oxford University Press.

Baillargeon, R., Scott, R.M., & He, Z. (2010). False-belief understanding in infants. *Trends in Cognitive Sciences*, **14**, 110–118.

Bargh, J.A., Schwader, K.L., Hailey, S.E., Dyer, R.L., & Boothby, E.J. (2012). Automaticity in social-cognitive processes. *Trends in Cognitive Sciences*, **16** (12), 593–605.

Buttelmann, D., Carpenter, M., & Tomasello, M. (2009). Eighteen-month old infants show false belief understanding in an active helping paradigm. *Cognition*, **112**, 337–342.

Butterfill, S., & Apperly, I. (2013). How to construct a minimal theory of mind. *Mind & Language*, **28**, 606–637.

Cikara, M., & Fiske, S.T. (2012). Stereotypes and schadenfreude: affective and physiological markers of pleasure at outgroup misfortunes. *Social Psychological and Personality Science*, **3**, 63–71.

Clements, W.A., & Perner, J. (1994). Implicit understanding of belief. *Cognitive Development*, **9**, 377–397.

Darwin, C. (2009). *The expression of the emotions in man and animals.* New York: Penguin Classics. (Original work published in 1872)

Davidson, D. (1982). Rational animals. *Dialectica*, **36** (4), 317–327.

Demos, E.V. (1982). Facial expressions of infants and toddlers: a descriptive analysis. In T. Field & A. Fogel (Eds.), *Emotion and early interaction* (pp. 127–160). Hillsdale, NJ: LEA.

Ekman, P. (2003). Sixteen enjoyable emotions. *Emotion Researcher*, **18**, 6–7.

Ekman, P., & Friesen, W.V. (2003). *Unmasking the face: A guide to recognizing emotions from facial cues.* Cambridge, MA: Malor Books.

Gallagher, S., & Povinelli, D. (2012). Enactive and behavioral abstraction accounts of social understanding in chimpanzees, infants, and adults. *Review of Philosophy and Psychology*, **3**, 145–169.

Garnham, W.A., & Perner, J. (2001). Actions really do speak louder than words – but only implicitly: young children's understanding of false belief in action. *British Journal of Developmental Psychology*, **19**, 413–432.

Goldie, P. (2007). Dramatic irony, narrative, and the external perspective. *Royal Institute of Philosophy Supplement*, **60**, 69–84.

Hadwin, J., & Perner, J. (1991). Pleased and surprised: children's cognitive theory of emotion. *British Journal of Developmental Psychology*, **9**, 215–234.

Haidt, J. (2001). The emotional dog and its rational tail: a social intuitionist approach to model judgment. *Psychological Review*, **108** (4), 814–834.

Hala, S., Chandler, M., & Fritz, A.S. (1991). Fledgling theories of mind: deception as a marker of three-year-olds' understanding of false beliefs. *Child Development*, **62** (1), 83–97.

Hansen, M.B., Fuglseth, K., Møller, S., Gregersen, C., & von Wovern, R *et al.* (2010). 'They thought the bear was a shark': three-year-olds talk about false belief. Poster presented at the International Conference for Infant Studies, Baltimore, MA.

Harris, P., Johnson, C.N., Hutton, D., Andrews, G., & Cooke, T. (1989). Young children's theory of mind and emotion. *Cognition and Emotion*, **3**, 379–400.

He, Z., Bolz, M., & Baillargeon, R. (2011). False belief understanding in 2.5-year-olds: evidence from violation-of-expectation change-of-location and unexpected-contents tasks. *Developmental Science*, **14** (2), 292–305.

He, Z., Bolz, M., & Baillargeon, R. (2012). 2.5-year-olds succeed at verbal anticipatory-looking false-belief task. *British Journal of Developmental Psychology*, **30**, 14–29.

Hiatt, S.W., Campos, J.J., & Emde, R.N. (1979). Facial patterning and infant emotional expression: happiness, surprise, and fear. *Child Development*, **50**, 1020–1035.

Hobson, J., Harris, R., García-Pérez, R., & Hobson, P. (2009). Anticipatory concern: a study in autism. *Developmental Science*, **12**, 249–263.

Hobson, P. (2002). *The cradle of thought*. New York: Oxford University Press.

Izard, C.E., Huebner, R.R., Risser, D., & Dougherty, L. (1980). The young infant's ability to produce discrete emotion expressions. *Developmental Psychology*, **16** (2), 132–140.

Kidd, D.C., & Castano, E. (2013). Reading literary fiction improves theory of mind. *Science*, **342**, 377–380.

Knudsen, B., & Liszkowski, U. (2012). Eighteen-month-olds predict specific action mistakes through attribution of false belief, not ignorance, and intervene accordingly. *Infancy*, **17**, 672–691.

Kovács, A.M., Téglás, E., & Endress, A.D. (2010). The social sense: susceptibility to others' beliefs in human infants and adults. *Science*, **330**, 1830–1834.

Lane, J.D., Wellman, H.M., Olson, S.L., LaBounty, J., & Kerr, D.C.R. (2010). Theory of mind and emotion understanding predict moral development in early childhood. *British Journal of Developmental Psychology*, **28**, 871–889.

Lewis, C., Freeman, N.H., Hagestadt, C., & Douglas, H. (1994). Narrative access and production in preschoolers' false belief reasoning. *Cognitive Development*, **9**, 397–424.

Liu, D., Wellman, H.M., Tardif, T., & Sabbagh, M.A. (2008). Theory of mind development in Chinese children: a meta-analysis of false-belief understanding across cultures and languages. *Developmental Psychology*, **44**, 523–531.

Lohmann, H., & Tomasello, M. (2003). The role of language in the development of false belief understanding: a training study. *Child Development*, **74**, 1130–1144.

Low, J. (2010). Preschoolers' implicit and explicit false-belief understanding: relations with complex syntactical mastery. *Child Development*, **81**, 597–615.

Low, J., & Watts, J. (2013). Attributing false beliefs about object identity reveals a signature blind spot in humans' efficient mind-reading system. *Psychological Science*, **24** (3), 305–311.

MacLaren, R., & Olson, D.R. (1993). Trick or treat? Children's understanding of surprise. *Cognitive Development*, **8**, 27–46.

Moll, H., & Stekeler-Weithofer, P. (submitted). Ontogenetic levels of understanding beliefs.

Onishi, K.H., & Baillargeon, R. (2005). Do 15-month-old infants understand false beliefs? *Science*, **308**, 255–258.

Oster, H. (1978). Facial expression and affect development. In M. Lewis & L. Rosenblum (Eds.), *The development of affect* (pp. 43–75). New York: Plenum.

Perner, J., Mauer, M.C., & Hildenbrand, M. (2011). Identity: key to children's understanding of belief. *Science*, **333**, 474–477.

Perner, J., & Roessler, J. (2012). From infants' to children's appreciation of belief. *Trends in Cognitive Sciences*, **16** (10), 519–525.

Rhodes, M., & Brandone, A.C. (2014). Three-year-olds' theories of mind in actions and words. *Frontiers in Psychology*, doi:10.3389/fpsyg.2014.00263

Rubio-Fernandez, P., & Geurts, B. (2013). How to pass the false belief task before your 4th birthday. *Psychological Science*, **24**, 27–33.

Ruffman, T., Garnham, W., Import, A., & Connolly, D. (2001). Does eye gaze indicate knowledge of false belief? Charting transitions in knowledge. *Journal of Experimental Child Psychology*, **80**, 201–224.

Ruffman, T., & Keenan, T. (1996). The belief-based emotion of surprise: the case for a lag in understanding relative to false belief. *Developmental Psychology*, **32** (1), 40–49.

Saxe, R. (2013). The new puzzle of theory of mind development. In M. Banaji & S. Gelman (Eds.), *Navigating the social world: What infants, children, and other species can teach us*. New York: Oxford University Press.

Scott, R.M., He, Z., Baillargeon, R., & Cummins, D. (2012). False-belief understanding in 2.5-year-olds: evidence from two novel verbal spontaneous-response tasks. *Developmental Science*, **15**, 181–193.

Sigman, M.D., Kasari, C., Kwon, J., & Yirmiya, N. (1992). Responses to the negative emotions of others by autistic, mentally retarded, and normal children. *Child Development*, **63** (4), 796–807.

Southgate, V., Chevalier, C., & Csibra, G. (2010). Seventeen-month-olds appeal to false beliefs to interpret others' referential communication. *Developmental Science*, **13** (6), 907–912.

Southgate, V., Senju, A., & Csibra, G. (2007). Action antici- pation through attribution of false belief by two-year-olds. *Psychological Science*, **18**, 587–592.

Sullivan, M.W., & Lewis, M. (2003). Emotional expressions of young children: a practitioner's primer. *Infants and Young Children*, **16** (2), 120–142.

Surian, L., Caldi, S., & Sperber, D. (2007). Attribution of beliefs by 13-month-old infants. *Psychological Science*, **18**, 580–586.

Surian, L., & Geraci, A. (2012). Where will the triangle look for it? Attributing false beliefs to a geometric shape at 17 months. *British Journal of Developmental Psychology*, **30**, 30–44.

Tomasello, M., & Moll, H. (2013). Why don't apes understand false beliefs? In M.R. Banaji & S.A. Gelman (Eds.), *Navigating the social world: What infants, children, and other species can teach us* (pp. 81–87). New York: Oxford Univer- sity Press.

Truffaut, F. (1966). *Le cinéma selon Hitchcock*. Paris: Robert Laffont.

Vaish, A., Carpenter, M., & Tomasello, M. (2009). Sympathy through affective perspective-taking and its relation to prosocial behavior in toddlers. *Developmental Psychology*, **45** (2), 534–543.

Wang, B., Low, J., Jing, Z., & Qinghua, Q. (2012). Chinese preschoolers' implicit and explicit false-belief understanding. *British Journal of Developmental Psychology*, **30**, 123–140.

Wellman, H.M., & Banerjee, M. (1991). Mind and emotion: children's understanding of the emotional consequences of beliefs and desires. *British Journal of Developmental Psychol- ogy*, **9** (2), 191–214.

Wellman, H.M., Cross, D., & Watson, J. (2001). Meta-analysis of theory of mind development: the truth about false belief. *Child Development*, **71** (3), 655–684.

Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: representations and constraining functions of wrong beliefs about young children's understanding of deception. *Cogni- tion*, **13**, 103–128.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Video S1. A child's expression in the False Belief Condition of Experiment 1.

Video S2. The same child's expression in the True Belief Condition of Experiment 1.

[Correction added on 27 June 2015, after first online publication: The Supporting Information section was added.]