

Inferring False Beliefs from Actions and Reactions

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MOSES, LOUIS J., and FLAVELL, JOHN H. *Inferring False Beliefs from Actions and Reactions*. CHILD DEVELOPMENT, 1990, 61, 929-945. Current evidence suggests that young children have little understanding of false belief. Standard false belief tasks, however, may underestimate children's ability for 2 reasons. First, the only cue to belief in these tasks is a protagonist's lack of perceptual access to some critical event, and this may not be a very salient cue for young children. Second, the standard tasks require children to make forward-looking predictions from the causes of a belief (e.g., from what a protagonist has or has not perceived) to either the protagonist's belief or the protagonist's action, and children may not be very skilled at making such predictions. In 2 experiments we investigated whether 3-year-olds would do better on tasks in which the belief cues were stronger, and in which they could reason backward to the belief from its effects (e.g., from a protagonist's actions and reactions). Even on these easy tasks, however, they did not perform well. These findings provide strong support for the view that children of this age do not fully understand the representational nature of belief.

In trying to make sense of other people's actions, adults rely on a folk or commonsense psychological theory (Lewis, 1972; Stich, 1983). Within this theory the behavior of others is interpreted in terms of a network of beliefs, desires, intentions, and the like. Two implicit principles are especially central to this folk theory. The first is that the relation between the mind and the world is mediated by representations that may or may not accurately reflect states of the world (Forguson & Gopnik, 1988). For example, beliefs may be false and desires may be unfulfilled. The second is that these representations are causally connected to the world in specific ways. Our beliefs and desires, for example, may be caused by what we perceive in the external world and, in turn, they are causally involved in producing our actions in the world. What is of interest to developmental psychologists is when and how children acquire these principles. In this article we report research on this issue that focuses on the mental state of belief and, in particular, on young children's conception of false belief.

Current evidence suggests that young children have little understanding of false belief (e.g., Gopnik & Astington, 1988; Hogrefe, Wimmer, & Perner, 1986; Johnson & Maratsos, 1977; Perner, Leekam, & Wimmer, 1987; Wimmer & Perner, 1983). In standard false belief tasks a story protagonist acquires a false belief by virtue of being absent during some critical event. For example, in one experiment by Perner et al. (1987), children were told a story in which a protagonist called John leaves some chocolate in a drawer and then, while he is away, his mother places the chocolate in the cupboard. On tasks like these children are asked either to predict the protagonist's belief (e.g., where does John think the chocolate is?), or to predict the protagonist's action (e.g., where will John look for the chocolate?). In either case, it is not until 4 or 5 years of age that most children succeed on these tasks. Three-year-olds typically assert that the protagonist's belief corresponds to the true state of affairs (or that the protagonist's action will be based on that state of affairs). For example, they say that John thinks

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930 Child Development

the chocolates are in the cupboard (or that he will look for them in the cupboard).

Nevertheless, children might understand a good deal about false belief and yet fail these standard tasks. One potential difficulty is that, to succeed on the tasks, children need to understand that failure to perceive a critical event can lead to the formation of a false belief. Strictly speaking, then, these tasks are as much tests of children's understanding of belief formation as they are tests of their understanding of false belief per se. Children might well understand that beliefs are representations that may or may not be accurate, and that people act on the basis of these representations, and nevertheless fail false belief tasks because they do not understand much about belief formation. With respect to this, Wimmer and his colleagues (Wimmer, Hogrefe, & Sodian, 1988) have argued that young children "have no idea where knowledge or belief come from" (p. 173). Although there is some evidence for this claim, both with respect to others' knowledge states (Wimmer, Hogrefe, & Perner, 1988) and with respect to the child's own knowledge states (Gopnik & Graf, 1988; O'Neill & Gopnik, 1989), not all of the evidence is supportive (e.g., Pillow, 1989; Pratt & Bryant, in press). Nevertheless, even if children do understand something of the origins of epistemic states, those origins might not be very salient for them in the context of a false belief task. Whether or not a character has had perceptual access to some critical event is, after all, a rather indirect cue to the character's belief. In the example from Perner et al. (1987) cited above, John certainly has not done anything to reveal his belief; he is merely absent during the critical event. Moreover, requiring children to determine the effects of perceptual access on a character's beliefs imposes an inferential burden that may hinder performance. Thus, if children were given cues to belief that were more salient and that required less of an inference to the belief, they might well do better.

In our everyday dealings with people such cues are often available. For example, we can sometimes almost read a belief from a person's actions, especially if we know the goal motivating the actions (see Davidson, 1980). To extend the Perner et al. (1987) example, suppose we know that John is looking for chocolate, and yet John, acting on the basis of his false belief, goes to look in the drawer instead of in the cupboard. John's action alone ought to strongly suggest what his (mistaken) belief is, even without considering his lack of perceptual access to the true state

of affairs. Moreover, a person's reactions to events often provide strong evidence about belief as well. Suppose, for example, that John looks in the drawer and is greatly surprised to find the chocolate missing. Again, John's reaction alone ought to strongly suggest that, at the very least, he did not expect to find the drawer empty.

Of course, whether young children could take advantage of these action and reaction cues would depend not only on their understanding of false belief. They would also need to have (a) an understanding of the relation between goals and actions, and (b) an ability to interpret given reactions as instances of surprise. With respect to the former, the evidence suggests that children as young as 2½ have considerable knowledge of how goals influence actions (Smiley, 1987; Wellman & Woolley, in press). With respect to the latter, the evidence is not as clear. Although a majority of 3-year-olds can distinguish surprise from other common emotions on the basis of facial expression, it is not until 4 or 5 years of age that children can make such distinctions on the basis of situational cues (Smiley & Huttenlocher, 1989). In these experiments, however, children were presented with only one type of cue to surprise (either facial expression cues alone or situational cues alone). In contrast, children might be expected to understand surprise earlier in more naturalistic settings. In these settings redundant cues to surprise, such as facial expression, bodily movements, vocal intonation, and situational context, are often available (Smiley & Huttenlocher, 1989). Moreover, most 3-year-olds comprehend the word *surprised*, at least by parental report (Ridgeway, Waters, & Kuczaj, 1985). Consistent with this, Trabasso, Stein, and Johnson (1981) found that when 3- and 4-year-olds were merely told that a character was surprised and were asked to create an appropriate explanation for this reaction, a majority of them were able to do so. Therefore, if children were not only given multiple perceptual cues to a character's surprise but were also told that the character was surprised, the reaction cues might provide very powerful evidence of the character's false belief. In sum, a person's actions and reactions may not only be stronger cues to belief than cues from perceptual access, but children have at least some of the necessary abilities to take advantage of these cues.

A second potential difficulty for children on standard false belief tasks is that they are asked to predict either a protagonist's belief or a protagonist's action from the cause of the

belief (e.g., from what the protagonist has and has not perceived). Young children, however, might not be very skilled at making forward-looking predictions from causes to effects in the belief domain. They might well find it easier to reason backward to a belief from its effects (e.g., from the protagonist's actions and reactions). Note that, when presented with an action or reaction that stems from a false belief, children are faced with something of a puzzle. Using our extension of the Perner et al. (1987) example again, children know that the chocolate is in the cupboard and that John wants the chocolate, and yet they see John acting in an apparently irrational way by looking in the drawer. The action may seem perverse to children because clearly it both frustrates John's desire and does not accord with the true state of the world. Unless they are able to invoke the notion of a false belief, they will be hard pressed to make sense of John's action at all. Similarly, John's surprise ought to be puzzling for children. If John believed that the drawer was empty, then of course he ought not be surprised when he looks there. Again, children ought to have difficulty accounting for John's surprise unless they credit him with a false belief. In standard false belief tasks, on the other hand, children are not faced with these puzzles. In these tasks they are given the cause of the belief and are asked to predict either the protagonist's belief or action. By predicting that the protagonist's belief or action will accord with reality, children will actually avoid any conflicts between the action, the belief, the desire, and the way the world is (see also Bartsch & Wellman, 1989).

In sum, there are at least two reasons for thinking that children might show more understanding of false belief when presented with action and reaction belief cues than when presented with belief cues from perceptual access. First, a character's actions and reactions appear to be much stronger cues to belief than perceptual access cues are, and second, action and reaction cues present children with puzzles that can only plausibly be resolved by invoking a false belief. Such puzzles do not arise in the standard tasks.

In Experiment 1 these ideas were tested by comparing children's performance on false belief tasks that differed in the kind and number of cues available for inferring belief. Children were shown two short movies in each of which a protagonist acquired a false belief by virtue of being denied perceptual access to a critical event. In a perception condition, the only belief cues available to children were

from the protagonist's lack of perceptual access to the critical event. This condition was designed to be similar in essential respects to the standard false belief tasks that others have used (e.g., Hogrefe et al., 1986; Perner et al., 1987; Wimmer & Perner, 1983). In an action condition, children had belief cues available from the protagonist's actions as well as from perceptual access. The protagonist acted (on the basis of a false belief) in a way that would not satisfy a goal. In a surprise condition, children had belief cues available from the protagonist's reaction of surprise, as well as from perceptual access and the protagonist's actions. In all three conditions, children were asked to state the protagonist's belief. Based on the kind and number of cues available in the different conditions, we predicted that children would show more understanding of false belief in the surprise condition than in the action condition and more in the action condition than in the perception condition.

Experiment 1

METHOD

Subjects

The subjects were 48 nursery school children (26 boys, 22 girls) drawn from upper-middle-class families. Sixteen children were randomly assigned to each condition with the constraint that the ratio of girls to boys, the age range, and the mean age be roughly equivalent in each condition. In the perception condition (7 girls, 9 boys) children's ages ranged from 3-0 to 3-11, in the action condition (7 girls, 9 boys) from 2-11 to 3-11, and in the surprise condition (8 girls, 8 boys) from 3-1 to 3-11. The mean age in each condition was 3-6.

Materials

In previous research on false belief (e.g., Perner et al., 1987; Wimmer & Perner, 1983) children have typically been asked to make belief attributions about a story character or a doll. To provide a more sensitive test of young children's understanding of false belief, we made use of movies portraying the speech and actions of real people. Two color movies, one about a clown and another about a fairy, were videotaped with sound using adult actors. Each movie consisted of three scenes and lasted from 4 to 4½ min, depending on condition. Children watched the movies on a 13-inch (33-cm) color monitor.

Procedure

All children were tested by the same male experimenter. The procedure will be described in detail for the clown movie. In

932 Child Development

the first scene of this movie, Cathy (a young adult playing the role of a child) entered a room and began to look for some toys. She looked first in the top drawer of a chest, remarked that there were no toys there, and then went on to discover a box of crayons in a bag on a chair. She next put the crayons back inside the bag and left the room, announcing that she was going to get some paper and that she would draw a picture. In the second scene, a clown entered through a side door, discovered the crayons in the bag, and announced that she was going to play a trick on Cathy. She hid the crayons in the top drawer, placed some rocks in the bag, and departed. The experimenter then stopped the videotape (whenever the tape was stopped a clear still picture remained on the screen) and asked Memory Question 1 concerning the final location of the original object ("Where are the crayons now?") and Memory Question 2 concerning the final contents of the original location ("What's in the bag now?"). In the third scene the procedure differed across conditions.

Perception condition.—Children in this condition had to infer the belief solely on the basis of the protagonist's lack of perceptual access to the critical event. In the third scene, Cathy reentered the room with some paper and the experimenter stopped the tape immediately. He then commented on Cathy's goal saying, "Hey, here's Cathy again. Cathy's got some paper. She's gonna draw a picture!" Immediately following this he asked the Belief Question: "And right now Cathy's thinking. What does Cathy think is in the bag? Does Cathy think there are crayons in the bag, or rocks?" He then asked the Reality Question: "And what's really in the bag? Crayons, or rocks?" This was followed by the Justification Question: "How come Cathy thinks there are crayons/rocks in the bag?" Finally, children were asked Memory Question 3 concerning Cathy's whereabouts during the second scene: "And was Cathy in the room or outside when the clown hid the crayons?"

Action condition.—Children in this condition were given additional belief cues in the form of the protagonist's actions. In the third scene, Cathy reentered the room and the experimenter commented on her goal, exactly as he did for children in the perception condition. Cathy then walked over to the bag, and the experimenter stopped the tape as she was about to open it. The experimenter then asked the Belief, Reality, Justification, and Memory 3 Questions. These questions were

identical to those asked in the perception condition.

Surprise condition.—Children in this condition were given further belief cues in the form of the protagonist's reaction on looking in the original location. In the third scene, Cathy reentered the room and the experimenter commented on her goal, just as he did in the other conditions. Cathy then walked over to the bag and opened it. On discovering the rocks she looked extremely surprised in both facial expression and bodily movements, and she said in a surprised tone of voice, "Hey, there are rocks in here!" Immediately after this, the experimenter stopped the tape and said, "Look how surprised Cathy is! We know why Cathy's surprised! Let's go back and see why." The tape was rewound to the point at which Cathy was about to walk toward the bag and then played forward and stopped when she was about to open it (the tape was thus stopped at the same point as in the action condition). The experimenter then said, "Remember back before Cathy opened the bag. Cathy was gonna draw a picture." Following this the Belief, Reality, and Justification Questions were asked. These were identical to the corresponding questions in the other two conditions except for a change in tense. The Belief Question was, "And Cathy was thinking. What did Cathy think was gonna be in the bag? Did Cathy think there were gonna be crayons in the bag, or rocks?" The Reality Question was, "And what was really in the bag? Crayons, or rocks?" The Justification Question was, "How come Cathy thought there were crayons/rocks in the bag?" Finally, Memory Question 3 was asked. This question was identical to the corresponding question in the other conditions.

The fairy movie had a similar format. In the first scene, Billy (a young adult playing the role of a child) discovered his birthday present in a box. He found out that the present, a toy plane, was broken and left to find some glue so that he could fix it. In the second scene, a fairy replaced the broken plane with a new truck and put the plane in a trash can. In the third scene, Billy returned with a hammer and some glue, walked over to the box, and opened it. On discovering the truck he looked extremely surprised in both facial expression and bodily movements, and he said in a surprised tone of voice, "Hey, there's a truck in here!" The various test questions were identical in form to those in the clown movie, and they were asked at the corresponding places in the movie.

In the clown movie, a desirable object (a box of crayons) was replaced with something undesirable (rocks). In the fairy movie, an undesirable object (a broken plane) was replaced with something desirable (a truck). The desirability of the original object was varied to check for the possibility that children might give correct responses simply by equating the protagonist's belief with the protagonist's desire. Thus, in the clown movie the protagonist falsely believed there were crayons in the bag, and she also desired the crayons; in the fairy movie, however, the protagonist falsely believed there was a broken plane in the box but presumably had no desire for a broken toy. If children misinterpret the belief question as a request for the protagonist's desire, then they should perform well on the clown movie but poorly on the fairy movie.

To help maintain children's interest, the experimenter enthusiastically commented on the important events in both movies, pointing out, for instance, why the protagonist had left the room, what the clown or fairy was doing with the objects, and noting that the protagonist was absent while this was happening.

Probe questions.—On their second movie, after children were asked the above set of test questions, they were given some additional probe questions. We describe here the two questions for which we have the most systematic data. For children in the second half of the sample ($n = 24$, 8 per condition), the experimenter stopped the tape while the protagonist was looking in the critical location and asked the Action Explanation Question: "Why is Cathy/Billy looking in the bag/box?" Following this, 46 of the 48 children were shown the protagonist's surprised reaction and were asked the Surprise Explanation Question: "Why is Cathy/Billy surprised?" For children in the surprise condition, this was the second time they had seen the part of the tape to which these probe questions relate.

Design

Each child participated in only one condition. The order of the two movies was counterbalanced across children. On their first movie, children saw only as much of the videotape as was appropriate for the condition to which they were assigned. On their second movie, after the test questions were asked, they saw all of the videotape regardless of condition. The order of Memory Questions 1 and 2 was counterbalanced across the two movies for each child. The Belief, Reality,

Justification, and Memory 3 Questions were always given in the same fixed order. The order was fixed rather than counterbalanced so that we could obtain information concerning children's false belief understanding uncontaminated by responses to these other questions. The response alternatives for the Belief and Reality Questions were always given in the same order for a given child for a particular movie, but they were counterbalanced across children. The position of the correct alternative for these questions was counterbalanced across the two movies for each child. The response alternatives for Memory Question 3 were also counterbalanced across the two movies for each child.

RESULTS AND DISCUSSION

Memory Questions

Children's memory for the critical aspects of both movies was excellent. On Memory Question 1, concerning the final location of the crayons or the broken plane, no child made even a single error. On Memory Question 2, concerning the final contents of the bag or the box, there was only one error. On Memory Question 3, concerning whether the protagonists were outside when the location of the crayons or the broken plane was changed, there were only five errors (out of 96 trials). There were no significant differences between the two movies on these or any of the other questions asked in this experiment.

Belief and Reality Questions

To assess children's false belief performance, we analyzed their responses to the Belief and Reality Questions. The results of these analyses will be presented first for the sample as a whole, and then for the individual conditions.

Overall performance.—On the Belief Question, children were correct on only 25% of the 96 trials. Children erred by claiming that the protagonist's belief corresponded with the actual state of affairs (e.g., in the clown movie they said that Cathy thought there were rocks in the bag). In contrast, on the Reality Question they were correct on 97% of the trials (e.g., in the clown movie they knew there were really rocks in the bag).

Children were credited with an understanding of false belief on a particular trial if they were correct on both the Belief and Reality Questions. Children met this criterion on only 24% of the 96 trials. Their errors were highly systematic. On 70 of the 73 trials on which children failed the false belief task, they did so by failing the Belief Question but

TABLE 1

MEAN AND STANDARD DEVIATION FALSE BELIEF SCORES FOR THE PERCEPTION, ACTION, AND SURPRISE CONDITIONS

Condition	Mean	SD
Perception25	.68
Action50	.82
Surprise69	.87

NOTE.—Possible scores range from 0 to 2.

passing the Reality Question. Each child completed two trials, and thus possible false belief scores ranged from 0 to 2. The mean number of correct out of two trials was 0.48 (SD = 0.80). This level of performance is significantly below chance, $t(47) = -4.52$, $p < .001$ (since children were essentially at ceiling on the Reality Question, the mean to be expected by chance was taken to be 1 rather than 0.5 out of 2). Children tended to either succeed on both or fail on both trials. Of the 48 children, only nine were correct on both trials; a further five were correct on just one trial; and a large majority of 34 were incorrect on both trials. Their overall performance on the task, therefore, was very poor.

Condition effects.—We had predicted that performance in the surprise condition would be better than performance in the action condition, which in turn would be better than performance in the perception condition. The data are consistent with this predicted ordering. In the surprise condition, children met our false belief criterion (correct on both the Belief and Reality Questions) on 34% of the trials, in the action condition on 25% of the trials, and in the perception condition on 13% of the trials. The mean false belief scores for each condition (see Table 1) show a similar pattern. Nevertheless, a condition (perception vs. action vs. surprise) \times movie order (clown movie first vs. fairy movie first) ANOVA on children's false belief scores revealed no significant effects. A more specific test of our hypothesis, however, is a test of monotonic trend (Ferguson, 1981, pp. 412–414). This test is based on the pattern of performance across all conditions, taking into account the predicted ordering of the conditions. The test essentially yields a rank-order correlation and is designed to assess whether rank-ordered scores on a dependent variable are monotonically related to an ordered set of conditions. The monotonic trend was significant, one-tailed $z = 1.76$, $p < .05$. False belief scores were monotonically related to the predicted ordering of the conditions. The more

belief cues children were given, the better was their performance.

Although children did somewhat better in the action and surprise conditions than in the perception condition, performance in these conditions was, nevertheless, rather poor. Even in the surprise condition, mean performance was not significantly different from the mean to be expected by chance (i.e., 1 out of 2), $t(15) = -1.43$, $p > .15$; it was significantly below chance in both the action condition, $t(15) = -2.45$, $p < .03$, and the perception condition, $t(15) = -4.39$, $p < .001$.

Children's Justifications

Immediately following the Reality Question, children were asked to justify their responses to the Belief Question. Because there were relatively few correct responses to the Belief Question, we will report only the justifications that followed incorrect responses. Children were incorrect on 72 of the 96 false belief questions. In these cases, children most frequently (50%) justified attributing a true belief to the protagonist by referring to some aspect of the outcome (e.g., "coz the crayons are not in there"; "coz the clown put them in there"). A further 7% of the justifications were related to the protagonist's desires, and in 4% of their justifications children claimed that the protagonist had perceptual access to what the clown or fairy did during the second scene. Finally, on 39% of the trials children gave an uninterpretable justification or no justification at all.

Probe Questions

Responses to the Action and Surprise Explanation Questions were coded into four categories. The desire-related category could include references to the protagonist's wants, goals, intentions, likes, and needs. The belief-related category could include references to the protagonist's false belief or ignorance, to his or her lack of perceptual access to the critical event, to some deception that had taken place, or (for the surprise explanations) to a discrepancy between a prior state and a current state of affairs. The outcome-related category could include references to the current content of the critical location (e.g., the rocks), to the absence of the original content (e.g., the crayons) from that location, or to how the current content came to be there (e.g., the clown put the rocks in the bag). Finally, the no explanation category could include cases in which children did not answer, did not know, or gave irrelevant or uninterpretable responses.

TABLE 2

PERCENTAGES AND EXAMPLES OF CHILDREN'S ACTION EXPLANATIONS IN EACH CATEGORY

Category	Percentage	Example
Belief-related	12	"Because she thinks there are crayons in there."
Desire-related	46	"'Coz he wants to fix the broken plane."
Outcome-related	21	"'Coz there's a truck there."
No explanation	21	"Don't know."

In Tables 2 and 3, children's explanations are broken down into these categories for the Action and Surprise Explanation Questions, respectively. An example from each category is also given. The most striking aspect of these data is that, for both questions, belief-related responses were extremely rare. On the Action Explanation Question, both desire- and belief-related responses are appropriate explanations of the protagonist's action. For example, Cathy's desire for crayons and her belief that crayons are in the bag jointly explain her looking in the bag. Combining these two categories yields a total of 58% appropriate responses. Nevertheless, within these appropriate explanations, children referred much more frequently to desires (46%) than to beliefs (12%). On the Surprise Explanation Question, both outcome- and belief-related responses are appropriate explanations of the protagonist's reaction. For example, the fact that rocks are in the bag is the proximal cause of Cathy's surprise, and the reason that the rocks are surprising is that Cathy believed there would be crayons in the bag. Combining these two categories yields a total of 67% appropriate responses. Again, however, within these appropriate explanations children rarely referred to the protagonist's beliefs (6%); references to some aspect of the outcome were much more frequent (61%). Thus, even asking explicitly for explanations of actions and reactions did not prompt children to offer false belief responses.

Experiment 2

Clearly, children did not perform well on the false belief task in Experiment 1. Nevertheless, there were signs that children might possess some latent false belief understanding that our task was not tapping. After all, performance did improve to some extent in the more facilitative conditions, and many of the children's appropriate surprise explanations could have been mediated by an understanding of false belief. In Experiment 2 we examined this possibility by giving children a version of the surprise condition (the condition in which they performed best in Experiment 1) in which the task demands were reduced considerably.

We made several changes. First, in Experiment 1 the task was embedded in a rich context designed to engage children's interest and attention. Nevertheless, it did require children to integrate information from three scenes, and to keep track of two characters, two objects, and two locations. The processing demands of the task may thus have depressed children's performance. To reduce these demands, we adapted the "Smarties" false belief task that various researchers have used (e.g., Gopnik & Astington, 1988; Hogrefe et al., 1986; Perner et al., 1987). In the Smarties task children are shown a familiar candy box which, when opened, is seen to contain pencils. Children are then asked what another child, who has not yet seen the box, will think is inside it. In such a task, children

TABLE 3

PERCENTAGES AND EXAMPLES OF CHILDREN'S SURPRISE EXPLANATIONS IN EACH CATEGORY

Category	Percentage	Example
Belief-related	6	"'Coz the clown put the crayons in the drawer and she wasn't there."
Desire-related	11	"'Coz she wants her crayons."
Outcome-related	61	"'Because there was a truck in there."
No explanation	22	"Don't know."

need to absorb much less information than they do in the "change of location" task used in Experiment 1. In addition, they first experience the other person's perspective themselves before being asked to state that person's perspective. That is, children initially have the same false belief about the candy box as the naive other does, and this may ease the perspective-taking burden (see Chandler & Helm, 1984). In our adaptation of the Smarties task, a protagonist looked for a certain object (e.g., bandaids), saw a box that normally contained such an object (e.g., a bandaid box), but was then greatly surprised to find that it contained something else (e.g., a toy car). Like the Smarties task, this new task consisted of a single scene only and required children to keep track of only one character, one object, and one location.

Second, inferring a false belief from surprise cues has some inherent complexity that inferences from other belief cues do not share. Specifically, once the protagonist has been surprised, he or she no longer holds a false belief. The problem then is to ensure that children understand that the test question refers to the protagonist's prior rather than current belief. Our approach to this in the first experiment was to rewind the tape to the earlier point in time before asking the false belief question. It might be argued, however, that this sophisticated technology merely confused children and that their performance suffered accordingly. Even though children gave no positive indication of such confusion, we adopted a different approach in the second experiment to circumvent this possibility altogether. Instead of rewinding the tape, we asked the test questions immediately after children saw the protagonist's surprise. To clarify that we were referring to the protagonist's prior belief, we relied on strong linguistic markers in the test question and, in addition, we pretested children on a task that was similar to the false belief task in its linguistic demands and temporal aspects but that did not involve beliefs (see Gopnik & Astington, 1988). On this pretest task, rather than having to infer beliefs, children were simply required to state a prior and a current action of a protagonist. Only children who performed well on the pretest were retained for the false belief task.

Third, part of the rationale for the first experiment was that children might find it easier to infer a false belief from an action or a reaction provided they knew the goal motivating the action. In this second experiment, the goal information was strengthened in two

ways. To begin with, both the protagonist and the experimenter explicitly stated the goal (e.g., in one movie the protagonist said that she was looking for bandaids, and this was immediately reiterated by the experimenter). Further, as in Experiment 1, children were asked to explain the protagonist's action and surprise, but, in addition, to ensure they understood the goal of the action, we specifically asked them to state that goal. Both before and after these questions, children were asked about the protagonist's belief. If children were unaware of the protagonist's goal when the first false belief question was asked, then their performance should improve on the second false belief question.

Fourth, to provide children with even more powerful belief cues, the protagonist's false belief in this experiment was strongly implied, not only by what she did, but also by what she said. For example, in the bandaid movie, the protagonist found a bandaid box and said, "Ah, here are some bandaids!"; then, after discovering a pencil in the box, she said, "Where are the bandaids?"

Finally, we were concerned that, in this new task, the protagonists would be so heavily associated with the correct answer to the false belief question (e.g., bandaids) that children might give this answer without a true understanding of false belief. In the first experiment, we credited children with an understanding of false belief if they were correct on both the false belief question and the reality question. In this second experiment, to control for false positives, we replaced the reality question with a question about the protagonist's current true belief. If children answered the belief questions merely through some association between the protagonist and the alternative with which she was strongly paired, then they should be correct on the false belief question but incorrect on the true belief question. The addition of this true belief question also allowed a test of children's understanding of change of belief as well as of their understanding of false belief (see Gopnik & Astington, 1988).

METHOD

Subjects

The subjects were 19 nursery school children (10 boys, 9 girls) drawn from upper-middle-class families. Their ages ranged from 3;1 to 3;11, with a mean of 3;6.

Materials

Four color movies with adult actors were videotaped. Each movie consisted of a single

scene and lasted from 60 to 90 sec. The movies were shown to children on a 19-inch (48-cm) color monitor.

Procedure

Pretest.—Children watched two movies in which a protagonist performed one action before opening a box, and a different action afterward. They were asked what the protagonist had done before opening the box, and what she was doing now. To illustrate, in the cookie movie Mary entered a room, saw a cookie box on a table, jumped up and down three times, opened the box, and began to eat a cookie. The tape was then stopped and children were asked about Mary's previous action: "Let's remember back to when Mary first saw the box. What did Mary do before she opened the box? Did she jump up and down or did she eat a cookie?" They were then asked about her current action: "What about now? What is Mary doing now? Is she jumping up and down or is she eating a cookie?" If children erred on either of these questions they were corrected, and their errors were illustrated by showing the movie over again. The crayon movie had a similar form: Sally saw a crayon box on the table, clapped her hands three times, opened the box, and began to draw a picture.

False belief task.—Children watched two movies in each of which a protagonist had a false belief by virtue of not having seen the unexpected content of a familiar-looking box. The tape was stopped after the protagonist discovered and was surprised by this content, and children were asked the test questions. To illustrate, the bandaid movie opened with a close-up of a bandaid box on a table. Children were asked to name the box and, if they could not do so, they were given the answer. Mary then entered shaking her hand and said, "Ouch, my finger hurts! I'm looking for a bandaid." The experimenter immediately restated her goal, saying, "She's looking for a bandaid." Mary then saw the bandaid box on the table and said, "Ah, here are some band-aids." Next she sat down at the table, opened the box, discovered a toy car inside, pulled it out, looked astonished, and exclaimed, "Hey, there's a car in here! Where are the band-aids?" While saying this, she shook the box up and down to make sure there were no band-aids inside, and then pointed the open end of the empty box toward the camera. Finally, she placed the car half-way back in the box and the tape was stopped with a close-up clearly showing a puzzled Mary holding the car in the bandaid box. The experimenter said, "Look how surprised Mary is!" and then

asked the False Belief Question: "Let's remember back to when Mary first saw the box. What did Mary think was gonna be in the box before she opened it? A car, or band-aids?" This was followed by the True Belief Question: "What about now? What does Mary think is in the box now? A car, or band-aids?"

Probe questions.—Following these belief questions, children were asked the Action Explanation Question: "Why was Mary looking in the box?" They were then asked the Goal Question: "What was she looking for?" Next, they were asked the Surprise Explanation Question: "Why was Mary surprised?" Finally, they were re-asked the False Belief Question: "What did Mary think was gonna be in the box before she opened it? A car, or band-aids?"

The popcorn movie had a similar format. Sally came in looking for popcorn, found a popcorn box on the table, and was then surprised to discover a pencil in the box. Test questions formally identical to those in the bandaid movie were then asked.

Design

The two pretest movies were given in a fixed order (cookie movie followed by crayon movie), whereas the order of the two false belief movies was counterbalanced. The test and probe questions for the pretest and false belief tasks were always given in the order indicated above. The response alternatives for these questions were always given in the same order for a given child for a particular movie, but they were counterbalanced across children. The position of the correct alternative for these questions was counterbalanced across movies for each child.

RESULTS AND DISCUSSION

Pretest

Fourteen children answered the test questions about the protagonist's actions correctly on both pretest movies. A further two children answered incorrectly on the first movie, were given corrective feedback, and then answered correctly on the second movie. The remaining three children were either incorrect on both movies, or their performance deteriorated from the first to the second movie. These three children were not retained for the false belief task. The final sample thus consisted of 16 children (8 boys and 8 girls). Their ages ranged from 3-1 to 3-11, with a mean of 3-6. These sample characteristics are identical to those of the surprise condition in Experiment 1.

False Belief Task

Initial belief questions.—To assess children's false belief performance, we first analyzed their responses to the False and the True Belief Questions. There were no significant differences between the two movies on these or any of the other questions asked in this experiment. On the False Belief Question children were correct on 47% of the 32 trials. Each child completed two trials, and thus possible false belief scores ranged from 0 to 2. The mean number correct out of two trials was 0.94 ($SD = 0.85$), which is not significantly different from the mean to be expected by chance (*i.e.*, 1 out of 2).

Children's performance on the True Belief Question was little better. They were correct on only 59% of the trials. Children erred by claiming that the protagonist's current belief was false (*e.g.*, in the bandaid movie they said that Mary now thought there were bandaids in the box, when in fact there was a car). The mean number correct was 1.19 ($SD = 0.91$), which is not significantly different either from chance or from performance on the False Belief Question. Below we rule out two explanations for children's performance on the True Belief Question and then suggest a third, more likely, alternative.

One possibility is that some children mistakenly took the current True Belief Question to be referring to the protagonist's prior belief. This is implausible, however, because the false belief task had no more temporal complexity than the pretest task did, and yet, on that task, children did not take the question about the protagonist's current action to be referring to her prior action. A second possibility is that their errors stemmed from confusion about the true contents of the boxes. Against this, however, recall that in Experiment 1 children were near ceiling on the Reality Question. Moreover, in Experiment 2 children had even more information about the reality than in the first study. In the bandaid movie, for instance, Mary not only stated that there was a car in the box, but she asked where the bandaids were and shook the box up and down to make sure it was empty. In addition, when the test questions were asked, children could clearly see Mary holding the car in the box. Further, although we did not test children's knowledge of the reality directly, many of them revealed this understanding in responses to the probe questions (see below). On these questions children frequently made reference to either the presence of the true content of the boxes or the absence of the expected content. Therefore,

confusion about the reality is an unlikely source of children's errors on the True Belief Question.

A third, more plausible, explanation is that many of these children understood little about beliefs and, hence, responded with whatever seemed most salient to them at the time of the test question. Given that the protagonist had been much more strongly associated throughout the task with what turned out to be the wrong alternative (*e.g.*, bandaids) on the True Belief Question, it is not surprising that many children found this alternative highly salient and, thus, fell into error on this question. One implication of this is that some of the correct responses to the False Belief Question may also reflect little more than a positive association between the protagonist and one of the response alternatives; indeed, we included the True Belief Question to control for that very possibility.

In Experiment 1 we credited children with an understanding of false belief on a particular trial if they correctly identified both the false belief and the true state of affairs. In Experiment 2 we did so if they correctly identified both the prior false belief and the current true belief. Children met this criterion on only 28% of the 32 trials. Two children did so on both movies, five on one movie, and nine children did not meet it on either movie. The mean number correct out of two trials using this joint criterion was 0.56 ($SD = 0.73$), which is not significantly different from chance (the mean to be expected by chance is based on responses to both the false and true belief questions and is thus 0.5 out of 2). Thus, whether children's responses are examined for the False Belief Question alone, or for the False and True Belief Questions jointly, the conclusion is the same. Children's performance hovers around chance and inspires little confidence in their understanding of false belief.

Probe questions.—In coding children's responses to the Action and Surprise Explanation Questions, we used the same categories as in Experiment 1. Table 4 shows these responses broken down by category for both explanation questions. For purposes of comparison, the corresponding percentages from Experiment 1 are shown in parentheses. Two things are noteworthy. First, the profile of responses for both questions was very similar to that obtained in Experiment 1. Second, belief-related responses were extremely rare. For action explanations, desire-related responses were again most frequent, as were

TABLE 4

PERCENTAGES OF CHILDREN'S ACTION AND SURPRISE EXPLANATIONS IN EACH CATEGORY

Category	Action Explanations	Surprise Explanations
Belief-related	3 (12)	9 (6)
Desire-related	53 (46)	16 (11)
Outcome-related . .	16 (21)	47 (61)
No explanation . . .	28 (21)	28 (22)

NOTE.—Corresponding percentages from Experiment 1 are in parentheses.

outcome-related responses for surprise explanations. Of the action explanations, 56% were appropriate (belief- plus desire-related responses). Similarly, 56% of the surprise explanations were appropriate (belief- plus outcome-related responses).

In both experiments, over half the children appropriately explained the protagonist's surprise. They typically did so, however, not by invoking the protagonist's false belief but by referring to some aspect of the outcome. Nevertheless, it might be argued that children's outcome-related responses were in fact mediated by an understanding of false belief even though they did not include explicit references to beliefs. Although this is possible, several other, more frugal, interpretations of the data are available. First, recall that, immediately prior to the test questions, the protagonist had commented in a surprised tone of voice on the presence of the unexpected object (e.g., a car) and, in Experiment 2, on the absence of the expected objects (e.g., band-aids). Some children may then have merely echoed the protagonist's words in their explanations without any consideration of beliefs. Second, children's responses may have been generated by scriptlike knowledge of the situations that typically evoke surprise (see Smiley & Huttenlocher, 1989). They might merely understand that novel objects (e.g., cars) or events (e.g., a clown putting rocks in a bag in Experiment 1) lead to surprise, again without any understanding of how beliefs are involved. Finally, outcome-related responses could well have stemmed from an understanding of desire rather than belief. For example, take children who, in the bandaid movie, said that Mary was surprised because there was a car in the box. They might have believed this, not because Mary thought there would be band-aids in the box, but because she wanted and did not find band-aids there. With respect to this possibility, even 4-year-olds have some difficulty relat-

ing specific reactions to specific mental states. For example, Wellman and Bartsch (1988) found that, although most 4-year-olds predicted that a protagonist would be surprised if an outcome was incongruent with a belief, a majority also predicted that the protagonist would be surprised if the outcome was incongruent with a *desire* (see also Wellman, in press). Given that when children in the present studies did refer to mental states in their surprise explanations they more often referred to desires than to beliefs, some of the outcome-related responses to the surprise probe may well have been mediated by an understanding of desires rather than an understanding of beliefs.

These other possibilities cast considerable doubt on any claim that children's outcome-related responses are evidence of false belief understanding. Moreover, if they were truly mediated by such an understanding, then there should be at least some correlation between performance on the Surprise Explanation Question and on the False Belief Question. To test this hypothesis, we scored children's explanations as correct if they were in either the belief- or outcome-related categories, and as incorrect otherwise. Children's explanation scores summed over the two trials could thus range from 0 to 2. The correlation between these scores and children's scores on the False Belief Question was essentially zero ($r = .02$, N.S.). Thus, children's outcome-related explanations of the protagonist's surprise seem unlikely to have been generated by a latent understanding of belief (see also Hadwin & Perner, 1989).

Following the Action Question, and prior to the Surprise Question, children were asked what the protagonist was looking for (some children had already given the answer to this question in response to the Action Explanation Question). Children were essentially at ceiling in recalling the protagonist's goals: in response to this Goal Question there was only a single error out of 32 trials. This impressive performance, together with children's spontaneous tendency in both experiments to interpret the protagonist's actions in terms of desires and goals, is consistent with other work showing that 2- and 3-year-olds have considerable understanding of goals and desires and their relation to actions (e.g., Hood & Bloom, 1979; Smiley, 1987; Stein & Levine, 1989; Wellman & Woolley, in press).

Second False Belief Question.—Finally, following these probe questions, children were re-asked the False Belief Question. On

this question, children were correct on 50% of the 32 trials. The mean number correct was 1.00 (SD = 0.89), which is not significantly different from chance (i.e., 1 out of 2) by a *t* test. Ten out of 16 children (63%) were correct on at least one False Belief Question, which is also not different from chance (binomial test). If the probe questions were priming some latent false belief knowledge, then performance should have been better on the second as compared to the first False Belief Question. Performance on these two questions, however, was not significantly different. Consistent with this, children's performance was relatively stable from the initial to the repeated False Belief Questions ($r = 0.70$, $p < .001$). As in Experiment 1, asking explicitly for explanations did not expose any previously hidden false belief knowledge. This conclusion holds whether we examine children's explanations directly or their responses to a subsequent False Belief Question.

Children's responses to both the first and repeated False Belief Questions are in marked contrast to their responses to the Goal Question. In fact, they typically attributed a belief to the protagonist that would have made the action irrational, given the protagonist's goal. For example, some of the children very confidently claimed that Mary was looking for band-aids in the box and yet, both shortly before and shortly after this, they said, equally confidently, that she thought there was a pencil in the box! The perversity of the behavior they were attributing to the protagonist somehow escaped them. What this suggests is that children may only have assimilated the protagonists' actions to a well-grounded understanding of desires and goals. They gave little hint of understanding the relevance of actions to the protagonists' beliefs.

General Discussion

At the outset we argued that standard false belief tasks might be masking young children's true competence. They might well have considerable understanding of belief, and yet fail these tasks. We suggested that children's difficulties might be related to the belief cues available in the tasks. They might have problems either in inferring the belief on the basis of perceptual access cues or, more generally, in reasoning forward from the cause of a belief as opposed to reasoning backward from the effects of a belief. Our findings provide little support for these suggestions. In both experiments we gave children very strong and redundant cues to belief, and anomalous situations that could only be

resolved by invoking a false belief. The majority of children, however, were unmoved by our efforts and failed to attribute false beliefs to the protagonists. In neither experiment did children's performance rise above chance levels. These findings provide powerful evidence for the view that young children do not understand false belief. In addition, the results from Experiment 2 support and extend earlier findings by Gopnik and Astington (1988) that children of this age do not understand change of belief. Whereas Gopnik and Astington showed that children do not understand changes in their own beliefs, our findings show that they also do not understand changes in another person's beliefs.

We believe that children's failure to interpret actions and reactions in terms of false beliefs is symptomatic of an inadequate conception of belief. Before this conclusion can be accepted, however, certain peripheral task factors need to be ruled out as explanations of children's performance. Below we discuss a range of such factors and argue that none of them can account for the findings from these and other false belief studies.

One peripheral factor that might affect children's performance would be a failure to remember the critical facts of the tasks. However, in the present experiments, as in other false belief studies (e.g., Perner et al., 1987), children were at or near ceiling on all memory questions. Similarly, children's performance showed no clear improvement in Experiment 2, even though the memory demands of the task were reduced considerably. A second possibility is that children perform poorly because they do not find false belief tasks engaging. In the present studies, however, our tasks were presented in a movie format with real-life protagonists involved in plots designed to be of considerable interest to preschool children (Experiment 1 especially). It was the experimenter's strong impression that children did find the movies engaging, and their excellent performance on the memory questions is testimony to that. Nevertheless, children were generally unable to make correct attributions about the protagonists' beliefs. A third possibility is that children's attributional errors are specific to a particular kind of protagonist. However, a wide range of protagonists have now been included in false belief studies (e.g., dolls, story characters, children, adults, and movie characters) without seeming to affect children's performance (e.g., Flavell, Flavell, Green, & Moses, 1990, in this issue; Gopnik & Astington, 1988; Johnson & Maratsos, 1977; Perner

et al., 1987; Wimmer & Perner, 1983). A fourth possibility is that children fail false belief tasks because of the linguistic demands of the task. Consistent with other findings (e.g., Gopnik & Astington, 1988; see also Hartl & Wimmer, 1989), however, children performed exceptionally well in Experiment 2 on a pre-test task roughly equivalent to the false belief task in its general linguistic complexity. Similarly, children's difficulty is unlikely to be due to the specific language used in the test questions. In their work, Wimmer and Perner have varied the form of the questions considerably without affecting children's performance (Hogrefe et al., 1986; Perner et al., 1987; Wimmer & Perner, 1983). Moreover, in a recent study by Wimmer and Hartl (1989), children correctly answered a test question that had precisely the same wording as a corresponding false belief question but which did not require an understanding of false belief. To illustrate, in a "change of state" task, after children had seen one object in a container being replaced by another object, they were asked what they had initially (correctly) thought was in the container. In a "change of mind" task, after they had discovered the unexpected content of a familiar container, they were also asked what they had initially (but this time mistakenly) thought was in the container. Three-year-olds performed exceptionally well on the "change of state" belief question but poorly on the "change of mind" belief question. These findings strongly suggest that children's difficulties with false belief are conceptual rather than linguistic.

A final factor that might affect children's task performance concerns possible problems in predicting forward from the cause of a belief as opposed to reasoning backward from the effects of a belief. Indeed, such a possibility was one motivation for our studies. Certainly, children's somewhat improved performance in the action and surprise conditions of Experiment 1 is consistent with this suggestion. Moreover, an understanding of false belief may well begin to emerge when children are confronted with actions and reactions that conflict with the actor's goals and desires. It is in just these situations that an inadequate conception of belief will be found most wanting. Having said that, however, a substantial proportion of children in our studies performed poorly even in situations of this kind. Problems with prediction cannot, therefore, be the sole source of children's difficulty on these tasks.

Our conclusion on this issue conflicts with that of Bartsch and Wellman (1989), who

also gave children the opportunity to reason backward to a belief from a protagonist's actions. Bartsch and Wellman obtained results which they argue demonstrate "an early but genuine understanding of false belief" (p. 963). In their studies, children were told stories that were similar to our movies in that a protagonist acted in a way that would not satisfy a desire. For example, in one story they were told that "Jane is looking for her kitten. The kitten is hiding under a chair, but Jane is looking for her kitten under the piano" (p. 948). Children were asked to explain why the protagonist was acting in that way and, if the explanation did not make reference to a false belief, they were specifically asked about the protagonist's belief. These questions correspond most closely to our Action Explanation Question and second False Belief Question in Experiment 2. As in our experiment, Bartsch and Wellman found that children explained the protagonist's action much more frequently in terms of desires than beliefs. When responses to their follow-up belief question were taken into account, however, they found that approximately two-thirds of their 3-year-olds attributed a false belief to a protagonist at least once out of three trials in one study, and at least once out of five trials in a second study. Again, though, these results are not unlike ours. Recall that on the repeated False Belief Question in Experiment 2, 63% of the children were correct on at least one of two trials. We do not believe, however, that our results demonstrate false belief understanding since performance was not above chance and, in addition, children's difficulties on the True Belief Question suggest that they may have sometimes responded correctly on the False Belief Question merely because of the protagonist's having been heavily associated with the correct alternative. Bartsch and Wellman's confidence in their results stems largely from the fact that their questions were open-ended (whereas ours were two-alternative forced-choice). They argue that on their open-ended questions children would be unlikely to come up with the correct answer without an understanding of false belief. Against this, however, because their stories involved only a single object (e.g., a kitten in the story cited earlier), it is difficult to imagine what children could offer, other than that object, in response to their belief questions. Moreover, the danger of an associative bias is clearly greater in a case where there is only a single possible object with which to set up an association. Although this certainly does not rule out the possibility that Bartsch and Wellman have

discovered some precocious false belief understanding in young children, it does suggest that their estimates of children's abilities may be somewhat inflated. Apropos of this issue, Wellman (in press) has recently reanalyzed the Bartsch and Wellman data and found that most of the evidence of false belief understanding came from older 3-year-olds only. Thus, we would caution against attributing too much false belief competence to young children on the basis of Bartsch and Wellman's findings.

In sum, a number of potentially troublesome task factors have been examined in this and other false belief studies and, at this time, there is no clear evidence that any of them bear the major responsibility for children's difficulties with false belief. We are not claiming, of course, that all possible extraneous task factors have been ruled out as explanations of children's performance. What we would suggest, however, is that young children's difficulties are extremely robust and that, if they do possess an understanding of false belief, as some have argued (e.g., Bartsch & Wellman, 1989; Chandler, Fritz, & Hala, 1989), it must be either extraordinarily difficult to access or remarkably easy to shake. If, on the other hand, children's difficulties do result from an inadequate conception of belief, then what is lacking from their conception would need to be precisely specified. Below we discuss two classes of explanation that attempt to do just that. These explain children's difficulties in terms of a failure to understand the two implicit principles of folk psychology mentioned at the beginning of this article. The first class is concerned with children's understanding of the causal role of belief, while the second is concerned with their understanding of the representational nature of belief.

The Causal Role of Belief

According to the first class of explanation, children's difficulty with false beliefs lies in an inability to understand how psychological states like beliefs can be causally related to physical events in the world (Leslie, 1989). One component of this causal role of beliefs concerns how events in the world can give rise to beliefs, while the other concerns how beliefs can give rise to actions in the world. The first component involves the informational access issue (Wimmer et al., 1988). Our findings show that understanding the relation between informational access and belief formation cannot be the major difficulty on false belief tasks. In our tasks, because the false belief was strongly implied by what the protagonist did and said, children did not have to

rely on perceptual access cues to infer the false belief. Nevertheless, they still failed to perform well. Similar findings have recently been obtained by Flavell et al. (1990, in this issue) and by Hartl and Wimmer (1989) using tasks in which characters' actions provided strong evidence as to the false beliefs those characters held. Moreover, some other recent studies show that, even when no inference to the false belief is required, 3-year-olds continue to perform poorly (Harris, Johnson, & Harris, 1988; Wellman & Bartsch, 1988). In these studies the experimenter explicitly told children what a protagonist falsely believed, and then asked them to predict how the protagonist would act. The vast majority of children incorrectly predicted that the protagonist would act on the basis of the true state of the world rather than on the basis of the false belief. Similarly, children have about as much difficulty remembering their own prior false beliefs as they do in predicting others' false beliefs (Gopnik & Astington, 1988; Wimmer & Hartl, 1989). Thus, children's problems with false belief go well beyond difficulties in inferring beliefs from situational cues.

Perhaps, however, children do not understand how beliefs are related to actions in the world. The studies mentioned above (Harris et al., 1988; Wellman & Bartsch, 1988), in which children incorrectly predicted actions from beliefs, are clearly consistent with this hypothesis. Some additional evidence in support of it comes from the present studies in which children interpreted actions and reactions more frequently in terms of desires than beliefs. On the other hand, however, there is evidence that in certain situations children do show some understanding of the causal role of beliefs in producing action. Specifically, when the falsity of the belief is not at issue, 3-year-olds will take the belief into account when predicting an action. For example, Wellman and Bartsch (1988) found that, when the true location of an object was unknown, or when the object could be found in more than one location, children were able to correctly predict where a protagonist would look for the object if they were told the protagonist's belief. Whether these findings demonstrate a genuine understanding even of true belief, however, is controversial (see Perner, 1990; Wellman & Bartsch, 1989).

Even if children do not understand that beliefs are causally related to actions, this again cannot be their only source of difficulty. In one of Flavell et al.'s experiments (Flavell et al., 1990, in this issue, Study 3) young 3-year-olds failed false belief tasks even though

knowledge of the causal role of beliefs was not required to succeed. In this study, a confederate of the experimenter explicitly stated her false belief concerning the nature of a hidden object. Rather than ask children to predict the confederate's action on the basis of this belief, Flavell et al. merely asked them a simple yes/no question concerning the content of her belief. For example, on one task the confederate said that she thought there was a white cup behind a barrier, when in fact there was a blue cup in that location. Almost immediately after this children were asked, "Does she think we have a white cup over here?" Clearly, no knowledge of how the belief arose or of its implications for action was necessary for success at this task. Children could have responded correctly with little, if any, belief understanding. All they had to do was recall the words of the confederate. It is hard to conceive of a more straightforward and easy false belief task than this. Nevertheless, on these kinds of tasks approximately two-thirds of the children made incorrect belief attributions!

Wellman and Bartsch have proposed a different explanation of children's false belief difficulties that also locates the problem in the causal role of beliefs (Bartsch & Wellman, 1989; Wellman & Bartsch, 1988). Their hypothesis is that children as young as 2 years of age have an understanding of desires and how these relate to action. Moreover, by 3 years of age children are beginning to develop an understanding of beliefs and their relation to action. There are some circumstances, however, in which beliefs and desires lead to conflicting predictions concerning action and, in these cases, children fall back on their understanding of desires to predict the action. Thus, for example, if Sam thinks the puppy is under the porch but it is really in the garage, children ought to predict on the basis of Sam's belief that Sam will look under the porch. Understanding of Sam's desire alone, however, would lead to the prediction that Sam will look in the garage, because that will lead to the satisfaction of his desire. Wellman and Bartsch argue that, in these cases, children weight the information about desire more heavily than the information about belief, and thus predict the action on the basis of the desire. The Wellman and Bartsch hypothesis then is that children understand the causal role of both beliefs and desires taken in isolation, but they are unable to integrate information from the two sources into a broader causal picture.

While we agree with Wellman and Bartsch that an understanding of desire is

likely to develop before an understanding of belief, their hypothesis does not provide an adequate explanation for children's false belief difficulties. Although the hypothesis can handle cases in which children are asked to predict an action given a desire and a belief, it cannot handle certain cases in which children are asked to state the content of a protagonist's belief. Take Cathy in the action condition of Experiment 1, for example. Cathy wants the crayons, and yet she is about to look in the bag rather than in the drawer. On the face of it, if children predict her belief on the basis of her desire, they ought to say that she thinks there are crayons in the bag, because they know that crayons are what she wants and that she is about to look for them in the bag. At any rate, they certainly do not think that Cathy wants rocks to be in the bag and, yet, that is precisely the content of the belief they typically attribute to her. It is hard to see how an understanding of desires could lead to such an attribution. In addition, there are some false belief tasks in which desires play no role at all. One example is the "Smarties" task described earlier (Gopnik & Astington, 1988; Hogrefe et al., 1986; Perner et al., 1987) in which children are asked what another child, who has not yet seen the pencils, will think is inside the candy box. Clearly, the other child's desires do not enter the story at all, so it seems unlikely that children would answer test questions on the basis of them. Moreover, even if they did, it is implausible that the other child would want there to be pencils in a candy box. Again, however, that is the content of the belief that children typically attribute to the other child. Similarly, in the example from Flavell et al. (1990, in this issue) described earlier, the confederate expressed no desires at all, and yet children still failed the task. At the very least, therefore, the Wellman and Bartsch hypothesis does not have the generality to handle all of the relevant findings (see Wellman, in press, for a revised position).

The Representational Nature of Belief

The second class of explanation locates children's difficulties in a failure to understand the representational nature of belief (Flavell, 1988; Ferguson & Gopnik, 1988; Olson, 1988; Perner, 1988; Zaitchik, in press). Young children may not understand that a single state of the world can be represented in different, apparently contradictory, ways. Insofar as they have a notion of beliefs as mental representations at all, they think that there must be a tight correspondence between beliefs and true states of the world; that someone might, in all seriousness, hold to a belief

which misrepresents reality is beyond the realm of possibility. We believe that children's performance on our false belief tasks and those of others is strongly consistent with this hypothesis. The Flavell et al. (1990, in this issue) findings that children performed poorly even when knowledge of the causal role of belief was not required are particularly good evidence for it. Additional support comes from children's justifications in Experiment 1. Children most frequently justified attributing a true belief to the protagonist by citing some aspect of the outcome or how it came about. For these children the real state of affairs seemed to constitute a reason for the protagonist's belief. If this interpretation is correct, their concept of belief and, indeed, their theory of mind is qualitatively very different from our own.

In conclusion, the present studies contribute to our understanding of children's conception of belief in several ways. Our findings show that most children continue to perform poorly on false belief tasks even in conditions in which they are given massive assistance. These findings strongly converge with results from earlier research on false belief and on change of belief (e.g., Gopnik & Astington, 1988; Perner et al., 1987) and they indicate that children's difficulties are extremely robust. Together with other recent findings, they also suggest that children's difficulties do not stem from extraneous task factors, and that their difficulties go well beyond any failure to understand the causal role of belief. Rather, our findings lend powerful support to the hypothesis that children do not fully understand the representational nature of belief.

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